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REMOVAL SAMPLING WORK PLAN LOEFFEL ROUTE 203 PROPERTY

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REMOVAL SAMPLING WORK PLAN
LOEFFEL ROUTE 203 PROPERTY

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ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
Settlement Agreement	Administrative Settlement Agreement and Order on Consent, Index No. CERCLA-02-2019-2014
AST	aboveground storage tank
ASTM	ASTM International
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CN	cyanide
cDCE	cis-1,2-dichloroethene
CB	Chlorobenzene
CLP	Contract Laboratory Program
DGPS	differential global positioning system
DSNY	Dig Safely New York
DPT	direct push technology
DO	dissolved oxygen
EDD	electronic data deliverable
ELLE	Eurofins Lancaster Laboratories Environmental, LLC
EM	electromagnetic
FAC	facultative
FACW	facultative wetland
^{o}F	degrees Fahrenheit
gpm	gallons per minute
GE	General Electric Company
GPS	global positioning system
GPR	ground-penetrating radar
HAZWOPER	Hazardous Waste Operations and Emergency Response
HASP	Health and Safety Plan
IDM	investigation-derived materials
IPaC	Information, Planning and Conservation System
KSG	kame sand and gravel
Loeffel Companies	Loeffel's Waste Oil and Removal Service Company, Inc., and Marcar Oil, Inc.
MAG	magnetic
MS/MSD	matrix spike/matrix spike duplicate
MCLs	Maximum Contaminant Levels
NPL	National Priorities List
NWI	National Wetland Inventory
NYSDEC	New York State Department of Environmental

NYSDOT	New York State Department of Transportation
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NOV	Notice of Violation
OBG	O'Brien & Gere Engineers, Inc. (a Ramboll company)
OBL	obligate wetland
OSWER	Office of Solid Waste and Emergency Response
OG	outwash sand and gravel
ORP	oxidation reduction potential
OSC	On-Scene Coordinator
Parratt-Wolff	Parratt Wolff, Inc.
ppb	parts per billion
ppm	parts per million
%	percent
PPE	personnel protective equipment
PID	photoionization detector
PCBs	polychlorinated biphenyls
PAHs	polycyclic aromatic hydrocarbons
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RCDOH	Rensselaer County Department of Health
RETTEW	RETTEW Field Services, Inc.
RMLs	Removal Management Levels
RSWP	Removal Sampling Work Plan
SVOCs	semi-volatile organic compounds
SPCS	state plane coordinate system
SUNY	State University of New York
TAL	Target Analyte List
TCL	Target Compound List
TCLP	toxicity characteristic leaching procedure
TOC	total organic carbon
TCE	trichloroethene
UFP-QAPP	Uniform Federal Policy Quality Assurance Project Plan
USACE	United States Army Corps of Engineers
USDA	United State Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	underground storage tank
VOCs	volatile organic compounds
Weston	Weston Solutions, Inc.
1,1,1-TCA	1,1,1-trichloroethane
123TCB	1,2,3-trichlorobenzene
124TCB	1,2,4-trichlorobenzene
14DCB	1,4-dichlorobenzene

1. INTRODUCTION

1.1 General

This Removal Sampling Work Plan (RSWP) has been developed by O'Brien & Gere Engineers, Inc. (OBG, a Ramboll company) on behalf of the General Electric Company (GE or Respondent) for the Loeffel Route 203 Property and two adjacent properties (collectively the "Site") located in the Town of Nassau, Rensselaer County, New York (see **Figure 1-1**). The RSWP was prepared for inclusion in Administrative Settlement Agreement and Order on Consent For a Removal Action (Index No. CERCLA-02-2020-2008) (Settlement Agreement) between the United States Environmental Protection Agency (USEPA) and Respondent.

Owners and/or operators of the Site have included Mr. Richard Loeffel and Ms. Florence Loeffel (June 1955 to December 1975), and son, Mr. Dewey Loeffel (December 1975 to June 1978). Ms. Carol Loeffel has owned the Site since June 1978 to the present (**Exhibit A**). The Site was reportedly permitted by New York State Department of Environmental Conservation (NYSDEC) as a waste oil transfer facility in the 1970s and early 1980s and was reportedly used by Messrs. Richard and/or Dewey Loeffel, beginning in the 1950s to store trucks associated with their various companies including Loeffel Refining Products, Inc., Loeffel's Waste Oil and Removal Service Company, Inc. and Marcar Oil, Inc. (the "Loeffel Companies"). In July 2018, NYSDEC provided sampling information from 1979 and 1980 about the Site to USEPA, which then performed site investigation work from October 2018 through May 2019 (Weston Solutions, Inc. [Weston], 2019a and 2019b). The Site is listed on USEPA's Superfund Enterprise Management System (NYN000203244) but is not on or proposed for the federal National Priorities List (NPL).

1.2 Project Scope and Purpose

This RSWP presents the investigation activities to assess the scope of additional removal activities. As discussed with USEPA during a September 10, 2019 site visit and subsequently confirmed by USEPA during an October 1, 2019 meeting, the investigation will focus on the following areas:

- Loeffel Route 203 Property – Defined as property located at 5225-5239 Route 203, Town of Nassau, Rensselaer County, New York as shown on **Figure 1-2 and 1-3**. Current and historical uses included residential and commercial use. The residence is located in the northeastern portion of the property and is not the subject of this investigation. Commercial buildings are located in the south-central portion of the property. As shown on **Figure 1-3**, specific investigation areas on this property include the following:
  - Former Aboveground Storage Tank (AST)/Potential Lagoon Area – Shown on **Figure 1-3** and defined as the area encompassing a soil berm in the south-central portion of the property where four 30,000-gallon ASTs were historically located (Weston, 2019a) (also see historical aerial photographs dated 1985 and 1994 in **Exhibit B**). A lagoon was reportedly previously located in the area of the ASTs and may be buried by fill.
  - Underground Storage Tank (UST) – As shown on **Figure 1-3**, a 30,000-gallon UST is reportedly located in the south-central portion of the property proximal to the southeast corner of the easternmost commercial garage (Weston, 2019a). There is currently no visible expression of the UST at the surface (e.g., appurtenant piping and fill port), but the tank was identified by surface geophysical work performed by USEPA in October 2018.
  - Drum Area – Nine abandoned and deteriorated 55-gallon drums are located in the central portion of the property as shown on **Figure 1-3**.

  - Upland Area – Shown on **Figure 1-3** and defined as the topographically higher portion of the property located north of the southern driveway (to the commercial buildings) and also north of the pond and the area surrounding the pond that may include dredged material. This area is wooded, and is not believed to have been used for any historical operations, but is included in the RSWP for verification.

  - Eastern Drainageway – Defined as the onsite drainage swale associated with the ephemeral stream running from northeast to southwest through the southeastern corner of the property, crossing under Route 203 (single, large culvert) from the east and crossing under Sweets Crossing Road to the south (two parallel culverts). The ephemeral stream continues to the south-southwest through the adjacent residential property (see **Figure 1-3 and 1-4**).

  - Pond Area – As shown on **Figure 1-3**, an approximately 1-acre pond is located on the western portion of the property. This investigation area includes the pond and the banks where dredged material was or may have been deposited. In the past, the pond was reportedly used as a source of firefighting water.

- National Grid Property – Owned by National Grid and defined as that portion of the former railroad grade that trends north-south to the immediate east of the Pond Area. Beginning in 1899, the Albany and Hudson Railway and Power Company operated a third rail electric trolley system on this property, which ran from Hudson to Albany. The trolley operated from 1899 to 1929. During the operation of the trolley and after the cessation of transportation activities, the property was also used as an electrical transmission utility corridor. The current utility corridor separates the Loeffel Route 203 Property from the residential area to the west, as shown on **Figure 1-3 and 1-4**.

- Residential Property – Defined as the property located at 5213 Route 203, located across Sweets Crossing Road from the Loeffel Route 203 Property, as shown on **Figure 1-3**. The ephemeral stream runs through this property to the south-southwest from the twin culvert under Sweets Crossing Road.

This RSWP outlines the scope to further investigate the occurrence of contaminants in soil and sediment at the Loeffel Route 203 Property and the occurrence of Loeffel Route 203 Property-related contaminants in soil on the National Grid Property and Residential Property for the purpose of evaluating the scope of additional removal activities. As part of this investigation, some additional groundwater information will also be collected.

This RSWP contains nine sections. Section 1 presents a discussion of background information for the Site. Section 2 presents the proposed investigation activities. Sections 3 and 4 present a discussion of laboratory analyses and data validation. Section 4 provides an introduction of and reference to the Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP), which is separate from but associated with this RSWP. Section 5 provides an introduction of and reference to the Health and Safety Plan (HASP), which is also separate from but associated with this RSWP. Section 6 presents a summary of reporting activities, including, but not limited to, the Monthly Progress Reports (required by the Settlement Agreement), Data Validation Reports, an Interim Deliverable (to present the soil, sediment, and groundwater results for discussion), and the Final Investigation Report. Section 7 presents the project schedule, and references are provided in Section 8.

1.3 Background Information

This section presents background information for the Site, including physical setting, the Site geology and hydrogeology, and a summary of the Site contamination based on USEPA's investigation results.

1.3.1 Site Description

The Site is located approximately one mile south of the Village of Nassau in Rensselaer County, New York. The Site is situated in a glaciated valley with hummocky terrain characterized by low-lying areas (including wetlands, ponds and lakes) between elongated hills. The Loeffel Route 203 Property is located within a rural area with a mix of residential properties and farms (see **Figure 1-1**). To the north, the property is bounded by farmland. To the east, the property is bounded by Route 203 and then farmland. To the south, the property is bounded by Sweets Crossing Road and then residences. The National Grid Property bounds the property to the west, and separates the property from the small residential development (17 properties) farther west (see **Figure 1-4**).

The Loeffel Route 203 Property occupies approximately 8.4 acres on the west side of Route 203 and north side of Sweets Crossing Road (see **Figure 1-2**). The northeastern portion of the property is residential use and contains a single-family house built in 1936 (based on Rensselaer County tax information). The house appears to have been the only existing structure on the property until at least 1952 (see **Exhibit B**).[1] Three one-story commercial structures are located in the southern portion of the property. The structures are serviced by two onsite private supply wells (one for the residence and the other for the commercial structures) and onsite septic systems.

1.3.2 Site History

As discussed above, owners and/or operators of the Loeffel Route 203 Property have included Mr. Richard Loeffel and his wife Ms. Florence Loeffel, his son Mr. Dewey Loeffel, and others. Ms. Carol Loeffel is the current owner. The property was reportedly permitted by NYSDEC as a waste oil transfer facility in the 1970s and early 1980s, and was also reportedly used by Messrs. Richard and/or Dewey Loeffel beginning in the 1950s to store trucks associated with the Loeffel Companies. Loeffel Refining Products, Inc. (USEPA ID No. NYD980642912) is additionally identified as a company formerly located at the property (see **Exhibit C**).

Several site inspections were performed at the Loeffel Route 203 Property by the Rensselaer County Department of Health (RCDOH), as documented in memorandums dated December 7, 1973 and February 25, 1975. The memos indicate the presence of four 30,000-gallon ASTs[2] and one 30,000-gallon UST at the property, and also note that oil appeared to have entered the onsite swamp (Weston, 2019b).[3] Additional inspections were performed by NYSDEC on March 25, 1987 and April 8, 1988, and by USEPA on July 15, 1986. A notice of violation (NOV) was issued to Loeffel Refining Products, Inc. on March 25, 1987 (see **Exhibit C**).

NYSDEC is reported to have collected samples of amphibian tissue and an aquatic insect on November 27, 1979 from the pond for laboratory analysis.[4] Polychlorinated biphenyls (PCBs) were reportedly detected in the samples (Weston, 2019b). Soil and pond water samples reportedly collected at the Loeffel Route 203 Property by a neighbor on July 27, 1987 for laboratory analysis did not contain PCBs, lead, oil and grease, benzene, toluene, ethylbenzene, and xylenes (BTEX) and total petroleum hydrocarbons (Weston, 2019a).

[1] Additional features visible on the 1952 aerial photograph in **Exhibit B** include the pond and eastern drainageway (ephemeral stream).

[2] Mr. Dewey Loeffel stated in an April 3, 2019 declaration that in the late 1960s three ASTs were relocated to the property from a disposal facility located along Mead Road in Nassau, New York, now known as the Dewey Loeffel Landfill Superfund Site.

[3] Based on Mr. Dewey Loeffel's April 3, 2019 declaration, the onsite swamp was dredged in the 1960s or 1970s to create the existing pond, and that the dredged material was placed onto the banks of the pond.

[4] NYSDEC reportedly collected aquatic insect, freshwater crustacean, and amphibian tissue samples from the Valatie Kill at Sweets Crossing Road on November 20, 1979, June 8, 1980, and June 9, 1993 for laboratory analysis of PCBs.

1.3.3 Physical Setting

Physiography

The Site is located in the Hudson River Valley portion of the northern Appalachian physiographic province of New York State, which is characterized by hills and highlands ranging in elevation from 350 to 1,450 feet above mean sea level (amsl) (Randall et al., 1988). The area encompasses lowlands to the west and the Adirondack and Green Mountains to the northwest and east, respectively.

In the region of the Site, glacial erosion and deposition altered the drainage and topography forming a nearly continuous layer of glacial till over the underlying bedrock, consisting primarily of silt, clay, fine sand, and gravel. Glacial movement in southeastern Rensselaer County was in the southeasterly direction during the Pleistocene Epoch (approximately 50,000 years ago) (State University of New York [SUNY], 1965). With few exceptions, the entire region is mantled with glacial deposits consisting of till, kames, and outwash soils with minor amounts of alluvium of recent age. The alluvium is silt and sand associated with stream deposits (United States Department of Agriculture [USDA], 1937). The primary glacial deposits are stratified sand, gravel and till. The depth of till over bedrock in the region is reported to be generally greater than 10 feet and consists of a firm heterogeneous mixture of unsorted material rich in clay ranging in size from clay to boulders. The till was generally deposited at the base of an advancing glacier, and as such is compact and dense in nature. Overlying the till through the region in many of the stream valleys are kames consisting of boulders, gravel and sand.

The climate at the Site is typical of the Northeast United States. The average annual temperature of approximately 48 degrees Fahrenheit (˚F). Annual precipitation is approximately 40 inches, including an annual snowfall of approximately 60 inches.

Topography

As shown on **Figure 1-5**, elevations at the Site range from approximately 355 to 373 feet (North American Vertical Datum of 1988 [NAVD88]). The topography at the Site generally slopes downward from local topographic highs in (a) the northern portion of the Loeffel Route 203 Property and (b) the garage near the southern property boundary. The pond occupies a topographic low at an elevation of 355 feet NAVD88 in the southwestern and western portion of the property, with no apparent inlet or outlet. On the east side of the property the local topography slopes toward the eastern drainageway (ephemeral stream) at an approximate elevation of 360 feet NAVD, which drains to a topographic low-lying area at an approximate elevation of 350 feet NAVD on the residential property to the south of Sweets Crossing Road **(Figure 1-6)**. The Valatie Kill is located approximately 1,000 feet to the west of the western property boundary of the Loeffel Route 203 Property, at an approximate elevation of approximately 348 feet NAVD, and flows southward.

1.3.4 Site Geology and Hydrogeology

Bedrock in the vicinity of the Site is mapped as Late Proterozoic to Early Cambrian Nassau Formation and the Cambrian Germantown Formation (New York State Museum, 1999). The Nassau Formation is comprised of slate, shale, thin quartzite, and includes the Stuyvesant Conglomerate, Diamond Rock Quartzite, Curtis Mountain Quartzite, and Bomoseen Graywacke Members. The Germantown Formation is comprised of shale, conglomerate, and thin-bedded limestone (United States Geological Survey [USGS], 2005). Bedrock was not encountered during USEPA's investigation activities, but the bedrock surface at the Site likely ranges in depth from 30 to 40 feet below grade based on available records for the supply wells in the area.

The overburden geology in the area of the Site is characterized by unconsolidated glacial deposits overlying bedrock. The unconsolidated deposits at the Site are mapped as kame sand and gravel (KSG) and outwash sand and gravel (OG). The KSG is comprised of ice-contact deposits of fluvially sorted, coarse to fine gravel and/or sand in kames, kames terraces, and kame deltas (Reynolds, 1999). The OG is comprised of proglacial fluvial deposits of coarse to fine gravel with sand (Cadwell et al., 1986).

USEPA's investigation of the overburden at the Site was limited to a depth of 4 feet or less. The deposits observed during USEPA's investigation were generally described as light brown to brown, clayey silt to silty sand with gravel (Weston, 2019a).

The native materials have reportedly been disturbed in some portions of the Loeffel Route 203 Property or have been overlain by fill materials, including the reported filling of the former lagoon and channel between the Former AST/Potential Lagoon Area and the pond. Based on information provided by Mr. Dewey Loeffel, the onsite swamp was dredged in the 1960s or 1970s to make the pond, and the dredged material was placed on the bank.

Site Hydrogeology

Limited hydrogeologic information is available for the Site. The overburden groundwater table in the vicinity of the Site is mapped as 350 feet amsl and groundwater flow is to the east-southeast towards the Valatie Kill (Reynolds, 1999). Overburden groundwater flow in the vicinity of the Site may be perturbed by pumping by local supply wells, some of which are screened within the unconsolidated deposits.

Conceptually, overburden groundwater flow at the Loeffel Route 203 Property is expected to be towards the pond and/or to the southwest. As discussed above, although the pond is the topographic low at the property, there is no observed inlet or outlet. Groundwater at the Site is not expected to discharge to the eastern drainageway based on its higher elevation relative to the pond, and the lack of water observed in the drainageway (i.e., ephemeral nature of the stream).

1.3.5 Local Groundwater Use

Two supply wells are located at the Loeffel Route 203 Property, one serving the residence on the northeast portion of the property and the other serving the commercial buildings in the southeast portion of the property. Property owners located in the vicinity of the Loeffel Route 203 Property also use groundwater from private supply wells.[5]

1.3.6 Existing Contaminant Information

This section summarizes the analytical data collected by USEPA during its investigation of the Loeffel Route 203 Property, two adjacent properties (the National Grid Property and Residential Property), and numerous supply wells on other nearby residential properties in December 2018, March 2019 and May 2019. During these sampling events, samples were collected from residential supply wells on several properties; surface soil and near-surface soil (up to 4 feet deep) samples were collected from three properties (i.e., the Loeffel Route 203 Property, National Grid Property and Residential Property); and sediment, surface water and solid waste (drum) samples were collected from the Loeffel Route 203 Property.

[5] Although limited information is available, the supply wells in the area of the Site appear to be a mix of overburden and bedrock groundwater wells.

1.3.6.1 Residential Well Water

On December 10, 2018, USEPA collected three tap water samples (including a duplicate sample) at the Loeffel Route 203 Property. These samples were collected from the two supply wells on the property. Sample IDs P001-TW001-01 and P001-TW001-02 were collected from the southern well, which serves the commercial structures and is reported to be 100 feet deep. Sample ID P001-TW002-01 was collected from the northern well, which serves the residence; the depth of this well is unknown. The three samples from the Loeffel Route 203 Property were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), herbicides, and PCBs, Resource Conservation and Recovery Act (RCRA) metals, nitrate and nitrite. The results were validated and there were no exceedances of the federal Maximum Contaminant Levels (MCLs) or the state drinking water standards (Weston, 2019a).

Between March 18 and 21, 2019, USEPA sampled 26 supply wells located on 24 residential properties including the two supply wells located on the Loeffel Route 203 Property.[6] The samples were analyzed for TCL VOCs, SVOCs, and PCBs. The results were validated and there were no exceedances of the federal MCLs or the state drinking water standards (Weston, 2019c).

VOCs
Methylene chloride (a common laboratory artifact) and trichloroethene (TCE) were the only VOCs detected in the supply well samples collected on December 10, 2019 from the Loeffel Route 203 Property. TCE was detected in both samples from the southern supply well (sample IDs P001-TW001-01 and P001-TW001-02) at concentrations of 2.6 and 2.7 parts per billion (ppb), below the federal MCL of 5 ppb (which is also the state drinking water standard). TCE was not detected in the sample from the other supply well (sample ID P001-TW-002-01). The detection of TCE in the samples from the southern supply well may not be related to historical operations at the Site, as TCE was not detected in any of the drum samples, surface water samples, or sediment samples collected by USEPA. In addition, TCE was only detected in a few of the many soil samples that USEPA collected.

Methylene chloride (a common laboratory artifact), chloroform, and TCE (P001, P022, P023) were the only VOCs detected in the residential supply well samples collected in March 2019. TCE was detected in both samples from the southern supply well (sample IDs P001-TW001-03 and P001-TW001-04) at concentrations of 2.1 and 2.3 ppb, and residential supply wells #22 and #23 (sample IDs P022-TW-001-01 and P023-TW001-01) at concentrations of 0.54 and 1.2 ppb.

SVOCs
No SVOCs were detected in the three supply well samples collected on December 10, 2018 from the Loeffel Route 203 Property. Similarly, SVOCs were not detected in the residential supply well samples collected in March 2019.

PCBs
Aroclor 1260 was detected in the two samples (sample IDs P001-TW001-01 and P001-TW001-02) collected on December 10, 2018 from the southern supply well at the Loeffel Route 203

[6] As part of this sampling effort, USEPA also collected a sample from the Village of Nassau public water supply (i.e., Well #2), located approximately 1 mile north of the Site, in the Village of Nassau.

Property. Aroclor 1260 was detected at estimated concentrations of 0.0426 and 0.0475 ppb in these two sample, well below the federal MCL of 0.5 ppb for total PCBs (which is also the state's drinking water standard). PCBs were not detected in the sample collected from the northern supply well on the Loeffel Route 203 Property.

PCBs were not detected in the residential supply well samples collected in March 2019.

Pesticides/Herbicides
No pesticides/herbicides were detected in the supply well samples collected by USEPA on December 10, 2019 from the two wells on the Loeffel Route 203 Property.

Metals
Arsenic, barium, and chromium were detected in all three supply well samples collected by USEPA on December 10, 2018 from the two wells on the Loeffel Route 203 Property. The concentrations of each metal were similar in the samples, suggesting the results may reflect background conditions, and all of the results were well below the federal MCLs and the state's drinking water standards. Lead was detected in the sample from the northern supply well (sample ID P001-TW-002-01), but was also well below the federal MCL and below the state's drinking water standard.

Nitrate/Nitrite
Nitrate was detected in each of the three supply well samples collected by USEPA from the two wells on the Loeffel Route 203 Property. However, the results were at concentrations well below the federal MCL of 10 parts per million (ppm). The concentrations in the two samples from the southern supply well (sample IDs P001-TW001-01 and P001-TW001-02) were similar (0.67 and 0.71 ppm). The sample from the northern supply well (sample ID P001-TW-002-01) was slightly higher, at 1.1 ppm. Nitrite was not detected in any of the three supply well samples from the Loeffel Route 203 Property.

1.3.6.2 Surface and Near-Surface Soil

Surface and Subsurface Soil – Loeffel Route 203 Property

USEPA collected 115 soil samples (including several duplicate samples) at 32 locations on the Loeffel Route 203 Property. Soil samples were collected in 6-inch intervals, typically to a depth of 24 inches but to greater depths in some locations (with a maximum depth of 48 inches). The soils samples were analyzed for TCL VOCs, SVOCs, and PCBs and the eight RCRA metals.

USEPA's data tables (Weston, 2019a) provided the residential Removal Management Levels (RMLs) (which are based on a residential use scenario and an excess cancer risk of 10^{-4} risk level for carcinogens or a hazard quotient of 1 for non-carcinogens) for comparison to the sample results. None of the results for SVOCs exceeded the USEPA residential RMLs in any of the soil samples. Lead was the only RCRA metal that exceeded its USEPA residential RML, in three soil samples at two locations. Total xylenes exceeded its USEPA residential RML in eight soil samples at three locations, and 1,2,4-trichlorobenzene (124TCB) exceeded the USEPA residential RML in one soil sample; no other VOCs exceeded their USEPA residential RMLs. Aroclor 1260 exceeded its USEPA residential RML in 49 soil samples at 18 locations; Aroclor-1016 exceeded its USEPA residential RML in one of those samples.

VOCs
Several VOCs were detected in one or more of the 115 soil samples collected by USEPA on the Loeffel Route 203 Property. Acetone, methylene chloride, and 2-butanone were frequently detected, and are common laboratory artifacts. BTEX compounds were also detected, as follows:

- Benzene was detected in 22 of the 115 samples (19 percent), with a maximum concentration of 0.75 ppm (estimated, sample ID P001-SS013C-3036-01, 36- to 42-inch depth), which is below the USEPA residential RML.
- Toluene was detected in 49 of the 115 samples (43 percent), with a maximum concentration of 2,685.8 ppm (sample ID P001-SS013C-3642-01, 36- to 42-inch depth), which is below the USEPA residential RML.
- Ethylbenzene was detected in 21 of the 115 samples (18 percent), with a maximum concentration of 375.9 ppm (sample ID P001-SS013C-3642-01, 36- to 42-inch depth), which is below the USEPA residential RML.
- Total xylenes were detected in 38 of the 115 sample (33 percent), with a maximum concentration of 2,848.8 ppm (sample ID P001-SS013C-3642-01, 36- to 42-inch depth).
- Chlorobenzenes were also detected in the soil samples collected by USEPA, particularly 1,4-dichlorobenzene (14DCB), chlorobenzene (CB), 124TCB and 1,2,3-trichlorobenzene (123TCB):
    - 14DCB was detected in 14 of the 115 samples (12 percent), with a maximum concentration of 22.9 ppm (sample ID P001-SS013B-4248-01, 42- to 48-inch depth).
    - CB was detected in 14 of the 115 samples (12 percent), with a maximum concentration of 6.2 ppm (sample ID P001-SS013B-4248-01, 42- to 48-inch depth).
    - 124TCB was detected in 11 of the 115 samples (10 percent), with a maximum concentration of 94 ppm (sample ID P001-SS013A-2430-01, 24- to 30-inch depth). This was the only sample exceeding the USEPA residential RML of 58 ppm.
    - 123TCB was detected in 11 of the 115 sample (10 percent), with a maximum concentration of 42.4 ppm (sample ID P001-SS013A-2430-01, 24- to 30-inch depth).
- TCE and its degradation products (cis-1,2-dichloroethene [cDCE] and vinyl chloride) were detected in soil samples collected on the Loeffel Route 203 Property. TCE was detected at a maximum concentration of 0.0556 ppm (estimated, biased high, at location P001-SS013). cDCE was detected at a maximum concentration of 0.0025 ppm (at location P001-SS013C). Vinyl chloride was detected a maximum concentration of 0.0362 ppm (estimated, biased high, at location SS013C).

SVOCs
Several SVOCs were detected in the soil samples collected by USEPA. Naphthalene was detected at the highest concentration, with a maximum concentration of 14.5 ppm (sample ID P001-SS013A-2430-01, 24- to 30-inch depth). Phenol and dimethylphthalate were the most frequently detected SVOCs, with maximum concentrations of 1.3 ppm (sample ID P001-SS010-1218-01, 12- to 18-inch depth) and 0.93 ppm (sample ID P001-SS026-0006-02, 0- to 6-inch depth), respectively. Hexachlorobenzene was detected at a maximum concentration of 0.47 ppm (estimated, sample ID P001-SS015-0006-01, 0- to 6-inch depth). 1,4-Dioxane was not detected in any of the soil samples.

PCBs
PCBs were detected in all of the 115 soil samples collected by USEPA. Aroclor 1260 was detected in all of the soil samples, albeit with a wide range of concentrations up to 1,200 ppm (sample ID

P001-SS013-1218-01, 12- to 18-inch depth). Aroclor 1016 and Aroclor 1248 were the other PCBs that were detected in the soil samples (at frequencies of 3 and 1 percent, respectively).

Thirty-one of the 115 samples (27 percent) contained total PCB concentrations at or above 50 ppm. Thirty-five of the 115 soil samples (30 percent) had a total PCB concentration between 10 ppm and 50 ppm. PCBs were detected in 22 of the 115 soil samples (19 percent) at a total PCB concentration less than 1 ppm.

Metals

Six of the eight RCRA metals (arsenic, barium, cadmium, chromium, lead, and mercury) were detected in all of the soil samples collected by USEPA. Selenium was detected in 113 (98 percent) of the soil samples, and silver was detected in 30 (26 percent) of the soil samples. Based on the high frequencies of detection and the concentrations, the results for the eight RCRA metals may reflect background concentrations. Only lead was detected above the USEPA residential RML, and in just one sample (2,000 ppm, sample ID P001-SS013C-1824-01, 18- to 24-inch depth).

Surface and Near-Surface Soil – National Grid Property

Surface and near-surface soil samples were collected by USEPA on the National Grid Property located immediately west of the pond. A total of 90 soil samples (including five duplicate samples) were collected from 17 locations, including multiple depth intervals to a maximum depth of 18 or 24 inches depending on the location. The samples were analyzed for TCL VOCs, SVOCs, and PCBs and the eight RCRA metals.

Detected VOCs included 2-butanone, acetone and methylene chloride (common laboratory artifacts), 1,1-dichloroethene, 1,1,1-trichloroethane (1,1,1-TCA), cyclohexane, methyl acetate, methylcyclohexane, toluene, ethylbenzene, xylenes, styrene, isopropylbenzene, but no VOCs were detected at concentrations above the USEPA residential RMLs. Several SVOCs were detected in the soil samples, including several polycyclic aromatic hydrocarbons (which are very common along railroad beds due to the creosote and tar products that were historically used as a preservative in railroad ties). However, no SVOCs were detected in the soil samples at concentrations above the USEPA residential RMLs. Several SVOCs were detected in the soil samples, including benzo(a)anthracene (13.1 ppm, sample ID P026-SS004-0002-01, 0- to 2-inch depth), benzo(b)fluoranthene (11.9 ppm, sample ID P026-SS004-0002-01, 0- to 2-inch depth), benzo(a)pyrene (17 samples at a maximum of 10 ppm, sample ID P026-SS004-0002-01, 0- to 2-inch depth), and dibenz(a,h)anthracene (1.7 ppm, estimated, sample ID P026-SS004-0002-01, 0- to 2-inch depth).[7] PCBs were detected in several soil samples collected by USEPA, but none of the PCB results for the National Grid Property were above the USEPA residential RMLs. For metals, the maximum concentration of lead detected in soil samples on the National Grid Property was 3,960 ppm (estimated, sample ID P026-SS004-0002-01, 0- to 2-inch depth). The maximum concentration of arsenic detected in soil samples on the National Grid Property was 23.4 ppm.

[7] These are all polycyclic aromatic hydrocarbons (PAHs), which are common along railroad beds.

Surface and Near-Surface Soil – Residential Property

USEPA collected a total of 48 soil samples (including two field duplicates) from 10 sampling locations on the Residential Property south of Sweets Crossing Road. The soils samples were analyzed for TCL VOCs, SVOCs, and PCBs and the eight RCRA metals.

No VOCs or SVOCs were detected at concentrations exceeding the USEPA residential RMLs. Only one of the 48 soil samples had a concentration of total PCBs above 1 ppm (6.4 ppm, sample ID SS010, 2- to 6-inch depth, total of Aroclors 1248 and 1260).

1.3.6.3 Sediment - Loeffel Route 203 Property

Thirty sediment samples (including two duplicate samples) were collected by USEPA at 14 locations around the perimeter of the pond located on the western portion of the Loeffel Route 203 Property. These samples were collected from two depth intervals (0- to 6-inches and 6- to 12-inches below the water column). The sediment samples were analyzed for the eight RCRA metals and TCL VOCs, SVOCs, and PCBs.

VOCs

Several VOCs were detected in one or more of the 30 sediment samples. Acetone, methylene chloride, and 2-butanone were frequently detected, and are common laboratory artifacts. BTEX compounds were commonly detected in the sediment samples:

- Benzene was detected in 14 of the 30 samples (47 percent), with a maximum concentration of 1.5 ppm (estimated, sample ID P001-SD012-0006-01, 0- to 6-inch depth).
- Toluene was detected in 22 of the 30 samples (73 percent), with a maximum concentration of approximately 1,432.7 ppm (sample ID P001-SD002-0612-01, 6- to 12-inch depth). However, of the 22 samples with toluene detected, only three samples had concentrations exceeding 0.25 ppm (sample IDs P001-SD002-0612-01, P001-SD012-0612-01, and P001-SD012-0612-02, all 6- to 12-inch depth).
- Ethylbenzene was detected in 12 of the 30 samples (40 percent), with a maximum concentration of 315.3 ppm (sample ID P001-SD002-0612-01, 6- to 12-inch depth).
- Total xylenes were detected in 25 of the 30 samples (83 percent). The three sediment samples with the highest concentrations were 2,134.4 ppm (sample ID P001-SD002-0612-01, 6- to 12-inch depth), 1,106.1 ppm (P001-SD012-0006-01, 0- to 6-inch depth), and 727.62 ppm (sample ID P001-SD014-0006-01, 0- to 6-inch depth).

Chlorobenzenes were also detected in the sediment samples collected by USEPA from the pond, particularly 14DCB, 13DCB and CB:

- 14DCB was detected in 23 of the 30 samples (77 percent), with a maximum concentration of 114.7 ppm (estimated, sample ID P001-SD012-0006-01, 0- to 6-inch depth).
- 13DCB was detected in 16 of the 30 samples (53 percent), with a maximum concentration of 12.9 ppm (estimated, sample ID P001-SD012-0006-01, 0- to 6-inch depth).
- CB was detected in 17 of the 30 samples (57 percent), with a maximum concentration of 47 ppm (estimated, biased high, sample ID P001- SD012-0006-01, 0- to 6-inch depth).

- 123TCB and 124TCB were each detected in one of the 30 sediment samples, at concentrations of 15.1 ppm and 36.6 ppm, respectively.

TCE and vinyl chloride (a TCE degradation product) were not detected in any of the 30 sediment samples collected by USEPA from the pond. cDCE (another TCE degradation product) was detected in two of the 30 samples (7 percent), with a maximum estimated concentration of 0.51 ppm (estimated, sample ID P001-SD002-0612-01, 6- to 12-inch depth).

Cyclohexane and methylcyclohexane were commonly detected in the sediment samples, although typically at low concentrations. Cyclohexane was detected in 15 of the 30 sediment samples (50 percent), with a maximum concentration of 24.9 ppm (estimated, sample ID P001-SD014-0006-01, 0- to 6-inch depth). Methylcyclohexane was detected in 17 of the 30 sediment samples (57 percent), with a maximum concentration of 42.9 ppm (estimated, sample ID P001-SD014-0006-01, 0- to 6-inch depth).

SVOCs
Several SVOCs were detected in the sediment samples collected by USEPA. Naphthalene was detected at the highest concentration (10.6 ppm, sample ID P001-SD002-0612-01, 6- to 12-inch depth). Phenol and dimethylphthalate were the most frequently detected SVOCs, with maximum concentrations of 1.2 ppm (estimated, sample ID P001-SD006-0006-02, 6- to 12-inch depth) and 0.86 ppm (estimated, sample ID P001-SD006-0006-02, 6- to 12-inch depth), respectively. 1,4-Dioxane was not detected in any of the sediment samples.

PCBs
PCBs were detected in all but one of the 30 sediment samples collected from the pond by USEPA. Aroclor 1260 was detected most frequently (in 97 percent of the sediment samples) and at the highest concentration (maximum of 100 ppm). Aroclor 1016, Aroclor 1248, and Aroclor 1254 were the other PCBs that were detected in the sediment samples (at frequencies of 20, 7, and, 27 percent, respectively).

The maximum concentration of total PCBs in the sediment samples was 114 ppm (sample ID P001-SD012-0006-01, 0- to 6-inch depth). That was the only sediment sample with total PCBs at or above 50 ppm. Five of the 30 sediment samples (17 percent) had total PCB concentrations between 10 ppm and 50 ppm. PCBs were detected in 11 of the 30 sediment samples (37 percent) at a total PCB concentration less than 1 ppm, and one sediment sample had no detectable PCBs.

Metals
All eight of the RCRA metals were detected in 18 of the 30 sediment samples. Silver was not detected in six of the sediment samples, and selenium was not detected in seven of the samples. Based on the frequencies of detection (ranging from 80 to 100 percent) and the concentrations, the results for the eight RCRA metals may reflect background concentrations.

1.3.6.4 Surface Water - Loeffel Route 203 Property

USEPA collected six surface water samples (including one duplicate sample) at five locations around the perimeter of the pond on the west side of the Loeffel Route 203 Property. The six samples were analyzed for TCL VOCs, SVOCs, and PCBs.

The water in the pond is not used as a source of drinking water. In addition, there does not appear to be an inlet or outlet to the pond. If the pond were to overflow, drainage would go across Sweets Crossing Road, through the Residential Property, and ultimately to the Valatie Kill, which is a Class C surface water body.

VOCs
Acetone (a common laboratory artifact) was detected in one of the six surface water samples at a low, estimated concentration. No other VOCs were detected in the surface water samples.

SVOCs
Many of the SVOC results for the surface water samples were rejected, including almost all of the results for two of the surface water samples (sample IDs P001-SW003-01 and P001-SW004-01) and many of the results for the other four samples. With respect to the SVOC results that were not rejected, 1,4-dioxane was not detected in any of the six surface water samples. Phenol and bis(2-ethylhexyl)phthalate were both detected in all six samples. The Class C standard for phenol is 5 ppb, and the maximum concentration of phenol in the six surface water samples was an estimated 4.9 ppb (sample ID P001-SW001-01). The maximum detection of bis(2-ethylhexyl)phthalate was 15.8 ppb (sample ID P001-SW002-01), which is above the Class C standard of 0.6 ppb. Dimethylphthalate was detected at a low estimated concentration in a single sample; there is no Class C standard for dimethylphthalate.

PCBs
The PCB results were rejected for one of the six surface water samples (sample ID P001-SW004-01). No PCBs were detected in the other five surface water samples collected by USEPA.

1.3.6.5 Solid Waste - Loeffel Route 203 Property

On December 13, 2018, three solid waste samples (including one duplicate sample) were collected by USEPA at two locations on the Loeffel Route 203 Property. These samples are assumed to represent the content of drums. The three samples were analyzed for RCRA metals and TCL VOCs, SVOCs, and PCBs.

VOCs
Several VOCs were detected in the three drum samples, but none at concentrations above the USEPA residential RMLs. Ethylbenzene, toluene, and xylenes were detected in all three samples, at relatively low concentrations except for an estimated 7.5 ppm of xylenes in one of the samples (sample ID P001-DS002-01). Notably, TCE, benzene, and chlorobenzene were not detected in any of the samples.

SVOCs
Although three drum samples were collected by USEPA for SVOC analysis (including one duplicate sample), the laboratory was unable to analyze two of the samples. In addition, results for a few of the analytes were rejected for the other sample. Although several SVOCs were detected in the one drum sample that was analyzed, none were at concentrations above the USEPA residential RMLs. The SVOCs detected at the highest concentrations were phenolic compounds and naphthalene. 1,4-Dioxane was not detected.

PCBs

Although USEPA collected three drum samples (including one duplicate sample) for PCB analysis, the laboratory was unable to analyze two of the samples. Aroclor 1260 was the only PCB detected in the sample that was analyzed, at a concentration of 50 ppm.

Metals

All eight RCRA metals were detected in one or more of the three drum samples that were collected by USEPA. However, none of the results exceeded USEPA's residential RMLs.

2. INVESTIGATION

This section details the additional investigation activities that are proposed to collect sufficient information to assess the scope of additional removal activities. The scope presented in this RSWP builds upon the analytical data and other information obtained by USEPA. This RSWP was developed with input from USEPA, specifically, during a Site visit on September 10, 2019 and a subsequent October 1, 2019 meeting. As discussed during these meetings, additional investigation is proposed in several areas of the Loeffel Route 203 Property (including the Former AST/Potential Lagoon Area, UST, Drum Area, Pond Area, Eastern Drainageway, and Upland Area), the National Grid Property, and the Residential Property. The proposed investigation activities are detailed in the following sections. However, as discussed with USEPA, the data collected during the activities discussed herein may suggest the need for some additional information. Therefore, this RSWP includes preparation of an Interim Deliverable (see Section 6.4) to facilitate discussion of the investigation results and a determination whether any additional data collection is warranted before proceeding with the Final Investigation Report.

2.1 Access

Access will be required from three property owners in order to conduct the proposed investigation activities (i.e., the Loeffel Route 203 Property, National Grid Property, and Residential Property). In addition, access and/or permits may need to be obtained from the Town of Nassau and New York State Department of Transportation (NYSDOT) for any work performed in the right of ways for Sweets Crossing Road and Route 203, respectively. Respondent will seek access to the three properties in accordance with the provisions of the Settlement Agreement. USEPA will advise the owner that allowing access to the Loeffel Route 203 Property (aka 5225-5239 Route 203, Town of Nassau, Rensselaer County, New York) to perform the additional investigation activities is an obligation of the owner.

2.2 Site Reconnaissance

An initial Site visit was conducted on September 10, 2019 during which Respondent and representatives from OBG met with USEPA to discuss the proposed investigation and walk the Loeffel Route 203 Property, National Grid Property, and Residential Property. Additional Site visits will be performed to identify sampling locations as described below and on an as-needed basis. However, as discussed in Section 2.5, a Site visit with USEPA will be conducted to discuss and physically mark/flag the sampling locations prior to starting the subsurface investigation activities.

2.3 Surface Geophysical Survey

A surface geophysical survey will be performed at the Loeffel Route 203 Property to attempt to identify potential subsurface anomalies, including but not limited to the suspected buried lagoon in the Former AST/Potential Lagoon Area and possible buried drums or other containers. The survey will also be conducted to delineate the extent of the suspected 30,000-gallon UST. As shown on

Figure 2-1, an electromagnetic (EM) and magnetic (MAG) survey will be performed in accessible areas of the Loeffel Route 203 Property, including the Pond Area and Upland Area, but excluding the residential area in the northeast corner. The EM and MAG surveys will be performed using a Geonics EM-31 terrain conductivity meter and Geometric G858G cesium vapor magnetometer (or similar) along parallel profiles spaced approximately 10 feet and 4 feet apart, respectively. Additionally, ground-penetrating radar (GPR) will be performed to further characterize anomalies identified by the EM and MAG surveys if surface conditions allow. A GSSI digital GPR system and a dual-frequency 300/800 megaHertz scanning antenna (or equivalent system) will be used. Measurement locations will be recorded using differential global positioning system (DGPS).

The surface geophysical survey will be performed by RETTEW Field Services, Inc. (RETTEW) (formerly Enviroscan, Inc.) or an alternative qualified surface geophysical survey firm under the supervision of OBG. The results of the geophysical survey will be summarized by RETTEW and presented in a report. These results and the utility mark-out discussed in Section 2.4, below will inform the selection of the actual subsurface investigation sampling locations, which will be reviewed with USEPA as discussed in Section 2.5.

2.4 Utility Mark-Out

The purpose of the utility mark-out task is to protect the health and safety of the investigation team, and reduce the potential for damage to underground utilities/structures. Prior to commencing subsurface work at the proposed drilling locations, Dig Safely New York (DSNY) will be contacted by the drilling subcontractor to clear utilities in the vicinity of the planned subsurface investigation locations. Also prior to commencing subsurface work and in conjunction with the surface geophysical survey (Section 2.3), a private utility mark-out will be performed. The utility mark-out will utilize surface geophysical techniques to locate underground utilities and structures at targeted portions of the Loeffel Route 203 Property and select proposed drilling locations on the National Grid Property and Residential Property if there is a concern that privately owned subsurface utilities/structures are proximal to a proposed drilling location. The location of identified subsurface utilities and structures will be marked with paint, wood stakes, and/or pin flags; locations will be documented with photographs and recorded using a DGPS system for future reference and reporting.

The utility mark-out will be performed by RETTEW or an alternative qualified utility locating firm under the supervision of OBG. The actual drilling locations will be modified as necessary based on the utility mark-out and surface geophysical survey results, as discussed in Section 2.3.

2.5 Soft Dig and Sampling of UST Contents

As discussed above, there is no port or piping at the ground surface to access and investigate the contents of the suspected UST. Based on the results of the surface geophysical survey proposed in Section 2.3, soft digging techniques (including use of a truck-mounted vacuum excavator) will be used to expose the top of the UST to locate a potential sampling port, pipe or bung. The top of the UST is estimated to be approximately 2 to 3 feet below grade. Exposing the top of the tank may reveal one or more connections to the tank such as a riser fill pipe and/or vent pipe. If present, the riser pipe or vent pipe joint at the top of the UST will be loosened to gain access to the tank to determine if any liquid is present. This will include obtaining an estimate of the thickness of any liquids in the tank to estimate volume. If liquid is present in the tank, a weighted bailer will be used to collect a sample of the aqueous UST contents and to visually observe the liquid(s). Alternatively, a peristaltic pump and drop tube will be used to collect a sample of the UST contents. If a sampling port or other readily accessible method of obtaining a sample cannot be identified on the UST, then no sample will be obtained.[8]

[8] As discussed with USEPA, the integrity of the UST will not be intentionally compromised during this investigation to collect a sample.

The aqueous UST sample(s) will be collected in accordance with the appropriate sampling procedure detailed in the UFP-QAPP and sent via chain-of-custody to Eurofins Lancaster Laboratories Environmental, LLC (ELLE) for laboratory analysis of: TCL VOCs using USEPA SW-846 Method 8260C; TCL SVOCs using USEPA SW-846 8270D; TCL pesticides using USEPA SW-846 Method 8081B; PCBs using USEPA SW-846 Method 8082A; Target Analyte List (TAL) metals using USEPA SW-846 6010D/6020; mercury using USEPA SW-846 Method 7470A; and total cyanide (CN) by USEPA SW-846 9012B (see **Table 2-1**). Quality assurance/quality control (QA/QC) samples will not be collected for the UST sample(s) and these data will not be validated.

If the UST contains liquids and/or solids that can be sampled, then disposal characterization sampling and analyses will also be performed. Aqueous and solid samples will be sent via chain-of-custody to ELLE for laboratory analysis of the toxicity characteristic leaching procedure (TCLP) and hazardous characteristic parameters identified on **Table 2-1**.

Following the sampling activities, the shallow excavation will be backfilled to the height of the surrounding grade.

OBG will perform the sampling activities proposed in this section and will supervise Parratt Wolff, Inc. (Parratt-Wolff) to soft dig above the top of the UST.

2.6 Pre-Investigation Sampling Location Mark-Out

After the performance of the surface geophysical and utility mark-out surveys and prior to the initiation of soil sampling activities, Respondent will have a call/meeting with USEPA to review and confirm the sampling plan, specifically, the sample locations and depths for PCB analysis and sample archiving for contingent PCB analysis, and TCL/TAL analysis. Following this meeting, OBG personnel will field locate and mark-out the proposed soil sample locations in consultation with USEPA.[9] The soil sampling locations will be located in the field using a handheld Trimble global positioning system (GPS) (or equivalent). The XY coordinates of the proposed sampling locations will be uploaded to the GPS unit prior to the Site visit. Each sample location will be checked for accessibility by a track-mounted, direct push technology (DPT) rig including the slope of the ground surface. A DPT rig is generally not capable of operating on slopes greater than 15 to 20 percent. Any location which is not accessible will be noted and either re-positioned or slated for sampling by an alternative method (e.g., manual method). Sampling locations may also be re-positioned based on other considerations as agreed upon with USEPA. Final sampling locations will be marked with a wooden stake or pin flag in the field. The flag/stake will indicate the sample location identification and targeted total depth.

2.7 Soil Sampling and Analysis

Soil sampling for laboratory analysis will be performed to augment the sample results from USEPA's investigation and to further characterize Loeffel Route 203 Property-related contaminants in soil at the Site, including the National Grid Property and Residential Property. As discussed above, a preliminary sampling plan including figures presenting sampling locations, sample numbers, depths and analyses was reviewed with USEPA during an October 1, 2019 meeting. USEPA concurred with the preliminary plan with some minor comments and additions, which are addressed in this RSWP. The details of the sampling and analysis plan is presented below and in the following subsections.

Soil sampling will be performed at the locations described in Sections 2.7.1 through 2.7.3, which includes overburden soil at the Loeffel Route 203 Property, the National Grid Property to the west, and the Residential Property to the south. In general, continuous soil cores will be collected using a single or dual tube sampling system lined with an acetate sleeve advanced with a DPT unit operated by Parratt-Wolff, or other qualified drilling firm. Continuous soil cores will be

[9] See Section 2.7 for a discussion of proposed soil sampling.

collected from ground surface to a depth of either 1 foot, 3 feet, 5 feet, 15 feet, or 30 feet below grade depending on location. If refusal is encountered shallower than the depth specified for a given location and the actual boring depth is approximately 50 percent (%) or more of the intended depth, then the boring will be considered complete. If refusal occurs at a depth of less than approximately 50% of the intended boring depth, then up two additional attempts will be made per location to attempt to bypass the refusal surface. In addition to a DPT rig, shallow borings (i.e., 5 feet or less) may be advanced using manual methods including hand-auger or manual direct push methods or powered hand-tool.

Soil samples will be collected and classified in the field in accordance with the appropriate procedure detailed in the UFP-QAPP by an OBG geologist using the Modified Burmeister and Unified Classification Systems. In addition to logging the geologic descriptions, observations including soil texture, composition, color, consistency, moisture content, recovery, and the observance of noticeable odors or stains will be recorded on the boring log by the geologist. Portions of the samples will also be collected for headspace analysis screening using a hand-held photoionization detector (PID).

Soil samples will be collected for laboratory analysis as described in Sections 2.7.1 through 2.7.3. However, the sample intervals described in these sections may be altered in the field by either party in consultation with the other and with USEPA approval based on visual observations and field screening results. For example, if warranted, an interval targeted for analysis may be switched with a non-sampled interval, and a non-sampled interval may be sampled for analysis or archived for potential analysis.

For the soil sampling program, QA/QC samples will be collected in accordance with the UFP-QAPP at a frequency of one per 20 environmental samples. QA/QC samples include blind duplicate samples and matrix spike/matrix spike duplicate (MS/MSD) sample pairs and trip blanks. Equipment blanks (i.e., rinsate blanks) will be collected for non-dedicated sampling equipment (e.g., hand auger). Trip blanks will be included with each sample cooler containing aqueous VOC samples. These QA/QC samples will allow for data validation, if performed (see Section 3).

Upon completion, soil borings less than 5 feet in depth will be backfilled to grade with granular bentonite, which will be tamped into placed. Soil borings deeper than 5 feet will be tremie grouted and/or backfilled to grade using granular bentonite.[10] Soil boring locations will be marked in the field using wooden stakes and survey flagging (or equivalent) and surveyed for horizontal and vertical control by a licensed Professional Land Surveyor as described in Section 2.15. Non-dedicated sampling equipment decontamination will be performed in accordance with the UFP-QAPP. The management of investigation-derived materials (IDM) produced during soil boring activities is described in Section 2.16.

2.7.1 Loeffel Route 203 Property

As shown on **Figure 2-2** and summarized on **Table 2-1**, a total of 94 soil sampling locations comprising shallow soil borings (5 feet in depth or less) and deep soil borings (to depths of 10, 15, and 30 feet)[11] will be advanced on the Loeffel Route 203 Property as discussed below.

2.7.1.1 Shallow Soil Borings

Sixty-five continuously sampled shallow soil borings will be advanced on the Loeffel Route 203 Property from ground surface to 5 feet below grade, or refusal (if shallower). As shown on **Figure 2-2**, the sampling locations are selected to further characterize soil where total PCB concentrations detected during USEPA's investigation are greater than 1 ppm (e.g., the Pond

[10] Soil borings that are completed as overburden groundwater monitoring wells will not be backfilled.

[11] Or shallower depending on refusal depth.

Area, Former AST/Potential Lagoon Area, and Drum Area) and to characterize soil in areas not previously investigated by USEPA (e.g., wooded area north of the pond and southern driveway, and proximal to the Eastern Drainageway).

Sample collection depths and analyses, including archived samples for contingent analysis, are provided on **Table 2-1**. Samples will be collected for laboratory analysis as follows:

- 195 samples will be analyzed for PCBs using USEPA SW-846 Method 8082A, and an additional 130 samples will be archived for contingent PCB analysis;[12]
- 10 samples will be analyzed for TCL/TAL constituents and CN;
- Five samples will be analyzed for total organic carbon (TOC) using the Lloyd Kahn method;
- Five samples will be analyzed for grain size using ASTM D422 and bulk density using ASTM e-868-82.

Soil samples will be collected in accordance with the soil sampling procedure detailed in the UFP-QAPP and sent via chain-of-custody to ELLE for laboratory analysis.

2.7.1.2 Deep Soil Borings

As discussed above, USEPA's investigation did not evaluate soil deeper than 4 feet at the Site. A total of 20 continuously sampled deep soil borings will be advanced on the Loeffel Route 203 Property from ground surface to up to 30 feet below grade or refusal (if shallower). As shown on **Figure 2-2**, 13 borings will be advanced to a maximum of 10 feet, two borings will be advanced to a maximum of 15 feet, and five borings will be advanced to a maximum of 30 feet. The sampling locations are selected to characterize subsurface soil around the UST, in the Former AST/Potential Lagoon Area, Drum Area and other portions of the Loeffel Route 203 Property.

Sample collection depths and analyses, including archived samples for contingent analysis, are provided on **Table 2-1**. Samples will be collected from the deep soil borings for laboratory analysis as follows:

- 80 samples will be analyzed for PCBs using USEPA SW-846 Method 8082A, and an additional 40 samples will be archived for contingent PCB analysis;[13]
- Five samples will be analyzed for TCL/TAL constituents and CN;
- Five samples will be analyzed for TOC using the Lloyd Kahn method; and
- Five samples will be analyzed for grain size using ASTM D422 and bulk density using ASTM e-868-82.

Soil samples will be collected in accordance with the soil sampling procedure detailed in the UFP-QAPP and sent via chain-of-custody to ELLE for laboratory analysis.

2.7.1.3 Eastern Drainageway

Nine continuously sampled shallow soil borings will be advanced in the bed of the ephemeral stream associated with the Eastern Drainageway from ground surface to 3 feet below grade or refusal (if shallower). The sampling locations are shown on **Figure 2-2** and were selected to

[12] Refer to Section 2.7, which discusses potential alteration of sample intervals by either party in consultation with the other and with USEPA approval based on visual observations and field screening results.

[13] Refer to Section 2.7 which discusses potential alteration of sample intervals by either party in consultation with the other and with USEPA approval based on visual observations and field screening results.

characterize soil in the potential surface migration pathway not previously evaluated during USEPA's investigation.

Sample collection depths and analyses, including archived samples for contingent analysis, are provided on **Table 2-1**. Samples will be collected for laboratory analysis as follows:

- 27 samples will be analyzed for PCBs using USEPA SW-846 Method 8082A, and an additional 18 samples will be archived for contingent PCB analysis;[14] and
- One sample will be analyzed for TCL/TAL constituents and CN.

As also shown on **Figure 2-2** and **Table 2-1**, one soil boring will be advanced to a depth of 2 feet below grade in the upgradient portion of the ephemeral stream on the eastern side of Route 203, immediately east of the culvert. Two samples will be analyzed for PCBs using USEPA SW-846 Method 8082A, and an additional two samples will be archived for contingent PCB analysis. One sample will be analyzed for TCL/TAL constituents and CN.

Soil samples will be collected in accordance with the soil sampling procedure detailed in the UFP-QAPP and sent via chain-of-custody to ELLE for laboratory analysis.

2.7.2 National Grid Property

The National Grid Property lies immediately to the west of the Loeffel Route 203 Property extending in approximately a north-south direction and is a former railroad grade (see **Figure 1-2**). In December 2018 and May 2019, USEPA collected soil samples at approximately 18 locations on the National Grid Property. These samples were organized into approximately six east-west oriented transects extending from the western shoreline of the pond on the Loeffel Route 203 Property to the west, across the property boundary and up the slope to the former railroad grade. Each transect included two and five soil sample locations. At five of the 18 sample locations, one or more soil samples detected total PCB concentrations exceeding 1 ppm. Other constituents were also detected, and are commonly associated with railroad beds.

Nine continuously sampled shallow soil borings will be advanced on the National Grid Property[15] from ground surface to 3 feet below grade or refusal (if shallower). As shown on **Figure 2-2**, the sampling locations are selected to further characterize soil where total PCB concentrations detected during USEPA's investigation are greater than 1 ppm. As discussed with USEPA, the sampling locations are constrained to the eastern slope of the utility corridor.

Sample collection depths and analyses are provided on **Table 2-1**. Samples will be collected for laboratory analysis as follows:

27 samples will be analyzed for PCBs using USEPA SW-846 Method 8082A.[16] One sample will be analyzed for TCL/TAL constituents and CN.

Soil samples will be collected in accordance with the soil sampling procedure detailed in the UFP-QAPP and sent via chain-of-custody to ELLE for laboratory analysis.

[14] Refer to Section 2.7 which discusses potential alteration of sample intervals by either party in consultation with the other and with USEPA approval based on visual observations and field screening results.

[15] The number of sampling locations on the National Grid Property is approximate and is based on the assumed location of the property boundary between this and the Loeffel Route 203 Property.

[16] Refer to Section 2.7 which discusses potential alteration of sample intervals by either party in consultation with the other and with USEPA approval based on visual observations and field screening results.

2.7.3 Residential Property

The Residential Property lies immediately south of Sweets Crossing Road from the Loeffel Route 203 Property. In May 2019, USEPA collected soil samples at 10 locations on this property or immediately adjacent as shown on **Figure 2-3**. Seven of these locations were distributed across the open grassy area south of the abandoned culvert that extends beneath Sweets Crossing Road from the southern tip of the pond. Total PCBs did not exceed 1 ppm in any of these samples. Three locations are distributed along the drainage swale associated with the ephemeral stream that flows from the Loeffel Route 203 Property through the twin culvert under Sweets Crossing Road. Total PCBs exceeded 1 ppm in one of the samples collected at the three drainage swale locations.

As shown on **Figure 2-3**, a total of 19 soil sampling locations will be advanced on the Residential Property to characterize shallow soil in or adjacent to the drainage swale and along the ephemeral stream. Of these, 16 continuously sampled shallow soil borings will be advanced from ground surface to 3 feet below grade. Four of these sampling locations will be advanced approximately 10 feet to the northeast, southeast, southwest, and northwest of the USEPA sample where total PCBs were detected above 1 ppm. As requested by USEPA, three of the 19 soil sampling locations will be advanced from ground surface to 1 foot below grade along and adjacent to the ephemeral stream where it enters a low-lying area in the southwestern corner of the Residential Property.

Sample collection depths and analyses, including archived samples for contingent analysis, are provided on **Table 2-1**. Fifty-four samples will be collected for laboratory analysis of PCBs using USEPA SW-846 Method 8082A, and an additional 32 samples will be archived for contingent PCB analysis.[17]

Soil samples will be collected in accordance with the soil sampling procedure detailed in the UFP-QAPP and sent via chain-of-custody to ELLE for laboratory analysis.

2.8 Wetlands Delineation

Based on information in **Exhibit C**, a portion of the Loeffel Route 203 Property in the area of the pond is included in the National Wetland Inventory (NWI) maintained by the United States Fish and Wildlife Service (USFWS). As part of this investigation a wetlands survey will be performed in accordance with the following approach:

- Prior to conducting the field survey, an OBG scientist will review the available published information which may include: Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (United States Army Corps of Engineers [USACE], January 2012); NWI Data; and Information, Planning and Conservation System (IPaC) – Species Data. The information acquired from this review will be used to guide the field survey and these sources may be consulted during the survey. However, final wetland determinations will be made based on information obtained in the field.
- Plant community types will be visually recognized and their dominant component species will be identified. Wetland indicator status will be obtained, if available, for each species which is identified and recorded on the field data sheet. If 50 percent or more of the dominant species in the plant community are observed to have an indicator status of facultative (FAC) or wetter (facultative wetland [FACW] and obligate wetland [OBL]), then a hydrophytic vegetative community will be determined to be present.

[17] Refer to Section 2.7 which discusses potential alteration of sample intervals by either party in consultation with the other and with USEPA approval based on visual observations and field screening results.

- Prospective wetland areas will be examined for the presence of hydrology in the areas occupied by the hydrophytic plant community. If wetland hydrologic indicators (e.g., water marks, water stained leaves, sediment deposits, drainage patters, inundation) are observed, then sufficient evidence of wetland hydrology will be considered to be present.
- Hand auger borings of the soil substrate in the prospective wetland areas will be examined in each area in multiple locations. The characteristics of the soil will be compared to hydric soil indicators as prescribed by USACE's 1987 Corps of Engineers Wetlands Delineation Manual. If the soils are observed to have positive hydric soil indicators (e.g., histosol, aquatic moisture regime, low chroma colors), then hydric soil will be considered present.
- If all of the above characteristics (i.e., hydrophytic vegetation, hydrology, and hydric soils) are found to be present in a prospective wetland area, the area will be considered to be a wetland. If any of the above characteristics are found to be absent in a prospective wetland area, then the area will not be considered a wetland. The location where hydrophytic vegetation and hydric soils give way to non-hydrophytic vegetation and nonhydric soils will be considered to be a wetland's boundary.

2.9 Pond Bathymetry Survey

An OBG representative will supervise a licensed Professional Land Surveyor to conduct a bathymetric survey of the approximately 1-acre pond on the western portion of the property. During the survey, the subcontractor will survey control points that will be horizontally referenced to the New York State Plane Coordinate System (SPCS), North American Datum (NAD83) and vertically to NAVD88.

The bathymetric survey will establish the subaqueous topography for use in planning sediment sampling. The bathymetric survey will be conducted to obtain the top of the sediment elevation using an echo-sounder and surveying instruments. A bathymetric contour map and a brief methodology report will be provided by the subcontractor.

2.10 Pond Soft Sediment Probing

The bathymetry data detailed in Section 2.9 will be augmented with water depth and soft sediment probing measurements to obtain sediment thickness in the pond. Measurement locations will be based on a gridded pattern and will generally correspond with the 31 sediment sampling locations shown on **Figure 2-4**. Depth measurements and soft sediment probing will be performed in accordance with the UFP-QAPP.

2.11 Pond Sediment Sampling and Analysis

Thirty sediment samples were collected at 14 locations near the perimeter of the pond during USEPA's investigation. Samples from the interior portion of the pond were unable to be collected because of winter weather conditions. As discussed above, a preliminary sampling plan including figures presenting sampling locations, sample numbers, depths and analyses was reviewed with USEPA during an October 1, 2019 meeting. USEPA concurred with the preliminary plan with some minor comments and additions, which have been addressed in this RSWP. The details of the sampling and analysis plan is presented below.

Sediment samples will be obtained at an additional 31 sample locations to a depth of 3 feet below the top of sediment or refusal (if shallower). As shown on **Figure 2-4**, the 31 proposed sediment sampling locations are distributed across the pond in an approximately gridded pattern. Based on the depth of the pond and the estimated thickness of the pond sediments obtained during the bathymetric survey and soft sediment probing, the sediment sampling methods and number of vertical samples may need to be adjusted. For the purpose of the RSWP, it is presumed the soft

sediment samples will be collected using a combination of techniques using Lexan or aluminum tubes (or equivalent) advanced manually or with hand-held equipment.

Sample collection depths and analyses, including archived samples for contingent analysis, are provided on **Table 2-1**. Samples will be collected for laboratory analysis as follows:

- 93 samples will be analyzed for PCBs using USEPA SW-846 Method 8082A, and an additional 62 samples will be archived for contingent PCB analysis;
- Five samples will be analyzed for TCL/TAL constituents and CN;
- 31 samples will be analyzed for TOC using the Lloyd Kahn method; and
- Five samples will be analyzed for grain size using ASTM D422 and bulk density using ASTM e-868-82.

Samples will be collected in accordance with the sediment sampling procedure detailed in the UFP-QAPP and sent via chain-of-custody to ELLE for laboratory analysis. QA/QC samples will be collected in accordance with the UFP-QAPP at a frequency of one per 20 environmental samples. QA/QC samples include blind duplicate samples and MS/MSD sample pairs. Equipment blanks (i.e., rinsate blanks) will be collected for non-dedicated sampling equipment. Trip blanks will be included with each sample cooler containing aqueous VOC samples. These QA/QC samples will allow for data validation, if performed (see Section 3).

Horizontal coordinates for each sediment sampling location will be obtained during the sampling event using a hand-held GPS device capable of sub-meter accuracy.

The management of IDM produced during sediment sampling activities is described in Section 2.16.

2.12 Staff Gauge Installation

To obtain the surface water elevation in the pond relative to groundwater, a staff gauge will be installed on the eastern side of the pond at the approximate location shown on **Figure 2-2**. The staff gauge (SG-01) will be constructed of either a fiberglass, porcelain enameled iron or steel plating affixed to a stable structure (e.g., galvanized steel post manually driven into the pond sediments). The staff gauge will include graduation marks to allow for measurements to the nearest hundredth of a foot. Measurement of the staff gage will be recorded during groundwater monitoring as discussed in Section 2.14.1.

2.13 Overburden Monitoring Well Installation

Under the oversight of an OBG geologist or hydrogeologist, overburden monitoring wells will be installed at five locations on the Loeffel Route 203 Property. The installation of these wells will facilitate the collection of groundwater samples to characterize overburden groundwater and to evaluate groundwater flow direction. It is envisioned that the 30-foot deep soil borings discussed in Section 2.7 will be completed as overburden monitoring wells as shown on **Figure 2-2**. Concurrence on these monitoring well locations was reached during the October 1, 2019.

The five monitoring wells will be installed and constructed such that the screened portion of the wells intersect the water table within the unconsolidated deposits to allow the collection of groundwater samples and water level measurements from the uppermost portion of the saturated zone. Therefore, the depths of the wells will be determined based on the depth at which groundwater is first encountered in the overburden at each location.

The wells will be constructed with 10 feet of 2-inch inner diameter, 0.010-inch or 0.020-inch slot schedule 40 polyvinyl chloride (PVC), pre-packed (No. 1 or No. 2 size sand) well screen flush-threaded to appropriate lengths of 2-inch inner diameter schedule 40 PVC riser casing necessary

to bring the top of the well to grade. Each new overburden monitoring well will be completed with keyed-alike padlocks with J-plugs, and steel casing equipped with a locking cap placed over the monitoring well. The protective casing will extend at least two feet below ground surface and will be cemented in place. In some areas it may be necessary to complete the wells with flush-mounted, bolt-down steel manholes set within approximately 2-foot by 2-foot square protective concrete pads, a minimum of 4-inches thick.

2.13.1 Overburden Monitoring Well Development

Following installation of the overburden monitoring wells, each overburden well will be developed prior to performing the additional hydrogeologic investigation activities described in the following sections. The overburden wells will be developed to:

- Remove fine-grained particulates from the well and filter pack;
- Reduce the turbidity within the water column; and
- Enhance the hydraulic connection between each well and the surrounding formation.

Monitoring well development will be completed in accordance with the development procedure provided in the UFP-QAPP. Each newly-constructed monitoring well will be developed as soon as practicable, but no sooner than 24 hours after installation. Non-dedicated, non-disposable equipment used in the development process will be decontaminated before and after each use in accordance with the field equipment decontamination procedure provided in the UFP-QAPP

The management of IDM groundwater and solids produced during the well development activities is described in Section 2.16.

2.14 Groundwater Sampling and Analysis

Groundwater samples will be collected from each of the newly-installed overburden monitoring wells at the Site shortly after monitoring well installation and development activities are completed. Concurrent with this sampling event, a sample will also be collected from the supply well located in the southern portion of the Loeffel Route 203 Property near the commercial outbuildings, as discussed below in Section 2.14.2.

2.14.1 New Monitoring Wells

Groundwater samples will be collected no less than two weeks after the completion of well development activities at each newly-installed monitoring well. Non-dedicated, non-disposable sampling equipment will be decontaminated before and after sampling at each monitoring well in accordance with the field equipment decontamination procedure provided in the UFP-QAPP. Groundwater samples will be obtained using low-flow sampling techniques in accordance with the sampling procedure provided in the UFP-QAPP for analysis of TCL/TAL constituents and CN per **Table 2-1**. To provide additional information on the general groundwater conditions, water quality parameters will be measured using a flow-through cell during low-flow sampling. Measurements of dissolved oxygen (DO), oxidation reduction potential (ORP), temperature, pH, specific conductivity and turbidity will be obtained for each monitoring well sampled.

The groundwater samples will be sent to ELLE under chain-of-custody procedures as provided in the UFP-QAPP. QA/QC samples will be collected in accordance with the QAPP at a frequency of one set per 20 environmental samples. QA/QC samples include blind duplicate samples, equipment blanks, MS/MSD sample pairs, and trip blanks. Trip blanks will be included with each sample cooler containing aqueous VOC samples. These QA/QC samples will allow for data validation (see Section 3).

During the sampling event, water level measurements will be collected from the monitoring wells and newly-installed pond staff gage in accordance with the water level measurement procedure provided in the UFP-QAPP.

2.14.2 Supply Well

The supply well located at the southern end of the Loeffel Route 203 Property (see **Figure 1-2**) will be sampled concurrently with the five new overburden wells. Based on the limited information in the available well record, the supply well was drilled to a depth of 100 feet with casing installed to a depth of 38 feet. It is assumed that the well was installed into bedrock which is reported to be "slate rock" with a reported yield of 50 gallons per minute (gpm). As discussed above, the supply well was previously sampled by USEPA in December 2018 and March 2019 and the results were below the federal MCLs.

A sample will be collected from the supply well in accordance with the sampling procedure provided in the UFP-QAPP for analysis of TCL/TAL constituents and CN per **Table 2-1**. The sample will be sent to ELLE under chain-of-custody procedures. QA/QC samples will be collected in accordance with the UFP-QAPP at a frequency of one set per 20 environmental samples. QA/QC samples include blind duplicate samples, equipment blanks, MS/MSD sample pairs, and trip blanks. Trip blanks will be included with each sample cooler containing aqueous VOC samples. These QA/QC samples will allow for data validation (see Section 3).

2.15 Professional Land Survey

The following locations associated with the investigation activities presented in this RSWP will be surveyed for horizontal and vertical control by a licensed Professional Land Surveyor:

- Soil sampling locations;
- Pond staff gage;
- Select subsurface utilities and structures identified during surface geophysical survey and marked at the surface by the geophysical contractor;
- Five new overburden monitoring wells; and
- Two supply wells on the Loeffel Route 203 Property.

For the locations listed above, the surveyor will use and report the horizontal locations in New York SPCS, NAD83 and vertical elevations in NAVD88. Horizontal coordinates will be obtained to the nearest 0.1 feet. Elevation data will be obtained from the top of the inner PVC casing (or steel casing), the top of the riser pipe, and top of the staff gage to the nearest 0.01 feet, and ground surface to the nearest 0.1 feet. The survey information will be incorporated into the Site base map.

2.16 Management of Investigation-Derived Materials

IDM resulting from the various investigation activities in this RSWP will require appropriate management. The IDM includes the following:

- Soil and drill cuttings;
- Sediment;
- Groundwater resulting from the development of the overburden monitoring wells;
- Purge water from well sampling;
- Decontamination fluids;

- Solids (if any) which settle out of groundwater and/or decontamination fluids; and
- Personnel protective equipment (PPE) and associated debris resulting from the execution of the various field activities (e.g., polyethylene sheeting, sample tubing, disposable equipment, etc.).

In addition to any specific requirements in the Settlement Agreement, Respondent will provide advanced notification to USEPA's On-Scene Coordinator (OSC) prior to the off-site shipment of IDM. Such notification will include the anticipated shipment date(s) and name(s) of the receiving facility(ies).

The management of these materials is discussed below.

2.16.1 Soil and Drill Cuttings

For the soil sampling locations including shallow and deep soil boring and monitoring well locations, any soil remaining after screening and sampling will be collected in a 5-gallon bucket or placed directly into a 55-gallon drum. If using a 5-gallon bucket, the bucket will be periodically emptied into a 55-gallon drum. The soil excavated from the top of the UST will be replaced after the tank is accessed and sampled.

The drum(s) of excess soil from the investigation will be transported to the designated temporary IDM staging area at the Loeffel Route 203 Property and will be labeled with the appropriate location identification(s), the dates on which the cuttings were containerized, and a description of the type of material (i.e., overburden drill cuttings). Representative samples of the drummed soil and drill cuttings will be collected and sent via chain-of-custody to ELLE for laboratory analysis of TCLP and hazardous characteristic parameters identified on **Table 2-1**. The final disposition of the drummed drill cuttings will be determined based on the results of the laboratory analysis. After receiving the necessary approval(s), the soil will be transported for off-site disposal at an approved facility.

2.16.2 Sediment

Any excess sediment collected during the pond sampling program will initially be placed in a 5-gallon bucket (or similar) for ease of handling. The sediment will be allowed to settle and as necessary, any excess water will be decanted off the top, and the decanted water will be containerized, characterized and managed with the decontamination fluids IDM. The sediment will be containerized, characterized and managed with the soil and drill cuttings IDM.

2.16.3 Groundwater

Groundwater collected during the overburden well drilling, well development, and groundwater sampling event will be containerized in polyethylene storage tanks and/or 55-gallon drums and transported to the designated temporary IDM staging location at the Loeffel Route 203 Property and appropriately labeled. A representative sample or samples of the containerized groundwater will be collected and sent via chain-of-custody to ELLE for laboratory analysis of TCLP and hazardous characteristic parameters identified on **Table 2-1**. The final disposition of the containerized groundwater will be determined based on the results of the laboratory analysis. After receiving the necessary approval(s), the groundwater will be transported for off-site disposal at an approved facility.

2.16.4 Decontamination Fluids and Settled Solids

To the extent possible, non-disposable equipment will be decontaminated at the Loeffel Route 203 Property prior to and after use at the Site. Liquid/solid mixtures generated during equipment decontamination will be temporarily stored in 5-gallon bucket(s) and/or 55-gallon drum(s) to allow solids to settle. Settled solids (e.g., sediment) will be containerized, characterized and managed with the soil and drill cuttings IDM.

Decontamination fluids generated during the investigation activities will be containerized in 55-gallon drums and transported to the designated temporary IDM staging location at the Loeffel Route 203 Property and appropriately labeled. A representative sample or samples of the containerized decontamination fluids will be collected and sent via chain-of-custody to ELLE for laboratory analysis of TCLP and hazardous characteristic parameters identified on **Table 2-1**. The final disposition of the containerized decontamination fluids will be determined based on the results of the laboratory analysis. After receiving the necessary approval(s), the decontamination fluids will be transported for off-site disposal at an approved facility.

2.16.5 Personal Protective Equipment and Associated Debris

PPE generated during non-intrusive, non-sampling activities (e.g., Tyvek® coveralls used during site visits or reconnaissance activities for protection against aggressive fauna and flora [e.g., ticks and poison ivy]) will be transported off-site for disposal at a local, permitted sanitary landfill.

All other PPE and associated debris (e.g., polyethylene sheeting, sample tubing, disposable equipment, etc.), will be containerized in 55-gallon drums transported to the designated temporary IDM staging location at the Loeffel Route 203 Property and labeled appropriately. A representative sample or samples of the containerized PPE/debris will be collected and sent via chain-of-custody to ELLE for laboratory analysis of TCLP and hazardous characteristic parameters identified on **Table 2-1**. The final disposition of the containerized PPE and debris will be determined based on the results of the laboratory analysis. After receiving the necessary approval(s), the PPE/debris will be transported for off-site disposal at an approved facility.

3. LABORATORY ANALYSIS, DATA VALIDATION, AND ELECTRONIC DATA DELIVERABLES

As discussed in Section 2.0, soil samples, sediment samples, and groundwater samples will be collected for laboratory analysis during implementation of the investigation. A summary of these samples is provided on **Table 2-1**. Third-party, fully-validatable, Contract Laboratory Program (CLP) equivalent data packages will be obtained from ELLE for the following analyses:

- PCBs for soil and sediment samples;
- Non-PCB TCL/TAL constituents and CN for select soil and sediment samples;
- TCL/TAL constituents and CN for groundwater samples; and
- 1,4-dioxane for groundwater samples.

Data validation will be performed for the soil, sediment and groundwater sample results for TCL/TAL constituents (including PCBs) and CN, and for the groundwater sample results for 1,4-dioxane. Sufficient QA/QC samples[18] will be collected for the analyses listed above in order to perform the data validation.

Data packages will be obtained from ELLE for the soil and sediment samples submitted for analysis of TOC, grain size, and bulk density, and for the aqueous sample(s) collected from the UST for analysis of TCL/TAL constituents and CN. These data packages will consist of a case narrative, analytical results, data qualifications, and field chain-of-custody forms, and the results will not be validated.

Data packages will be obtained from ELLE for the waste characterization samples collected from the IDM (see Section 2.16). These results will not be validated.

Sampling and monitoring data will be submitted to USEPA in a USEPA Region 2 Electronic Data Deliverable (EDD) format. Associated geospatial data will be submitted to USEPA in an Environmental Systems Research Institute (ESRI) Shapefile format.

4. QUALITY ASSURANCE PROJECT PLAN

A UFP-QAPP was prepared for the investigation in accordance with the Uniform Federal Policy for Quality Assurance Project Plans, Parts 1, 2A, 2B and 2C, USEPA-505-B-04-900A, B and C (Version 1), March 2005 or newer (e.g., Part 2A revised March 2012), and is included as **Appendix A**, attached hereto.

5. HEALTH AND SAFETY PLAN

A HASP has been prepared for the investigation activities and is being provided under separate cover. The HASP was prepared in conformance with 29 CFR 1910.120, which is OSHA's Hazardous Waste Operations and Emergency Response (HAZWOPER) regulation, and is included as **Appendix B**, attached hereto.

[18] As described in the UFP-QAPP, this includes duplicate samples, equipment blanks, MS/MSD sample pairs and, for VOC analyses, trip blanks.

6. REPORTING

This section describes the various reporting that will be performed during implementation of this RSWP.

6.1 Weekly Conference Calls

During the investigation field activities, Respondent will schedule and hold weekly conference calls with USEPA to provide updates on progress, upcoming tasks, and any potential issues to be resolved. Subsequent to each conference call, a summary of each conference call will be emailed to USEPA unless otherwise agreed upon by USEPA.

6.2 Monthly Progress Reports

Monthly Progress Reports will be prepared and submitted to USEPA by the 15th day of each month following the Effective Date of the Settlement Agreement and will continue until submittal of the Final Investigation Report to USEPA. The Monthly Progress Reports will include the elements specified in the Settlement Agreement. A summary data table showing detections will be developed for each sampling event and included in the Monthly Progress Report. The frequency of these reports may be revised with written approval from USEPA.

6.3 Data Validation Reports

The analytical results obtained for TCL/TAL constituents (including PCBs), CN and 1,4-dioxane in the soil, sediment and/or groundwater samples will be validated in accordance with the procedures detailed in the UFP-QAPP. The data validation will be documented in Data Validation Reports, which will be submitted to USEPA within 45 days of meeting to discuss the Interim Deliverable (see Section 6.4 below), and will be included in Final Investigation Report.

6.4 Interim Deliverable for Soil, Sediment, and Groundwater Results

An Interim Deliverable for the soil, sediment, and groundwater results will be prepared and submitted to USEPA within 45 days after the receipt of the final set of laboratory analytical results, or such longer time as specified or agreed to by USEPA. The Interim Deliverable will provide the opportunity to evaluate and discuss the results for each sample medium to determine if additional data collection is warranted prior to the preparation of the Final Investigation Report.

6.5 Final Investigation Report

A Final Investigation Report will be submitted to USEPA within (a) 60 days after determination by USEPA and Respondent based on the Interim Deliverable that additional field investigation activities are not needed or, in the alternative, (b) 75 days after receipt of the final set of laboratory analytical results from the additional field investigation activities, or such longer time as specified or agreed to by USEPA.

7. SCHEDULE

A schedule for implementing this RSWP is provided as **Figure 7-1**. This schedule begins with execution of the Settlement Agreement (which is expected to include this RSWP and the UFP-QAPP) and progresses through approval of the Final Investigation Report. The figure includes the implementation sequence of the various field tasks. For the Interim Deliverable, the schedule assumes a meeting will be held with USEPA within 7 days of submittal, and that USEPA and Respondent determine that no additional field investigation activities are needed. For the Final Investigation Report, a USEPA review time of 30 calendar days has been assumed for the initial submittal, and 14 calendar days has been assumed for review and approval or approval with

modifications for the re-submittal. Other assumptions/clarifications associated with the schedule presented on **Figure 7-1** include the following:

- Access required to perform the investigation field work on the three private properties is obtained within 20 days of the Effective Date of the Settlement Agreement. Note that access to the National Grid Property may require more time to obtain than access to the Loeffel Route 203 Property and the Residential Property.
- Investigation activities requiring access to the pond (e.g., bathymetry, soft sediment probing, sediment sampling) will be performed after ice-out has occurred.

If USEPA and Respondent determine that additional field investigation activities are warranted, then the schedule shown in **Figure 7-1** will need to be updated.

8. REFERENCES

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Weston Solutions, Inc., 2019a. Removal Assessment Sampling Report, Route 203 Site, Nassau, Rensselaer County, New York. Prepared for U.S. Environmental Protection Agency (USEPA), Region II Superfund and Emergency Management Division, Edison, New Jersey, May 23, 2019.

Weston Solutions, Inc., 2019b. Final Removal Assessment Sampling Report, Properties P021 and P026 Sampling Event, Route 203 Site, Nassau, Rensselaer County, New York. Prepared for U.S. Environmental Protection Agency (USEPA), Region II Superfund and Emergency Management Division, Edison, New Jersey, August 6, 2019.

Weston Solutions, Inc., 2019c. Removal Assessment Sampling Report, Residential Tap Water Sampling Event, Route 203 Site, Nassau, Rensselaer County, New York. Prepared for U.S. Environmental Protection Agency (USEPA), Region II Superfund and Emergency Management Division, Edison, New Jersey, June 11, 2019.

TABLES

Table 2-1

Sample Summary Table
Loeffel Route 203 Property
Nassau, Rensselaer County, New York

SAMPLE LOCATION	NUMBER OF SAMPLE LOCATIONS	MATRIX	DESCRIPTION	SAMPLE DEPTH/INTERVAL	LABORATORY ANALYSIS	FIELD ANALYSIS	NUMBER OF ANALYSES	FIGURE REFERENCE
Surface and Near-Surface Soil Sampling								
5225-5239 Route 203 Property (Upland Soil)								
SS-P001-001 to SS-P001-065*	65	Soil	Shallow soil sampling to 5 fbgs	0-6"; 18-24"; 30-36"	PCBs by 8082A	NA	195	Figure 2-2
				TBD	TCL/TAL: VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		10	
				TBD	TOC by Lloyd Kahn		5	
				TBD	Grain Size / Bulk Density		5	
			Shallow soil samples to be archived for potential analysis	42-48"; 54-60"	PCBs by 8082A		TBD	
5225-5239 Route 203 Property (Eastern Drainageway)								
SS-EDW-P001-001 to SS-EDW-P001-009*	9	Soil	Shallow soil sampling in ditch to 3 fbgs	0-6"; 6-12"; 18-24"	PCBs by 8082A	NA	27	Figure 2-2
				TBD	TCL/TAL: VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		1	
			Shallow soil samples from ditch to be archived for potential analysis	12-18"; 30-36"	PCBs by 8082A		TBD	
Route 203 Right-of-Way (Eastern Drainageway)								
SS-EDW-ROW-001	1	Soil	Shallow soil sampling in ditch to 2 fbgs	0-6"; 6-12"	PCBs by 8082A	NA	2	Figure 2-2
				TBD	TCL/TAL: VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		1	
			Shallow soil samples from ditch to be archived for potential analysis	12-18"; 18-24"	PCBs by 8082A		TBD	
Residential Property to the South								
SS-P021-001 to SS-P021-016*	16	Soil	Shallow soil sampling to 3 fbgs	0-6"; 6-12"; 18-24"	PCBs by 8082A	NA	48	Figure 2-3
			Shallow soil samples to be archived for potential analysis	12-18"; 30-36"	PCBs by 8082A		TBD	
SS-P021-017 to SS-P021-019	3	Soil	Shallow soil sampling to 1 fbgs	0-6"; 6-12"	PCBs by 8082A	NA	6	Figure 2-3
National Grid Property								
SS-P026-001 to SS-P026-009*	9	Soil	Shallow soil sampling to 3 fbgs	0-6"; 18-24"; 30-36"	PCBs by 8082A	NA	27	Figure 2-2
				TBD	TCL/TAL: VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		1	
Overburden Soil Borings								
Soil Borings to 30 Feet Below Ground Surface (or refusal if shallower)								
SB-P001-001 to SB-P001-005*	5	Soil	Deep soil boring sampling to 30 fbgs	0-6"; 18-24"; 30-36"; 54-60"	PCBs by 8082A	NA	20	Figure 2-2
				TBD	TCL/TAL: VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		1	
				TBD	TOC by Lloyd Kahn		5	
				TBD	Grain Size / Bulk Density		5	
			Soil samples from deep soil borings to 30 fbgs to be archived for potential analysis	72-84"; 108-120"	PCBs by 8082A		TBD	
Soil Borings to 15 Feet Below Ground Surface (or refusal if shallower)								
SB-P001-006 to SB-P001-007*	2	Soil	Deep soil boring sampling to 15 fbgs	0-6"; 18-24"; 30-36"; 54-60"	PCBs by 8082A	NA	8	Figure 2-2
				TBD	TCL/TAL: VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		1	
			Soil samples from deep soil borings to 15 fbgs to be archived for potential analysis	72-84"; 108-120"	PCBs by 8082A		TBD	
Soil Borings to 10 Feet Below Ground Surface (or refusal if shallower)								
SB-P001-008 to SB-P001-020*	13	Soil	Deep soil boring sampling to 10 fbgs	0-6"; 18-24"; 30-36"; 54-60"	PCBs by 8082A	NA	52	Figure 2-2
				TBD	TCL/TAL: VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		3	
			Soil samples from deep soil borings to 10 fbgs to be archived for potential analysis	72-84"; 108-120"	PCBs by 8082A		TBD	
Sediment Sampling								
SD-PND-P001-01 to SD-PND-P001-31	31	Sediment	Pond sediment sampling	0-6"; 6-12"; 18-24"	PCBs by 8082A	NA	93	Figure 2-4
				TBD	TCL/TAL: VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		5	
				0-6"	TOC by Lloyd Kahn		31	
				0-6"	Grain Size / Bulk Density		5	
			Pond sediment samples to be archived for potential analysis	12-18"; 24-36"	PCBs by 8082A		TBD	
Groundwater Sampling								
MW-OVB-P001-Well-01 to MW-OVB-P001-Well-05	5	Overburden Groundwater	Synoptic groundwater sampling event including newly installed overburden monitoring wells on property P001	TBD - Typically well screen mid-point	TCL/TAL: VOCs by 8260C; 1,4-dioxane by 8270D SIM; SVOCs by 8270D; pesticides by 8081B; PCBs by 8082A; total and dissolved metals by 6010D, mercury by 7470A and total cyanide by 9012B	pH, Temperature, Specific Conductivity, Dissolved Oxygen, Oxidation-Reduction Potential, Turbidity	5	Figure 2-2
TW-BR-P001-001	1	Bedrock Groundwater	Supply well adjacent to commercial building on property P001	Supply well pump depth	TCL/TAL: VOCs by 8260C; 1,4-dioxane by 8270D SIM; SVOCs by 8270D; pesticides by 8081B; PCBs by 8082A; total and dissolved metals by 6010D, mercury by 7470A and total cyanide by 9012B	NA	1	Figure 2-2
UST Contents Sampling								
TBD	1	Liquid (Tank Content)	Samples of tank content (if accessible and liquid present)	NA	TCL/TAL: VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; PCBs by 8082A; total and dissolved metals by 6010D/6020, mercury by 7470A and total cyanide by 9012B	NA	1	NA
Soil/Liquid Disposal Characterization								
TBD	NA	Solid (Soil, Tank Content)	Samples of soil (select locations and depths) and tank content (if accessible and solids present)	NA	TCLP Method 1311 – Volatiles by 8260C; semivolatiles by 8270D; pesticides by 8081B; herbicides by 8151A; metals including mercury by 6010D/7470A PCBs by 8082A	NA	TBD	NA
				NA	Ignitability (solids) by 40 CFR 261.21; reactivity by Method SW846 Chapter 7.3 SW846, 9012B SW846 9034	NA	TBD	NA
TBD	NA	Liquid (Tank Content)	Samples of tank content (if accessible and liquid present)	NA	TCLP Method 1311 – Volatiles by 8260C; semivolatiles by 8270D; pesticides by 8081B; herbicides by 8151A; metals including mercury by 6010D/7470A PCBs by 8082A	NA	TBD	NA
				NA	Corrosivity by SW846 Chapter 7 (including pH SW846 9045D); ignitability/flashpoint (liquids) by SW846 1010A; reactivity by Method SW846 Chapter 7.3 SW846, 9012B SW846 9034	NA	TBD	NA
IDM Characterization								
TBD	NA	Solid	Samples of investigation IDM (e.g., excess soil, PPE/debris, etc.)	NA	TCLP Method 1311 – Volatiles by 8260C; semivolatiles by 8270D; pesticides by 8081B; herbicides by 8151A; metals including mercury by 6010D/7470A PCBs by 8082A	NA	TBD	NA
					Ignitability (solids) by 40 CFR 261.21; flashpoint (liquids) by SW846 1010A; reactivity by Method SW846 Chapter 7.3 SW846, 9012B SW846 9034	NA	TBD	NA
TBD	NA	Liquid	Samples of investigation IDM (e.g., decontamination fluids, well development, well purging, etc.)	NA	TCLP Method 1311 – Volatiles by 8260C; semivolatiles by 8270D; pesticides by 8081B; herbicides by 8151A; metals including mercury by 6010D/7470A PCBs by 8082A	NA	TBD	NA
					Corrosivity by SW846 Chapter 7 (including pH SW846 9045D); ignitability/flashpoint (liquids) by SW846 1010A; reactivity by Method SW846 Chapter 7.3 SW846, 9012B SW846 9034	NA	TBD	NA

Notes:

EDW = eastern drainageway

fbgs = feet below ground surface

IDM = investigation-derived material

NA = not applicable

ROW = right-of-way

TBD = to be determined

TCL = Target Compound List

TAL = Target Analyte List

TOC = total organic carbon

TW = tap water

UST = underground storage tank

VOCs = volatile organic compounds

Grain size and bulk density by ASTM D422 and ASTM e-868-82, respectively

* Refer to Section 2.7 of the Removal Sampling Work Plan, which discusses potential alteration of PCB sample intervals by either party in consultation with the other and with USEPA approval based on visual observations and field screening results.

Project Sample Designation:

Sample location designations will be as follows: A-B-C where:

A = sample type; examples:

BR = bedrock

GW = groundwater

SB = soil boring

SD = sediment

SS = surface soil sample

MW-OVB = overburden monitoring well

B = sample field location; examples:

P001 = 5225-5239 Route 203 property

P021 = residential property south of P001

P026 = National Grid property west of P001

PND = pond

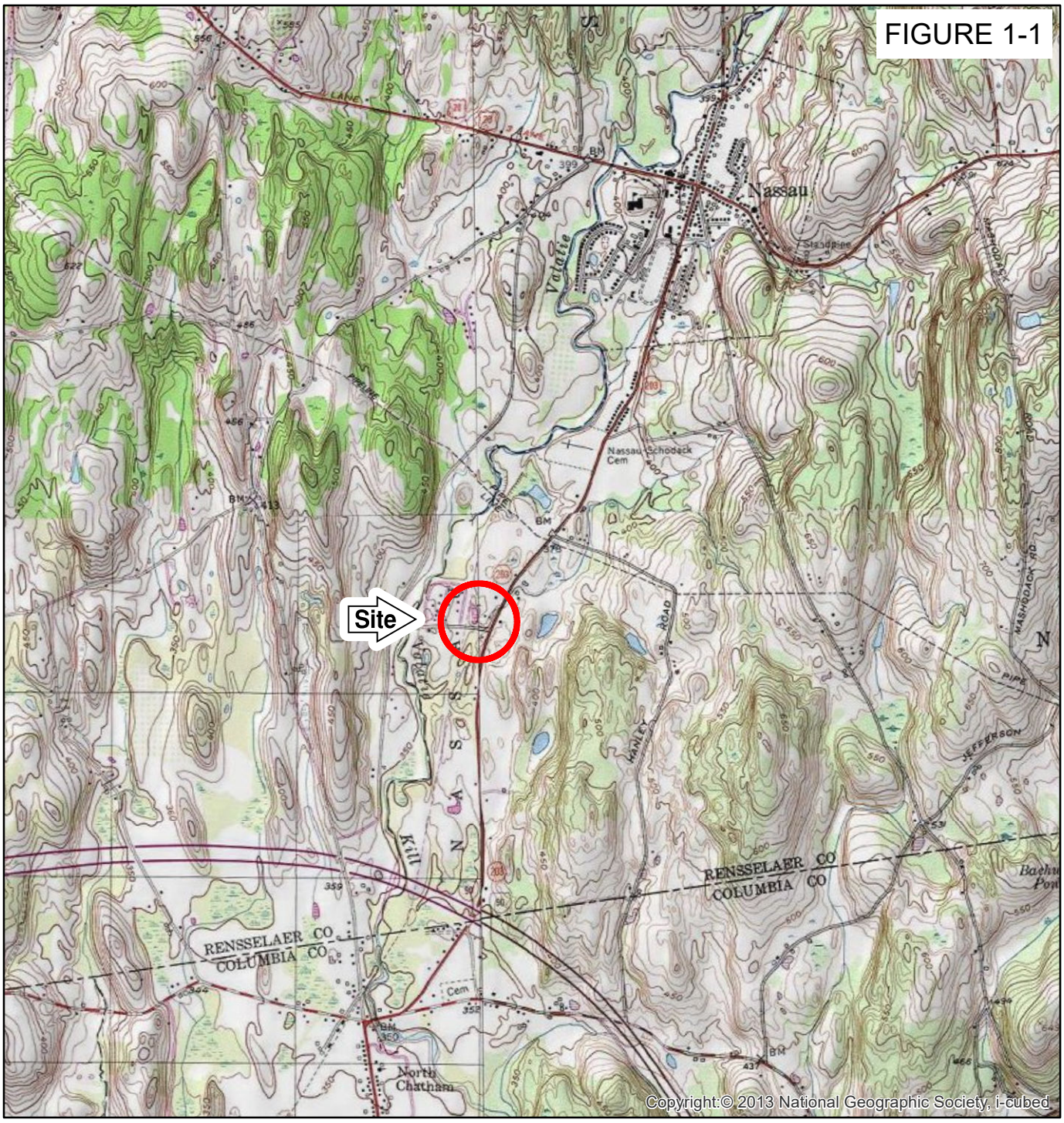
C = sample well location number or sample number:

WELL-01 = well number 01 (new well)

001 = sample number 001

FIGURES

FIGURE 1-1



I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 1-1 - Site Location.mxd

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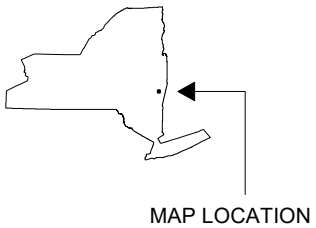

MAP LOCATION

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

SITE LOCATION MAP

N

0 0.1250.25 0.5 0.75 1

Miles

73458
OCTOBER 2019

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N

LEGEND

- Loeffel Route 203 Property
- Existing Supply Well
- Drum Area
- Former Aboveground Storage Tank / Potential Lagoon Area
- Underground Storage Tank
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert

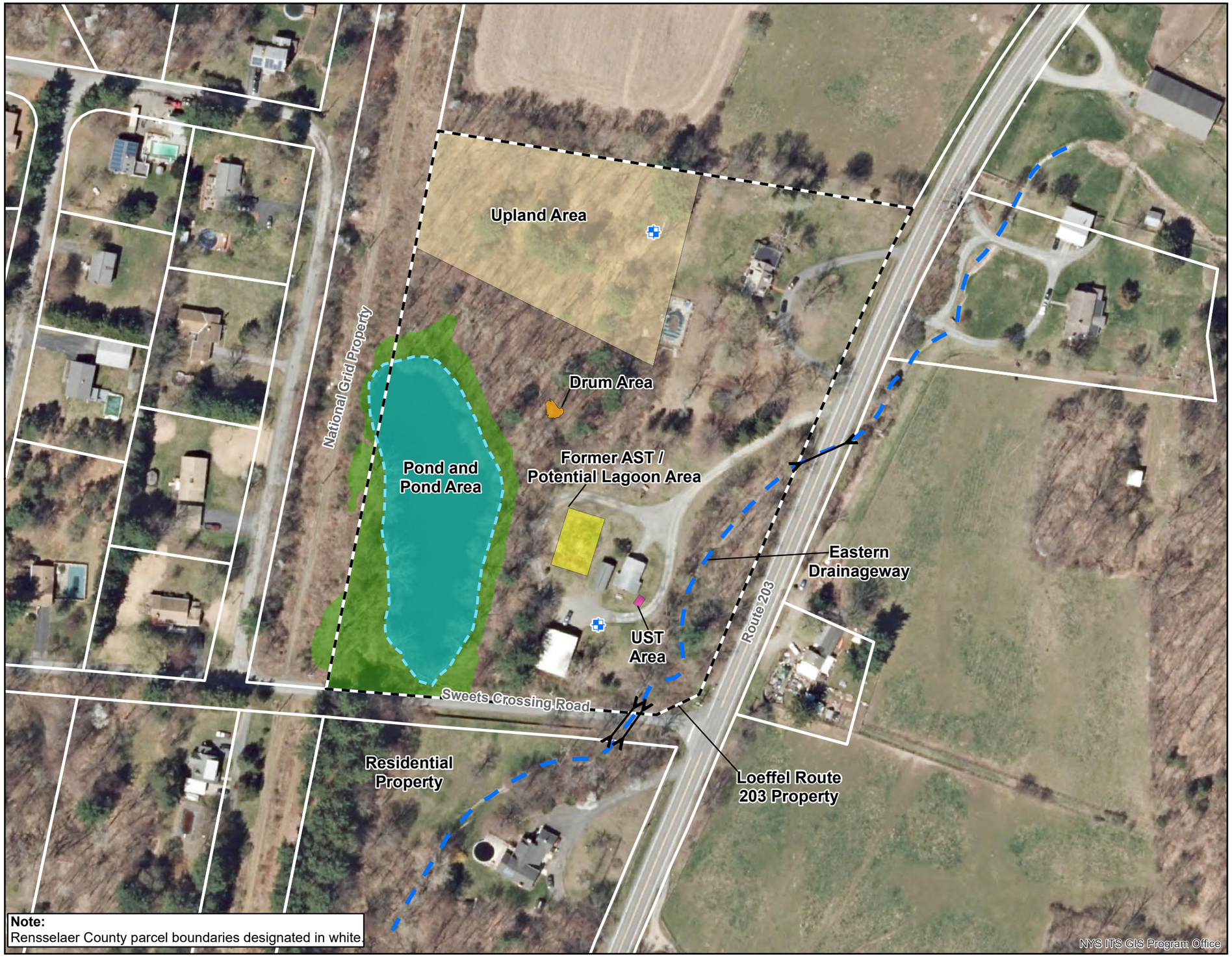
LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

SITE MAP

0 50 100 200
Feet

612.73458
OCTOBER 2019

O'BRIEN & GERE ENGINEERS, INC.



Note:
Rensselaer County parcel boundaries designated in white.

N

LEGEND

- Loeffel Route 203 Property
- Existing Supply Well
- Former Aboveground Storage Tank / Potential Lagoon Area
- Approximate Pond and Pond Area
- Underground Storage Tank
- Upland Area
- Drum Area
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

INVESTIGATION AREAS

0 50 100 200
Feet

612.73458
JANUARY 2020

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N

LEGEND

Loeffel Route 203 Property

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

AREA MAP

0 250 500 1,000
Feet

612.73458
NOVEMBER 2019

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FIGURE 1-5

360
370
370
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360
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360
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370
370

N

LEGEND

Loeffel Route 203 Property

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

LiDAR IMAGERY

0 125 250 500
Feet

612.73458
NOVEMBER 2019

O'BRIEN & GERE ENGINEERS, INC.

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I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 1-6 - LiDAR Imagery.mxd

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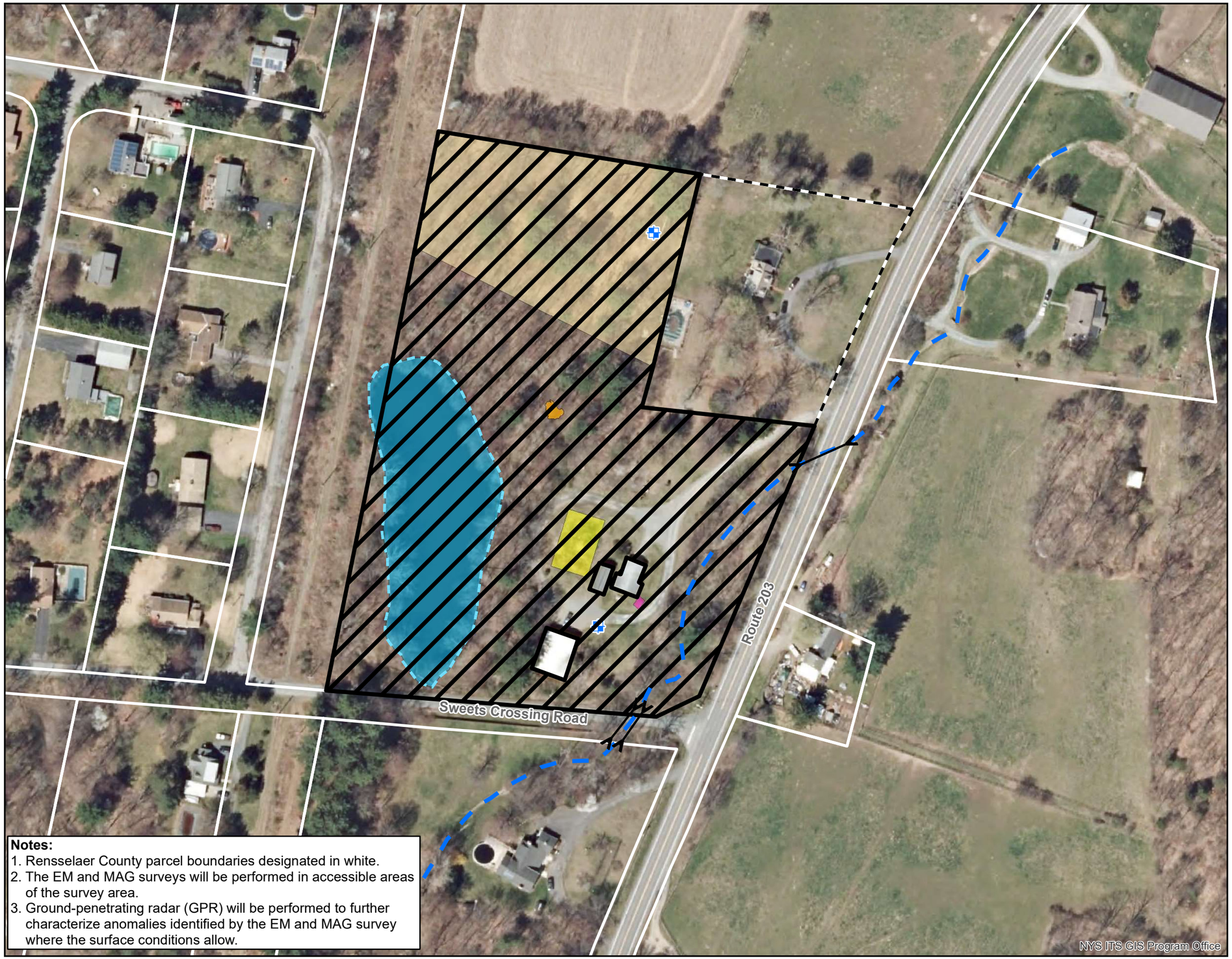
I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 2-1 - Surface Geophysical Survey Area.mxd



Notes:
1. Rensselaer County parcel boundaries designated in white.
2. The EM and MAG surveys will be performed in accessible areas of the survey area.
3. Ground-penetrating radar (GPR) will be performed to further characterize anomalies identified by the EM and MAG survey where the surface conditions allow.

N

LEGEND

- Loeffel Route 203 Property
- Existing Supply Well
- Former Aboveground Storage Tank / Potential Lagoon Area
- Pond and Pond Area
- Underground Storage Tank
- Upland Area
- Drum Area
- Approximate Electromagnetic (EM) and Magnetic (MAG) Survey Area(2 & 3)
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

SURFACE GEOPHYSICAL SURVEY AREA

0 50 100 200
Feet

612.73458
DECEMBER 2019

O'BRIEN & GERE ENGINEERS, INC.

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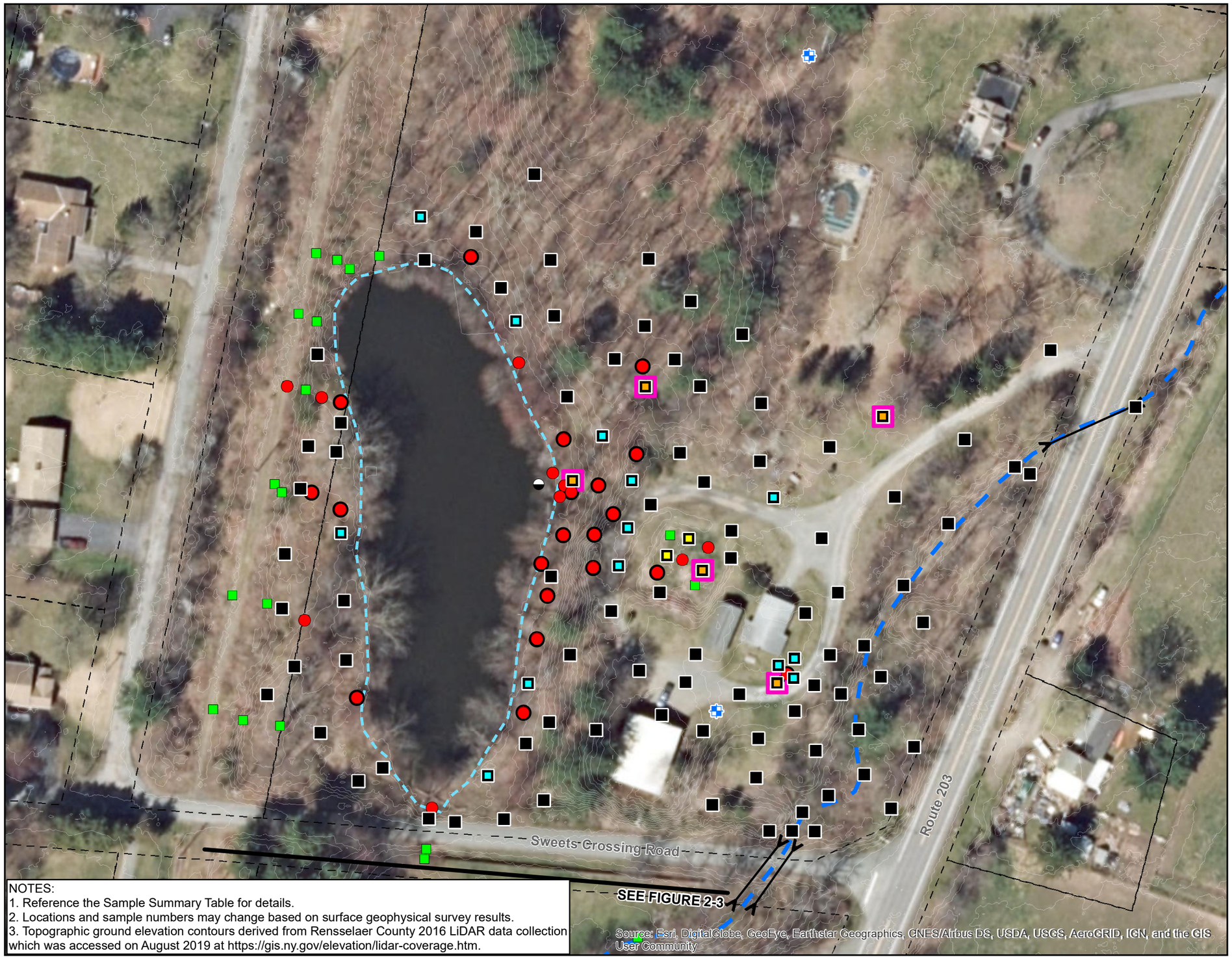
I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 2-2 Conceptual Soil Sample Locations - Onsite.mxd



NOTES:
1. Reference the Sample Summary Table for details.
2. Locations and sample numbers may change based on surface geophysical survey results.
3. Topographic ground elevation contours derived from Rensselaer County 2016 LiDAR data collection which was accessed on August 2019 at https://gis.ny.gov/elevation/lidar-coverage.htm.

N

LEGEND

Proposed Soil Sample Locations

- Shallow Soil Sampling Location
- Deep Soil Sampling Location to 10 feet
- Deep Soil Sampling Location to 15 feet
- Deep Soil Sampling Location to 30 feet
- Proposed Monitoring Well Location
- Total PCB Result ≥ 1 ppm
- Bottom Sample Total PCB Results ≥ 1 ppm
- Total PCB Results < 1 ppm
- Proposed Staff Gauge
- Existing Supply Well
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert
- Minor Elevation Contour (1 foot)
- Rensselaer County Tax Parcel

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

PROPOSED SOIL SAMPLE AND MONITORING WELL LOCATIONS (NORTH OF SWEETS CROSSING ROAD)

0 25 50 100
Feet

612.73458
NOVEMBER 2019

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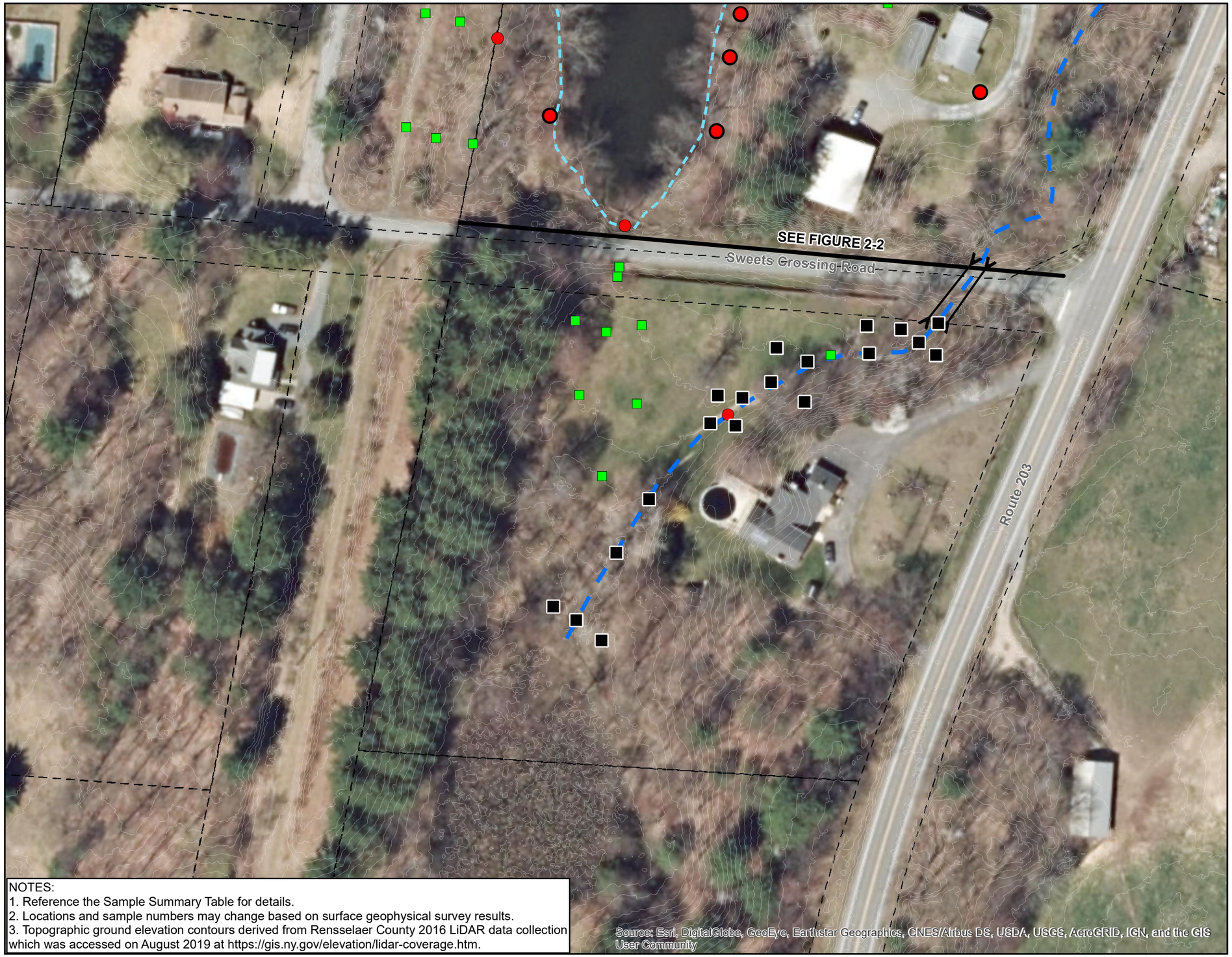

NOTES:
1. Reference the Sample Summary Table for details.
2. Locations and sample numbers may change based on surface geophysical survey results.
3. Topographic ground elevation contours derived from Rensselaer County 2016 LiDAR data collection which was accessed on August 2019 at https://gis.ny.gov/elevation/lidar-coverage.htm.

N

LEGEND

- Proposed Shallow Soil Sampling Location
- Total PCB Result ≥ 1 ppm
- Bottom Sample Total PCB Results ≥ 1 ppm
- Total PCB Results < 1 ppm
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert
- Minor Elevation Contour (1 foot)
- Rensselaer County Tax Parcel

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

PROPOSED SOIL SAMPLE LOCATIONS (SOUTH OF SWEETS CROSSING ROAD)

0 25 50 100
Feet

612.73458
NOVEMBER 2019

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I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 2-3 Conceptual Soil Sample Locations - Offsite.mxd

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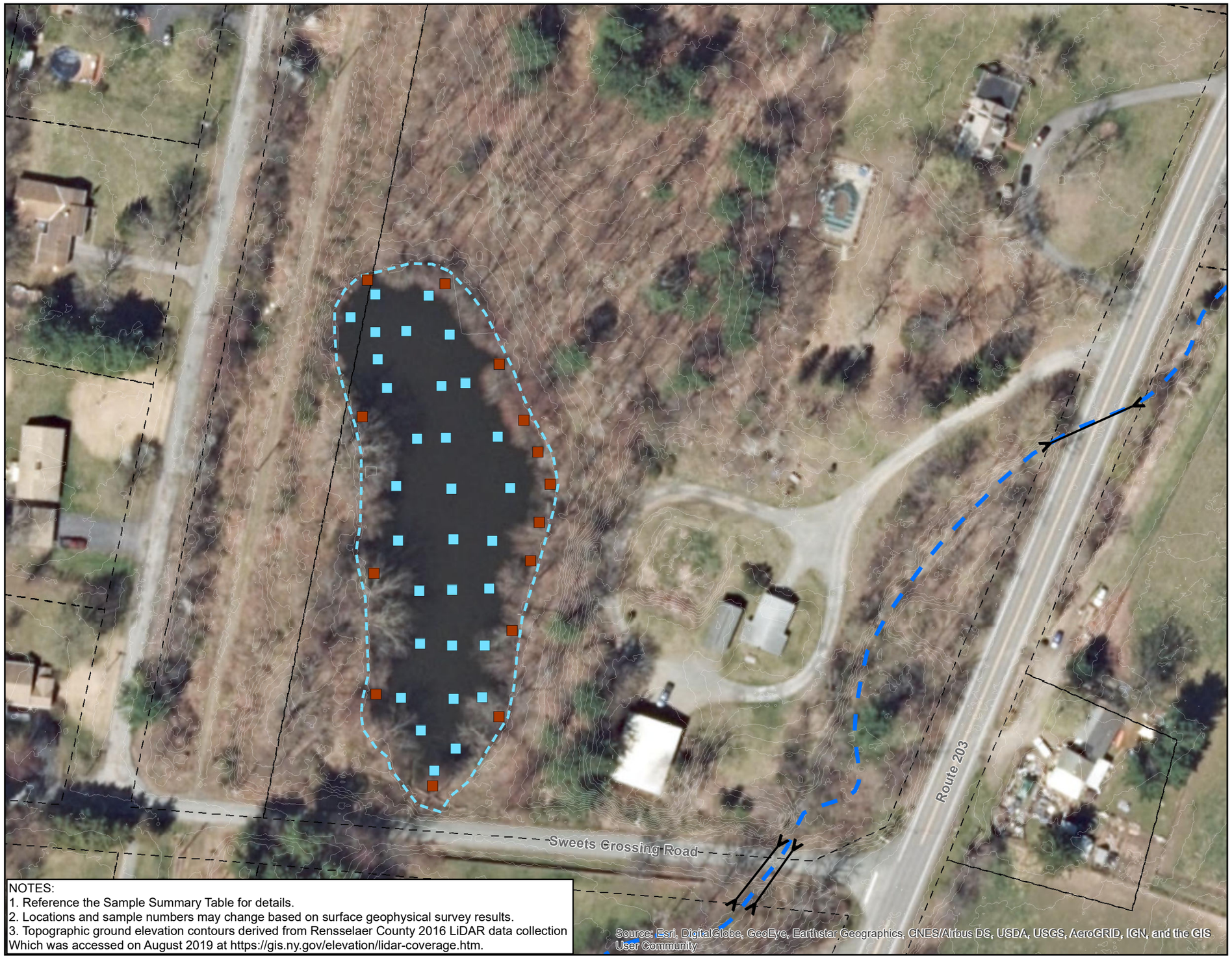
I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 2-4 Conceptual Sediment Sample Locations.mxd



NOTES:
1. Reference the Sample Summary Table for details.
2. Locations and sample numbers may change based on surface geophysical survey results.
3. Topographic ground elevation contours derived from Rensselaer County 2016 LiDAR data collection Which was accessed on August 2019 at https://gis.ny.gov/elevation/lidar-coverage.htm.

N

LEGEND

- Proposed Sediment Sampling Location
- Prior Sediment Sample Location
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert
- Minor Elevation Contour (1 foot)
- Rensselaer County Tax Parcel

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

PROPOSED SEDIMENT SAMPLE LOCATIONS

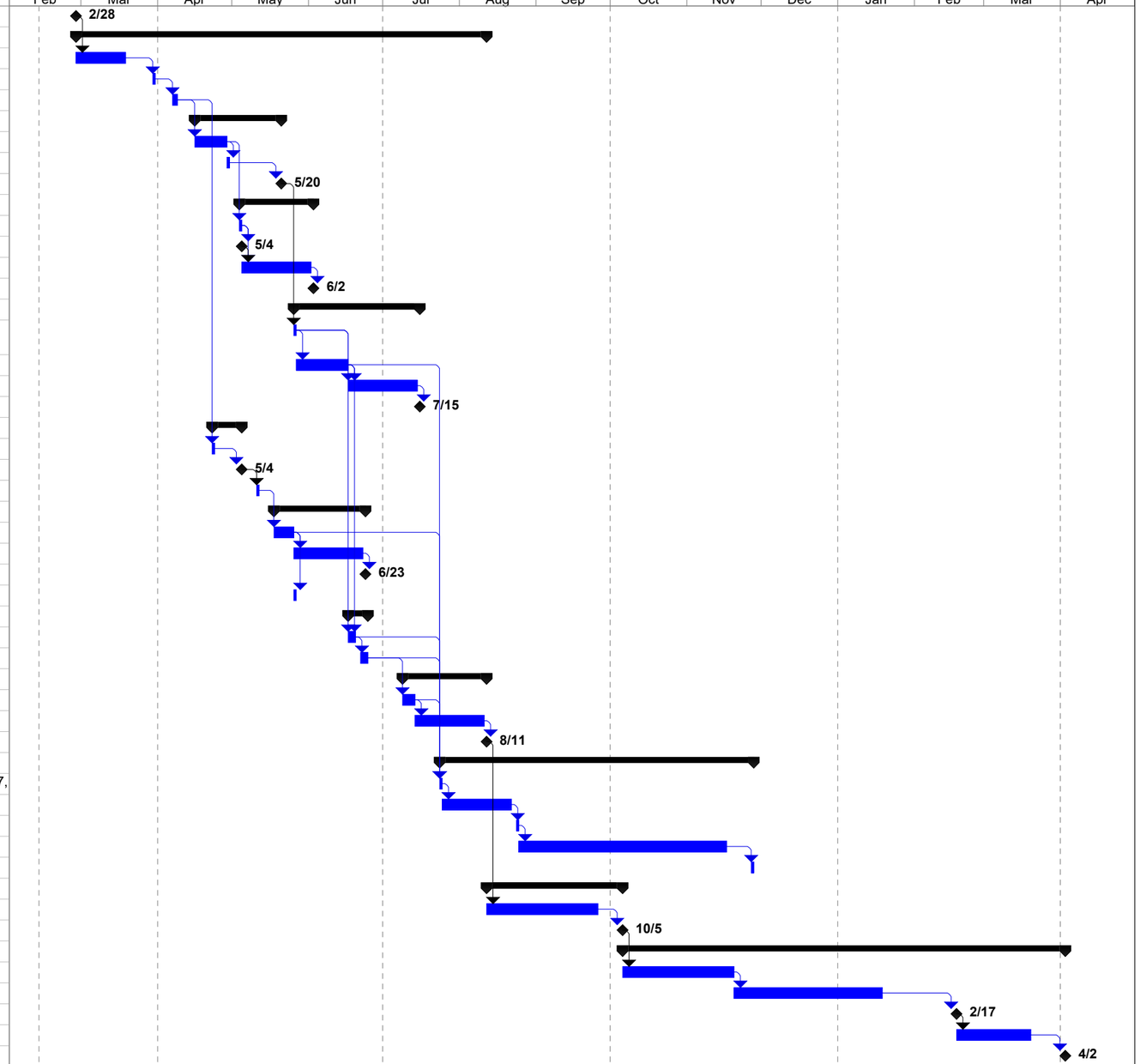
0 25 50 100
Feet

612.73458
NOVEMBER 2019

O'BRIEN & GERE ENGINEERS, INC.

FIGURE 7-1
Removal Sampling Work Plan Implementation Schedule
Loeffel Route 203 Property
Nassau, Rensselaer County, New York

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Execution of Settlement Agreement**	0 days	Fri 2/28/20	Fri 2/28/20	
2	**Investigation Implementation**	**118 days**	**Fri 2/28/20**	**Tue 8/11/20**	
3	**Obtain Access (three properties)**	20 edays	Fri 2/28/20	Thu 3/19/20	1
4	**Site Reconnaissance**	1 day	Mon 3/30/20	Mon 3/30/20	3FS+10 edays
5	**Site Preparation**	2 days	Tue 4/7/20	Wed 4/8/20	4FS+5 days
6	**Surface Geophysical Survey and Utility Mark-Out**	**25 days**	**Thu 4/16/20**	**Wed 5/20/20**	
7	Land-Based Field Survey and Utility Mark-Out	9 days	Thu 4/16/20	Tue 4/28/20	5FS+5 days
8	Pond Survey (after ice-out)	1 day	Wed 4/29/20	Wed 4/29/20	7
9	Receive Surface Geophysical Report	0 days	Wed 5/20/20	Wed 5/20/20	8FS+3 wks
10	**UST Sampling**	**22 days**	**Mon 5/4/20**	**Tue 6/2/20**	
11	Soft Dig	1 day	Mon 5/4/20	Mon 5/4/20	7FS+5 edays
12	UST Contents Sample Collection	0 days	Mon 5/4/20	Mon 5/4/20	11
13	UST Contents Sample Laboratory Analysis	28 edays	Mon 5/4/20	Mon 6/1/20	11,12
14	Receive Final Data Package	1 day	Tue 6/2/20	Tue 6/2/20	13
15	**Soil Sampling**	**37 days**	**Tue 5/26/20**	**Wed 7/15/20**	
16	Pre-investigation Sampling Location Mark-Out with USEPA	1 day	Tue 5/26/20	Tue 5/26/20	9FS+5 edays
17	Soil Sample Collection	15 days	Wed 5/27/20	Tue 6/16/20	16
18	Soil Sample Laboratory Analysis	28 edays	Tue 6/16/20	Tue 7/14/20	17,16
19	Receive Final Data Package	1 day	Wed 7/15/20	Wed 7/15/20	18
20	**Bathymetry Survey of Pond**	**8 days**	**Thu 4/23/20**	**Mon 5/4/20**	
21	Field Survey	1 day	Thu 4/23/20	Thu 4/23/20	5FS+10 days
22	Receive Bathymetry Survey Report	1 day	Mon 5/4/20	Mon 5/4/20	21FS+10 edays
23	**Soft Sediment Probing**	1 day	Mon 5/11/20	Mon 5/11/20	22FS+5 edays
24	**Sediment Sampling**	**27 days**	**Mon 5/18/20**	**Tue 6/23/20**	
25	Sediment Sample Collection	6 days	Mon 5/18/20	Mon 5/25/20	23FS+5 edays
26	Sediment Sample Laboratory Analysis	28 edays	Mon 5/25/20	Mon 6/22/20	25
27	Receive Final Data Package	1 day	Tue 6/23/20	Tue 6/23/20	26
28	**Staff Gage Installation**	1 day	Tue 5/26/20	Tue 5/26/20	25
29	**Overburden Monitoring Well Installation**	**6 days**	**Wed 6/17/20**	**Wed 6/24/20**	
30	Well Installation	3 days	Wed 6/17/20	Fri 6/19/20	17,16
31	Well Development	3 days	Mon 6/22/20	Wed 6/24/20	30
32	**Monitoring Well and Supply Well Sampling**	**24 days**	**Thu 7/9/20**	**Tue 8/11/20**	
33	Groundwater Sample Collection	3 days	Thu 7/9/20	Mon 7/13/20	31FS+14 edays
34	Groundwater Sample Laboratory Analysis	28 edays	Mon 7/13/20	Mon 8/10/20	33
35	Receive Final Data Package	1 day	Tue 8/11/20	Tue 8/11/20	34
36	**Management of Investigation-Derived Materials (IDM)**	**91 days**	**Fri 7/24/20**	**Fri 11/27/20**	
37	IDM Sampling	1 day	Fri 7/24/20	Fri 7/24/20	33FS+10 edays,17,
38	IDM Sample Laboratory Analysis	28 edays	Fri 7/24/20	Fri 8/21/20	37
39	Receive Final Data Package	1 day	Mon 8/24/20	Mon 8/24/20	38
40	IDM Management Coordination	60 days	Tue 8/25/20	Mon 11/16/20	39
41	IDM Removal	1 day	Fri 11/27/20	Fri 11/27/20	40FS+10 edays
42	**Interim Deliverable**	**39 days**	**Tue 8/11/20**	**Mon 10/5/20**	
43	Preparation/Submittal	45 edays	Tue 8/11/20	Fri 9/25/20	35
44	Meeting to Present Findings	1 day	Mon 10/5/20	Mon 10/5/20	43FS+7 edays
45	**Final Investigation Report**	**129 days**	**Mon 10/5/20**	**Fri 4/2/21**	
46	Data Validation	45 edays	Mon 10/5/20	Thu 11/19/20	44
47	Preparation/Submittal	60 edays	Thu 11/19/20	Mon 1/18/21	46
48	Receipt of USEPA Comments	30 edays	Mon 1/18/21	Wed 2/17/21	47
49	Modification/Resubmittal	30 edays	Wed 2/17/21	Fri 3/19/21	48
50	USEPA Approval or Approval w/ Modifications	14 edays	Fri 3/19/21	Fri 4/2/21	49



Note: Schedule does not include wetlands delineation & surveying.
Date: Thu 2/13/20

Task
Split
Milestone
Summary
Project Summary
External Tasks
External Milestone
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
Progress
Deadline

APPENDICES

APPENDIX A
UFP-QAPP

Intended for
General Electric Company

Document type
Final Plan

Date
February 2020

QUALITY ASSURANCE PROJECT PLAN
LOEFFEL ROUTE 203 PROPERTY

QUALITY ASSURANCE PROJECT PLAN
LOEFFEL ROUTE 203 PROPERTY

Project name	**Loeffel Route 203 Property**
Project no.	**73458**
Recipient	**General Electric Company**
Document type	**Final Plan**
Version	**0**
Date	**February 19, 2020**
Prepared by	**Karen Storne**
Checked by	**Amy Spooner-Stevens, Jesse Vollick**
Approved by	**Paul Hare**
Description	**Quality Assurance Project Plan**

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ACRONYMS AND ABBREVIATIONS

AMU	atomic mass unit
AST	aboveground storage tank
ASTM	ASTM International
BFB	bromofluorobenzene
BTEX	benzene, toluene, ethylbenzene and xylenes
CCB	continuing calibration blank
CCV	continuing calibration verification
CLP	Contract Laboratory Program
COC	chain-of-custody
COD	coefficient of determination
CRDL	Contract Required Detection Limit
CVAA	cold vapor atomic absorption
CN	cyanide
DO	dissolved oxygen
DPT	direct push technology
DQI	data quality indicators
EM	electron multiplier
EDD	electronic data deliverable
EDP	electronic data processor
Eurofins Lancaster	Eurofins Lancaster Laboratories Environmental, LLC
GC	gas chromatograph
GC/MS	gas chromatograph/mass spectrometer
GE	General Electric Company
GPC	gel permeation chromatography
HASP	Health and Safety Plan
ICB	initial calibration blank
ICP	inductively coupled plasma
ICP - AES	inductively coupled plasma atomic emission spectrometry
ICP/MS	inductively coupled plasma mass spectrometry
ICV	initial calibration verification
IDL	instrument detection limit
IDM	investigation-derived materials
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LIMS	laboratory information management system
LLQC	lower limit of quantitation check
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NAPL	non-aqueous phase liquid
NDIR	nondispersive infrared detector
NELAC	National Environmental Laboratory Accreditation Conference
NOV	notice of violation
NYSDEC	New York State Department of Environmental Conservation
OBG	O'Brien & Gere Engineers, Inc. (a Ramboll company)

ORP	oxidation reduction potential
%D	percent difference
PB	preparation blank
PCBs	polychlorinated biphenyls
pdf	portable document format
PID	photoionization detector
PPE	personnel protective equipment
ppm	parts per million
PVC	polyvinyl chloride
QA	quality assurance
QAM	Quality Assurance Manual
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
RCDOH	Rensselaer County Department of Health
RF	response factor
RPD	relative percent difference
RRT	relative retention time
RSD	relative standard deviation
RSWP	Removal Sampling Work Plan
RT	retention time
SDG	sample delivery group
SIC	spectral interference check
SIM	selected ion monitoring
SOP	Standard Operating Procedure
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TIC	tentatively identified compound
TOC	total organic carbon
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

1. INTRODUCTION

This Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) has been developed by O'Brien & Gere Engineers, Inc., (OBG, a Ramboll company), to present the objectives, scope, and procedures for implementing the Removal Sampling Work Plan (RSWP) activities at the Loeffel Route 203 Property and two adjacent properties (collectively the "Site") located in the Town of Nassau, Rensselaer County, New York (see **Figure 1-1**). The UFP-QAPP was prepared for the RSWP for inclusion in the Administrative Settlement Agreement and Order on Consent for a Removal Action (Index No. CERCLA-022020-2008) (Settlement Agreement) between the United States Environmental Protection Agency (USEPA) and the General Electric Company (GE or Respondent). This UFP-QAPP addresses activities described in the RSWP developed by OBG.

The overall project objective is to further investigate the occurrence of contaminants in soil and sediment at the Loeffel Route 203 Property and the occurrence of Loeffel Route 203 Property-related contaminants in soil on the National Grid Property and Residential Property for the purpose of evaluating the scope of additional removal activities. Sections 1.3.6.1 through 1.3.6.5 in the RSWP summarize the available information on constituents detected in soil, sediment, surface water and drinking water. Preliminarily, PCBs and certain VOCs have been identified as the dominant site-related contaminants.

This UFP-QAPP addresses investigation activities that focus on the following areas:

- Loeffel Route 203 Property – Defined as property located at 5225-5239 Route 203, Town of Nassau, Rensselaer County, New York as shown on **Figure 1-2 and 1-3**. Current and historical uses included residential and commercial use. The residence is located in the northeastern portion of the property and is not the subject of this investigation. Commercial buildings are located in the south-central portion of the property. As shown on **Figure 1-3**, specific investigation areas on this property include the following:

    - Former Aboveground Storage Tank (AST)/Potential Lagoon Area – Shown on **Figure 1-3** and defined as the area encompassing a soil berm in the south-central portion of the property where four 30,000-gallon ASTs were historically located (Weston, 2019a) (also see historical aerial photographs dated 1985 and 1994 in Exhibit B of the RSWP). A lagoon was reportedly previously located in the area of the ASTs and may be buried by fill.

    - Underground Storage Tank (UST) – As shown on **Figure 1-3**, a 30,000-gallon UST is reportedly located in the south-central portion of the property proximal to the southeast corner of the easternmost commercial garage (Weston, 2019a). There is currently no visible expression of the UST at the surface (e.g., appurtenant piping and fill port), but the tank was identified by surface geophysical work performed by USEPA in October 2018.

  - Drum Area – Nine abandoned and deteriorated 55-gallon drums are located in the central portion of the property as shown on **Figure 1-3**.

  - Upland Area – Shown on **Figure 1-3** and defined as the topographically higher portion of the property located north of the southern driveway (to the commercial buildings) and also north of the pond and the area surrounding the pond that may include dredged material. This area is wooded, and is not believed to have been used for any historical operations, but is included in the RSWP for verification.

  - Eastern Drainageway – Defined as the onsite drainage swale associated with the ephemeral stream running from northeast to southwest through the southeastern corner of the property, crossing under Route 203 (single, large culvert) from the east and crossing under Sweets Crossing Road to the south (two parallel culverts). The ephemeral stream continues to the south-southwest through the adjacent residential property (see **Figure 1-3 and 1-4**).

  - Pond Area – As shown on **Figure 1-3**, an approximately 1-acre pond is located on the western portion of the property. This investigation area includes the pond and the banks where dredged material was or may have been deposited. In the past, the pond was reportedly used as a source of firefighting water.

- National Grid Property – Owned by National Grid and defined as that portion of the former railroad grade that trends north-south to the immediate east of the Pond Area. Beginning in 1899, the Albany and Hudson Railway and Power Company operated a third rail electric trolley system on this property, which ran from Hudson to Albany. The trolley operated from 1899 to 1929. During the operation of the trolley and after the cessation of transportation activities, the property was also used as an electrical transmission utility corridor. The current utility corridor separates the Loeffel Route 203 Property from the residential area to the west, as shown on **Figure 1-3 and 1-4**.

- Residential Property – Defined as the property located at 5213 Route 203, located across Sweets Crossing Road from the Loeffel Route 203 Property, as shown on **Figure 1-3**. The ephemeral stream runs through this property to the south-southwest from the twin culvert under Sweets Crossing Road.

This UFP-QAPP was prepared in accordance with USEPA's guidance document on UFP-QAPPs (USEPA, 2005) and the associated worksheets, as revised in 2012. The UFP-QAPP guidance document includes 37 worksheets/tables that detail various aspects of the environmental investigation process and serve as guidelines for the field work and laboratory analyses.

Implementation of this UFP-QAPP will confirm that environmental data described in the RSWP are scientifically sound, of known and documented quality, and are suitable for intended uses.

1.1 Background Information

This section presents background information including the Site description and Site history.

1.1.1 Site Description

The Site is located approximately one mile south of the Village of Nassau in Rensselaer County, New York. The Site is situated in a glaciated valley with hummocky terrain characterized by low-lying areas (including wetlands, ponds and lakes) between elongated hills. The Loeffel Route 203 Property is located within a rural area with a mix of residential properties and farms (see **Figure 1-1**). To the north, the property is bounded by farmland. To the east, the property is bounded by Route 203 and then farmland. To the south, the property is bounded by Sweets Crossing Road and then residences. The National Grid Property bounds the property to the west, and separates the property from the small residential development (17 properties) farther west (see **Figure 1-4**).

The Loeffel Route 203 Property occupies approximately 8.4 acres on the west side of Route 203 and north side of Sweets Crossing Road (see **Figure 1-2**). The northeastern portion of the property is residential use and contains a single-family house built in 1936 (based on Rensselaer County tax information). The house appears to have been the only existing structure on the property until at least 1952. Three one-story commercial structures are located in the southern portion of the property. The structures are serviced by two onsite private supply wells (one for the residence and the other for the commercial structures) and onsite septic systems.

1.1.2 Site History

Owners and/or operators of the Loeffel Route 203 Property have included Mr. Richard Loeffel and his wife Ms. Florence Loeffel, his son Mr. Dewey Loeffel, and others. Ms. Carol Loeffel is the current owner. The property was reportedly permitted by New York State Department of Environmental Conservation (NYSDEC) as a waste oil transfer facility in the 1970s and early 1980s, and was also reportedly used by Messrs. Richard and/or Dewey Loeffel beginning in the 1950s to store trucks associated with the Loeffel Companies. Loeffel Refining Products, Inc. (USEPA ID No. NYD980642912) is additionally identified as a company formerly located at the property (see Exhibit C of the RSWP).

Several site inspections were performed at the Loeffel Route 203 Property by the Rensselaer County Department of Health (RCDOH), as documented in memorandums dated December 7, 1973 and February 25, 1975. The memos indicate the presence of four 30,000-gallon ASTs and one 30,000-gallon UST at the property, and also note that oil appeared to have entered the onsite swamp (Weston, 2019b). Additional inspections were performed by NYSDEC on March 25, 1987 and April 8, 1988, and by USEPA on July 15, 1986. A notice of violation (NOV) was issued to Loeffel Refining Products, Inc. on March 25, 1987 (see Exhibit C).

NYSDEC is reported to have collected samples of amphibian tissue and an aquatic insect on November 27, 1979 from the pond for laboratory analysis. Polychlorinated

biphenyls (PCBs) were reportedly detected in the samples (Weston, 2019b). Soil and pond water samples reportedly collected at the Loeffel Route 203 Property by a neighbor on July 27, 1987 for laboratory analysis did not contain PCBs, lead, oil and grease, benzene, toluene, ethylbenzene, and xylenes (BTEX) and total petroleum hydrocarbons (Weston, 2019a).

1.2 Project Summary

The goal of the project is to further investigate the occurrence of contaminants in soil and sediment at the Loeffel Route 203 Property and the occurrence of Loeffel Route 203 Property-related contaminants in soil on the National Grid Property and Residential Property for the purpose of evaluating the scope of additional removal activities. The historic data and the data generated during this investigation will be utilized.

The investigation activities in the RSWP focus on the following areas (**Figure 1-3**):

- Loeffel Route 203 Property, including the following:
    - Former AST/Potential Lagoon Area
    - UST
    - Drum Area
    - Upland Area
    - Eastern Drainageway
    - Pond Area
- National Grid Property
- Residential Property

1.2.1 Soil Sampling and Analysis

Soil sampling for laboratory analysis will be performed to augment the sample results from USEPA's investigation and to further characterize soil at the Site, including the National Grid and Residential Properties, as presented in Worksheet 18 and **Figures 2-2 and 2-3**.

Soil sampling will be performed for overburden soil at the Loeffel Route 203 Property, the National Grid Property to the west, and the Residential Property to the south and will be submitted for laboratory analysis as described in this UFP-QAPP. For the soil sampling program, quality assurance/quality control (QA/QC) samples will be collected at a frequency of one per 20 environmental samples. QA/QC samples include blind duplicate samples and matrix spike/matrix spike duplicate (MS/MSD) sample pairs. Equipment blanks (i.e., rinsate blanks) will be collected for non-dedicated sampling equipment (e.g., hand auger). Trip blanks will be included with each sample cooler containing VOC samples. The laboratory data will be validated in accordance with the UFP-QAPP. Non-dedicated sampling equipment decontamination will be performed in accordance with the UFP-QAPP.

1.2.1.1 Loeffel Route 203 Property

A total of 94 soil sampling locations comprising shallow soil borings (5 feet in depth or less) and deep soil borings (to depths of 10, 15, and 30 feet) will be advanced on the Loeffel Route 203 Property and will include the following locations:

- Shallow Soil Borings (**Figure 2-2**) – Sixty-five continuously sampled shallow soil borings will be advanced on the Loeffel Route 203 Property from ground surface to 5 feet below grade, or refusal (if shallower). The sampling locations are selected to further characterize soil where total PCB concentrations detected during USEPA's investigation are greater than 1 part per million (ppm) (e.g., the Pond Area, Former AST/Potential Lagoon Area, and Drum Area) and to characterize soil in areas not previously investigated by USEPA (e.g., wooded area north of the pond and southern driveway, and proximal to the Eastern Drainageway).

- Deep Soil Borings (**Figure 2-2**) – USEPA's previous investigation did not evaluate soil deeper than 4 feet at the Site. A total of 20 continuously sampled deep soil borings will be advanced on the Loeffel Route 203 Property from ground surface to up to 30 feet below grade or refusal (if shallower). Thirteen soil borings will be advanced to a maximum of 10 feet, two borings will be advanced to a maximum of 15 feet, and five borings will be advanced to a maximum of 30 feet. The sampling locations are selected to characterize subsurface soil around the UST, in the Former AST/Potential Lagoon Area, Drum Area and other portions of the Loeffel Route 203 Property.

- Eastern Drainageway (**Figure 2-2**) – Nine continuously sampled shallow soil borings will be advanced in the bed of the ephemeral stream associated with the Eastern Drainageway from ground surface to 3 feet below grade or refusal (if shallower). In addition, one soil boring will be advanced to a depth of 2 feet below grade in the upgradient portion of the ephemeral stream on the eastern side of Route 203, immediately east of the culvert. The sampling locations were selected to characterize soil in the potential surface migration pathway not previously evaluated during USEPA's investigation.

1.2.1.2 National Grid Property

USEPA previously collected soil samples at approximately 18 locations on the National Grid Property; one or more soil samples detected total PCB concentrations exceeding 1 ppm at five of the 18 sample locations. Nine continuously sampled shallow soil borings will be advanced from ground surface to 3 feet below grade or refusal (if shallower), as shown on **Figure 2-2**. The sampling locations were selected to further characterize soil where total PCB concentrations detected during USEPA's investigation are greater than 1 ppm.

1.2.1.3 Residential Property

USEPA previously collected soil samples at 10 locations on the Residential Property or immediately adjacent to it. Seven of these locations were distributed across the open grassy area south of the abandoned culvert that extends beneath Sweets Crossing Road from the southern tip of the pond; total PCBs did not exceed 1 ppm in any of

these samples. Three locations were distributed along the drainage swale associated with the ephemeral stream that flows from the Route 203 Property through the twin culvert under Sweets Crossing Road. Total PCBs exceeded 1 ppm in one of the samples collected at the three drainage swale locations.

A total of 19 soil sampling locations will be advanced on the Residential Property to characterize shallow soil in or adjacent to the drainage swale and along the ephemeral stream (**Figure 2-3**). Of these, 16 continuously sampled shallow soil borings will be advanced from ground surface to 3 feet below grade. Four of these sampling locations will be advanced approximately 10 feet to the northeast, southeast, southwest, and northwest of the USEPA sample where total PCBs were detected above 1 ppm. Three of the 19 soil sampling locations will be advanced from ground surface to 1 foot below grade along and adjacent to the ephemeral stream where it enters a low-lying area in the southwestern corner of the Residential Property.

1.2.2 Pond Sediment Sampling and Analysis

USEPA previously collected thirty sediment samples at 14 locations near the perimeter of the pond. Samples from the interior portion of the pond were unable to be collected because of winter weather conditions.

Sediment samples will be collected at an additional 31 sample locations to a depth of 3 feet below the top of sediment or refusal (if shallower), as shown on **Figure 2-4**. The sediment sampling locations are distributed across the pond in an approximately gridded pattern. Based on the depth of the pond and the estimated thickness of the pond sediments, the sediment sampling methods and number of vertical samples may need to be adjusted.

1.2.3 Overburden Monitoring Well Installation and Development

Overburden monitoring wells will be installed at five locations on the Loeffel Route 203 Property, as shown on **Figure 2-2**. The installation of these wells will facilitate the collection of groundwater samples to characterize overburden groundwater and to evaluate groundwater flow direction. The 30-foot deep soil borings discussed above will be completed as overburden monitoring wells. Following installation, the overburden monitoring wells will be developed in accordance with the UFP-QAPP. Non-dedicated, non-disposable equipment used in the development process will be decontaminated before and after each use in accordance with the field equipment decontamination procedure provided in the UFP-QAPP.

1.2.4 Groundwater Sampling and Analysis

Groundwater samples will be collected from each of the newly-installed overburden monitoring wells at the Loeffel Route 203 Property after the completion of well development at each monitoring well. Concurrent with this sampling event, a sample will also be collected from the supply well located in the southern portion of the Loeffel Route 203 Property near the commercial outbuildings. Non-dedicated, non-disposable sampling equipment will be decontaminated before and after sampling at each monitoring well in accordance with the field equipment decontamination procedure provided in the UFP-QAPP.

1.2.5 Soft Dig and UST Contents Sampling

As discussed above, a 30,000-gallon UST is reportedly located in the south-central portion of the property proximal to the southeast corner of the easternmost commercial garage. Soft digging techniques will be used to expose the top of the UST. If possible, sample(s) of the aqueous and sludge contents of the UST will be collected for laboratory analysis.

1.2.6 Characterization of Investigation-Derived Materials

Investigation-derived materials (IDM) resulting from the various investigation activities in this investigation will require appropriate management. The IDM includes the following:

- Soil and drill cuttings;
- Sediment;
- Groundwater resulting from the development of the overburden monitoring wells;
- Purge water from well sampling;
- Decontamination fluids;
- Solids (if any) which settle out of groundwater and/or decontamination fluids; and
- Personnel protective equipment (PPE) and associated debris resulting from the execution of the various field activities (e.g., polyethylene sheeting, sample tubing, disposable equipment, etc.).

Soil and drill cuttings – Any soil remaining from shallow and deep soil boring and monitoring well locations will be collected in a 5-gallon bucket or placed directly into a 55-gallon drum. If using a 5-gallon bucket, the bucket will be periodically emptied into a 55-gallon drum. Any 55-gallon drums will be transported to the IDM staging location and labeled.

Sediment – Any excess sediment collected will be placed in a 5-gallon bucket (or similar) and allowed to settle. Any excess water will be decanted off the top and containerized with the decontamination fluids IDM. The sediment will be containerized with the soil and drill cuttings IDM.

Groundwater – Groundwater collected during the overburden well drilling, well development, and groundwater sampling event will be containerized in polyethylene storage tanks and/or 55-gallon drums and transported to the IDM staging location and labeled.

Decontamination Fluids and Settled Solids – Non-disposable equipment will be decontaminated prior to and after use at the Site. Liquid/solid mixtures generated during equipment decontamination and decontamination fluids will be stored in 5-gallon bucket(s) and/or 55-gallon drum(s) to allow solids to settle. Settled solids will be managed with the soil and drill cuttings IDM.

PPE and Associated Debris – PPE generated during non-intrusive, non-sampling activities (e.g., Tyvek® coveralls used during site visits or reconnaissance activities for protection against aggressive fauna and flora [e.g., ticks and poison ivy]) will be

transported offsite for disposal at a local, permitted sanitary landfill. All other PPE (e.g., polyethylene sheeting, sample tubing, disposable equipment, etc.), will be containerized in 55-gallon drums and transported to the IDM staging location and labeled.

The final disposition of the Site IDM will be determined based on the results of laboratory analysis.

1.3 Laboratory Analysis

Eurofins Lancaster Laboratories Environmental, LLC (ELLE) of Lancaster, Pennsylvania, which is National Environmental Laboratory Accreditation Conference (NELAC) accredited (New York Certification # 10670), will perform the definitive analytical services for this investigation.

Soil, sediment, groundwater and IDM samples will be collected and submitted for laboratory analysis during the investigation. Full Contract Laboratory Program (CLP)-like data packages will be provided for definitive data generated by ELLE for the following analyses:

- PCBs for soil and sediment samples;
- Non-PCB Target Compound List (TCL)/Target Analyte List (TAL) constituents and cyanide (CN) for select soil and sediment samples;
- TCL/TAL constituents and CN for groundwater samples; and
- 1,4-dioxane for groundwater samples.

Data validation will be performed for the soil, sediment and groundwater sample results for TCL/TAL constituents (including PCBs) and CN, and for the groundwater sample results for 1,4-dioxane. Sufficient QA/QC samples will be collected for the analyses listed above in order to perform the data validation.

Data packages will be obtained from ELLE for the soil and sediment samples submitted for analysis of TOC, grain size, and bulk density, and for the aqueous sample(s) collected from the UST for analysis of TCL/TAL constituents and CN. These data packages will consist of a case narrative, analytical results, data qualifications, and field chain-of-custody forms, and the results will not be validated.

Data packages will be obtained from ELLE for the waste characterization samples collected from the IDM. These results will not be validated.

Appendix A contains Standard Operating Procedures (SOPs) for definitive analyses and screening analyses, Quality Assurance Manuals (QAMs) and NELAC certifications for Eurofins Lancaster. **Appendix B** provides field SOPs. **Appendix C** provides a description of the data validation approach.

REFERENCES

OBG. 2020. Removal Sampling Work Plan.

USEPA. 1993. Data Quality Objectives Process for Superfund, Interim Final Guidance.

USEPA. 2005. Uniform Federal Policy for Quality Assurance Project Plans, Intergovernmental Data Quality Task Force, EPA-505-B-04-900A.

USEPA. 2006a. USEPA Region II Validating Pesticide Compounds Organochlorine Pesticides by Gas Chromatography SW-846 Method 8081B. HW-44 Revision 1. Reviewed 2009. Albany, New York.

USEPA. 2006b. USEPA Region II Validating PCB Compounds, PCBs by Gas Chromatography SW-846 Method 8082A, HW-45 Revision 1. Reviewed 2009. Albany, New York.

USEPA. 2008a. Reviewed 2009. USEPA Region II Validating Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry SW-846 Method 8260B, SOP HW-24 Revision 2. Reviewed 2009. Albany, New York.

USEPA. 2008b. USEPA Region II Validating Semi-Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry SW-846 Method 8270D, SOP HW-22 Revision 4. Reviewed 2009. Albany, New York.

USEPA. 2012a. Hazardous Waste Support Section, SOP HW-02a Rev.15, ICP-AES Data Validation, (ISM01.2 - Evaluation of Metals Data for the CLP Method).

USEPA. 2012b. Hazardous Waste Support Section, SOP HW-02b Rev.15, ICP-MS Data Validation, (ISM01.2 - Evaluation of Metals Data for the CLP Method).

USEPA. 2012c. USEPA Region II Mercury and Cyanide Data Validation, SOP HW-2c Revision 15. Albany, New York.

WORKSHEETS

UFP QAPP: Loeffel Route 203 Property: Worksheets

QAPP Identifying Information

The following table lists the Optimized 2012 UFP QAPP worksheets and the associated UFP QAPP guidance document sections:

Optimized 2012 UFP QAPP Worksheets		2106-G-05 UFP QAPP Guidance Section	
1 &2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 &5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7 & 8	Personnel Qualifications and Sign-off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certification
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
10	Conceptual Site Model	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP Elements for Evaluating Existing data
14&16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection / Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 &30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field QC	2.3.5	Quality Control Requirements

21	Field SOPs	2.3.2	Sampling Procedures and Requirements
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26&27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical Quality Control and Corrective Action	2.3.5	Quality Control Requirements
29	Project Documents and Records	2.2.8	Documentation and Records Requirements
31, 32 & 33	Assessments and Corrective Action	2.4	Assessments and Data Review
		2.5.5	Reports to Management
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

QAPP Worksheet #1& 2: Title and Approval Page
(UFP QAPP Manual Section 2.1)
(EPA 2106-G-05 Section 2.2.1)

1. Project Identifying Information
    - Site name/project name – Loeffel Route 203 Property
    - Site Index number – CERCLA-02-2020-2008
    - Contract/Work assignment number – Not Applicable

2. Lead Organization
    - Lead Organization Project Manager
      Mr. Jesse Vollick, P.G., O'Brien and Gere Engineers, Inc. (OBG, a Ramboll company), Project Manager

    Approval Signature and Date _____

    - Lead Organization Quality Manager
      Ms. Karen Storne, OBG, Quality Assurance Officer

    Approval Signature and Date _____

3. Federal Regulatory Agency
   Mr. David Rosoff, USEPA Region 2 On-Scene Coordinator

   Approval Signature and Date _____

4. Respondent
   Mr. Lewis S. Streeter, General Electric Company, Senior Project Manager

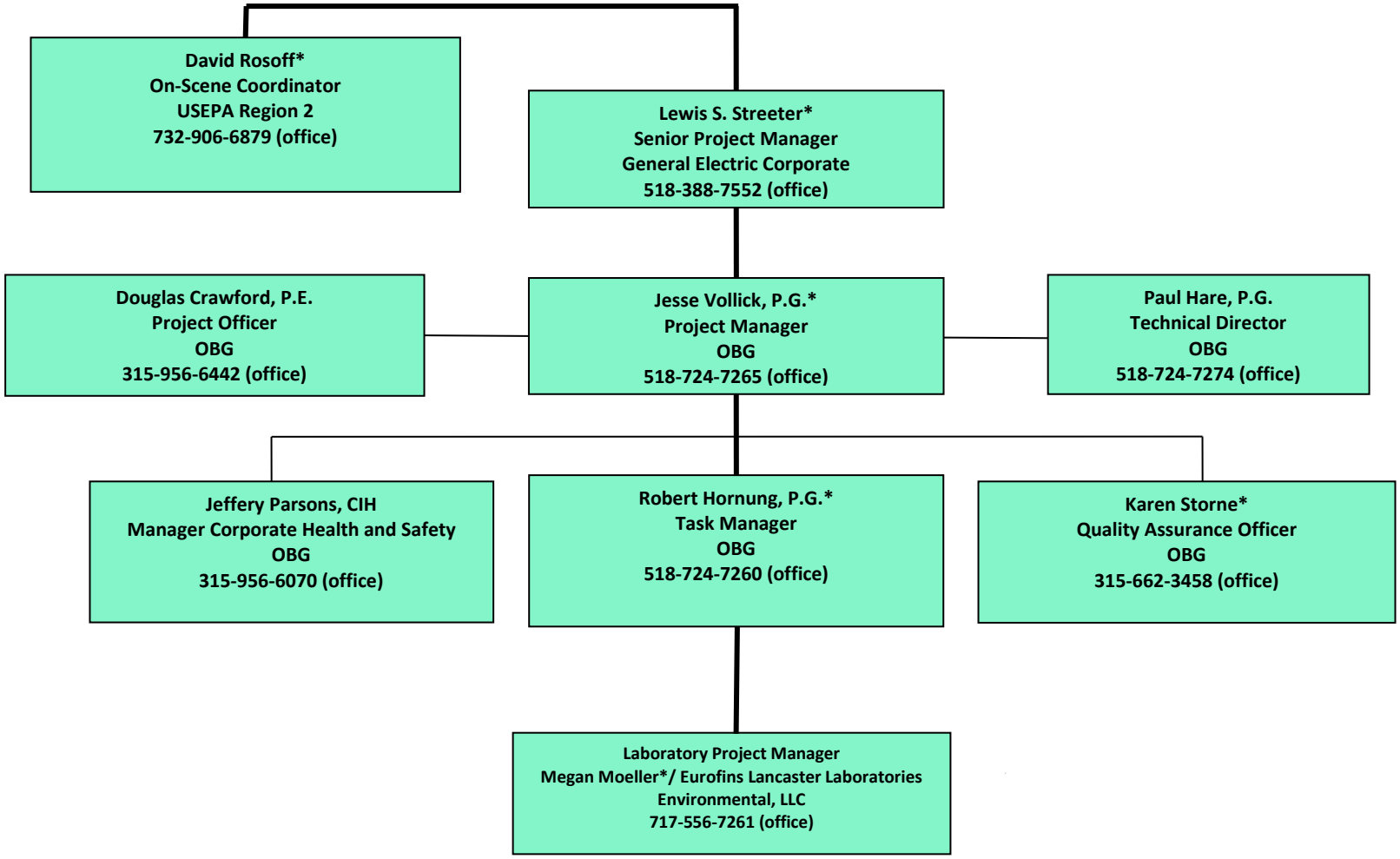
   Approval Signature and Date _____

5. Plans and reports from previous investigations relevant to this project:
    - Weston Solutions, Inc., 2019a. Removal Assessment Sampling Report, Route 203 Site, Nassau, Rensselaer County, New York. Prepared for U.S. Environmental Protection Agency (USEPA), Region II Superfund and Emergency Management Division, Edison, New Jersey, May 23, 2019.

- Weston Solutions, Inc., 2019b. Final Removal Assessment Sampling Report, Properties P021 and P026 Sampling Event, Route 203 Site, Nassau, Rensselaer County, New York. Prepared for U.S. Environmental Protection Agency (USEPA), Region II Superfund and Emergency Management Division, Edison, New Jersey, August 6, 2019.
- Weston Solutions, Inc., 2019c. Removal Assessment Sampling Report, Residential Tap Water Sampling Event, Route 203 Site, Nassau, Rensselaer County, New York. Prepared for U.S. Environmental Protection Agency (USEPA), Region II Superfund and Emergency Management Division, Edison, New Jersey, June 11, 2019.

QAPP Worksheet #3 & 5: Project Organization and QAPP Distribution
(UFP QAPP Manual Section2.3 and 2.4) (EPA 2106-G-05 Section 2.2.3 and 2.2.4)

* Indicates UFP-QAPP Distribution List. Lines of Authority Lines of Communication



QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet*
(UFP QAPP Manual Sections 2.3.2 – 2.3.4)
(EPA 2106-G-05 Section 2.2.1 and 2.2.7)

ORGANIZATION: USEPA Region II

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Mr. David Rosoff	On-Scene Coordinator	Available upon request	NA	

ORGANIZATION: General Electric (GE) Corporate

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Mr. Lewis S. Streeter	Senior Project Manager	Available upon request	NA	

ORGANIZATION: OBG

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Mr. Jesse Vollick	Project Manager	BS Economics, MS Geology, 15 years experience	HAZWOPER 40-hour training and current 8-hour refresher	
Mr. Robert Hornung	Task Manager	BS Geology, 10 years experience	HAZWOPER 40-hour training and current 8-hour refresher	
Ms. Karen Storne	Project Quality Assurance Officer (QAO)	BS Chemistry, 31 years experience	NA	

ORGANIZATION: Eurofins Lancaster Laboratories Environmental, LLC

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
Ms. Megan Moeller	Laboratory Project Manager	Available upon request	NA	

*Signatures indicate personnel have read and agree to implement this UFP-QAPP as written.

QAPP Worksheet #6: Communication Pathways
(UFP QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4)

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Regulatory Interface-Regulatory Agency	USEPA Region II	Mr. David Rosoff - On-Scene Coordinator	732-906-6879 (office) Rosoff.David@epa.gov	Project Delivery - Point of contact at USEPA Region II for project materials and information. Documentation as required during the project through Monthly Project Reports and e-mail, as necessary.
GE Interface and Communication with USEPA	General Electric Company	Mr. Lewis Streeter - Senior Project Manager	518-388-7552 (office) Lewis.Streeter@ge.com	Project Delivery - Point of contact at GE for project materials and information, as required during the project through e-mail communications. Reporting project issues to USEPA; Major project issues reported to USEPA within 1 business day of identification; work closely with members of the project team to understand any problems that arise and will have ultimate authority to stop work; consult with the project team to correct deficiencies and ensure appropriate actions are taken before work is re-started.
OBG Interface and Communication with GE	OBG	Mr. Jesse Vollick - Project Manager	518-724-7265 Jesse.Vollick@ramboll.com	Project Delivery - Point of contact at OBG for project materials and information, as required during the project through e-mail communications. Report major project issues to GE within 24 hours of detection; field problems reported to GE within 24 hours of detection. Supervising all aspects of the project to monitor compliance with work plans and requirements. Maintaining communication between project management and project team members. Acting as the primary communicator on quality matters when interfacing with external organizations.
Communication within OBG	OBG	Mr. Douglas Crawford - Project Officer	315-956-6442 Doug.Crawford@ramboll.com	Project oversight and approval of project documents as required during the project through e-mail communications.
Communication within OBG	OBG	Mr. Paul Hare – Technical Director	518-724-7274 Paul.Hare@ramboll.com	Project oversight and approval of project documents as required during the project through e-mail communications.
Communication within OBG The Field Team Manager will report directly to the PM and will address all Field and Project activities.	OBG	Mr. Robert Hornung – Field Team Manager	518-724-7260 Robert.Hornung@ramboll.com	Supervision of the field and project activities to monitor compliance with work plans and requirements. Maintain communication between project management and project team members through e-mail communications.
Primary Point of Contact for Quality Control (QC) issues The Quality Assurance	OBG	Karen Storne – Quality Assurance Officer	315-662-3458	Supervision if all QC aspects of the project to monitor compliance with work plans and requirements. Manage the QC program.

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Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Officer will report directly to the PM and will address QC matters.			Karen.Storne@ramboll.com	Approve all submittals and supervising all QC procedures. Oversight of data validation and release of validated analytical results to the OBG data management lead.
Progress of Field and Project Tasks - Safety	OBG	Jeffery Parson - Manager Corporate Health and Safety	315-956-6070 Jeff.Parsons@ramboll.com	Enforcement of Health and Safety Plan (HASP) requirements and communication of non-conformances and emergencies through e-mail communications.
Laboratory Receives direction from OBG	Eurofins Lancaster Laboratories Environmental, LLC	Megan Moeller – Laboratory Project Manager	717-556-7261 MeganMoeller@eurofinsUS.com	Laboratory Analysis - Point of contact for Definitive/Routine Laboratory Analysis Methods. Responsible for ensuring the UFP-QAPP requirements are met by the laboratory. Issues that may require communication with the OBG QAO include but are not limited to: laboratory preparation and analysis excursions, UFP-QAPP compliance, or other conditions affecting sample data quality. Laboratory analysis and/or sample receipt problems are reported to the OBG project manager within 24 hours of detection.

QAPP Worksheet #9: Project Planning Session Summary
(UFP QAPP Manual Section 2.5.1 and Figures 9-12)
(EPA 2106-G-05 Section 2.2.5)

Date of planning session: September 10, 2019
Location: Nassau, New York
Purpose: Site visit to discuss the proposed investigation and walk the Loeffel Route 203 Property, National Grid Property, and Residential Property.

Participants:

Name	Organization	Title/Role	Email
David Rosoff	USEPA	USEPA Region 2 On-Scene Coordinator	Rosoff.David@epa.gov
Joseph Battipaglia	USEPA	USEPA Region 2 Remedial Project Manager	Battipaglia.Joseph@epa.gov
Lewis Streeter	General Electric	Senior Project Manager	Lewis.Streeter@ge.com
Jesse Vollick	OBG	Project Manager	Jesse.Vollick@ramboll.com
Paul Hare	OBG	Technical Director	Paul.Hare@ramboll.com

Consensus Decisions

- Investigation areas
- Investigation scope
- Work Plan content
- Field implementation schedule

Action Items

- Prepare draft preliminary sampling plan (figures and tables) for review by and discussion with USEPA.

Date of planning session: October 1, 2019
Location: Albany, New York
Purpose: Discussion of investigation sampling plan (figures and tables) and project overview.

Participants:

UFP QAPP: Loeffel Route 203 Property: Worksheets

Name	Organization	Title/Role	Email
David Rosoff	USEPA	USEPA Region 2 On-Scene Coordinator	Rosoff.David@epa.gov
Lewis Streeter	General Electric	Senior Project Manager	Lewis.Streeter@ge.com
Jesse Vollick	OBG	Project Manager	Jesse.Vollick@ramboll.com
Paul Hare	OBG	Technical Director	Paul.Hare@ramboll.com

Consensus Decisions

- Sample location coverage is appropriate and plan is comprehensive
- Sample numbers and analyses are appropriate
- Archiving select soil samples for potential polychlorinated biphenyl (PCB) analysis
- Shallow monitoring well locations
- Site visit during implementation to physically mark out sampling locations
- Field decision making may be necessary for some soil sampling locations and depths
- Work Plan, HASP, and UFP-QAPP submittal schedule
- Monthly Progress Reports and weekly status calls during performance of field work

Action Items

- Add two to three shallow soil sampling locations in southern portion of Residential Property. Add a few additional soil sampling locations in former aboveground storage tank (AST) area to a depth of 15 feet and one to 30 feet. Add a deep (10 feet) soil sample location west of the pond.
- Preparation and submittal of draft Work Plan and HASP to USEPA and target submittal by October 31, 2019.
- Preparation and submittal of draft UFP-QAPP to USEPA and target submittal by November 28, 2019.

Date of planning session: December 4, 2019
Location: Conference call
Purpose: Discussion of USEPA's comments on the Work Plan.

Participants:

Name	Organization	Title/Role	Email
David Rosoff	USEPA	USEPA Region 2 On-Scene Coordinator	Rosoff.David@epa.gov
Joseph Battipaglia	USEPA	USEPA Region 2 Remedial Project Manager	Battipaglia.Joseph@epa.gov
Lewis Streeter	General Electric	Senior Project Manager	Lewis.Streeter@ge.com
Jesse Vollick	OBG	Project Manager	Jesse.Vollick@ramboll.com
Paul Hare	OBG	Technical Director	Paul.Hare@ramboll.com

Consensus Decisions

- Agreement on specific revisions to text from USEPA.

Action Items

- Revise text in several places as discussed during the teleconference.
- Modify new figure that shows and helps clarify the investigation areas.
- Consider adding a new figure to clarify where the various surface geophysical surveys will be performed. At a minimum, if a new figure is not created, augment text to provide the requested clarification.
- Revise and shorten duration of USEPA's review of submittals.
- Submit revised Work Plan in redline format to USEPA. Target date Friday, December 13, 2019.

Date of planning session: December 18, 2019
Location: Conference call
Purpose: Discussion of USEPA's comments on the Work Plan.

Participants:

Name	Organization	Title/Role	Email
David Rosoff	USEPA	USEPA Region 2 On-Scene Coordinator	Rosoff.David@epa.gov
Lewis Streeter	General Electric	Senior Project Manager	Lewis.Streeter@ge.com
Jesse Vollick	OBG	Project Manager	Jesse.Vollick@ramboll.com
Paul Hare	OBG	Technical Director	Paul.Hare@ramboll.com

Consensus Decisions

- Agreement on specific revisions to text from USEPA.

Action Items

- Additional Work Plan comments from other USEPA reviewers will be sent to Respondent.
- Revise text in several places as discussed during the teleconference.
- Modify figure that shows and helps clarify the investigation areas.
- Revise and shorten duration of USEPA's review of submittals.
- Submit revised Work Plan in redline format to USEPA, and flag items that were table for further discussion.

QAPP Worksheet #10: Conceptual Site Model/ Project Objectives
(UFP QAPP Manual Section 2.5.2)
(EPA 2106-G-05 Section 2.2.5)

1.0. Conceptual Site Model

As stated in the RSWP and elsewhere in this UFP-QAPP, the Loeffel Route 203 Property was reportedly used for the storage of liquid wastes (e.g., oils) in one underground tank, multiple aboveground tanks and potentially also a lagoon. Releases from these operations resulted in soil contamination and overland flow into a low-lying area on the property, resulting in sediment contamination. The low-lying area was subsequently dredged to make a pond, and the sediment that was removed was placed along the banks of the pond. As summarized in the RSWP, the results of analyses performed by USEPA show that the dominant contaminants at the Loeffel Route 203 Property are PCBs and certain VOCs. The available data shows that the PCB impacts extend onto the adjacent National Grid Property to the west (potentially due to dredging of the low-lying area) and the Residential Property to the south (likely due to transport along a drainage swale that extends onto this parcel from the Loeffel Route 203 Property). This preliminary conceptual site model (CSM) will be refined during implementation of the RSWP.

2.0. Project Summary

The overall project objective is to collect additional data for environmental media consisting of soil, sediment, groundwater, wastewater and sludge (if present) and investigation-derived material (IDM) samples to assess the scope of additional removal activities. The historic data and the data generated during this investigation will be utilized.

Investigation activities focus on the following areas:

- Loeffel Route 203 Property – Specific investigation areas on this property are defined in the Work Plan and include the following:
  - Former AST/Potential Lagoon Area
  - Underground Storage Tank (UST)
  - Drum Area
  - Upland Area
  - Eastern Drainageway
    Pond Area
- National Grid Property – Portion to the immediate west of the Pond Area on the Loeffel Route 203 Property.
- Residential Property – The residential property located south of the Loeffel Route 203 Property and Sweets Crossing Road.

2.1 Project Tasks

Sample collection for soil, sediment, groundwater, wastewater and sludge (if present) and IDM and submission of samples to Eurofins Lancaster Laboratories Environmental LLC (ELLE) for laboratory analysis will be performed as presented in Worksheet 18.

2.1.1 Soil Sampling and Analysis

Soil sampling for laboratory analysis will be performed to augment the sample results from USEPA's investigation and to further characterize soil at the Site, including on the National Grid and Residential Properties. Per Section 2.6 of the RSWP, Respondent will have a call/meeting with USEPA to review and confirm the sampling plan after the performance of the geophysical survey and utility mark-out, and this includes discussion of the locations/depths for the full TCL/TAL samples (in addition to field observations during drilling/sampling).

Soil sampling will be performed for overburden soil at the Loeffel Route 203 Property, the National Grid Property to the west, and the Residential Property to the south, and the samples will be submitted for laboratory analysis as

described in this UFP-QAPP. For the soil sampling, quality assurance/quality control (QA/QC) samples will be collected at a frequency of one per 20 environmental samples. QA/QC samples include blind duplicate samples and matrix spike/matrix spike duplicate (MS/MSD) sample pairs. Equipment blanks (i.e., rinsate blanks) will be collected for non-dedicated sampling equipment (e.g., hand auger). Trip blanks will be included with each sample cooler containing volatile organic compound (VOC) samples. The laboratory data will be validated in accordance with this UFP-QAPP. Non-dedicated sampling equipment decontamination will be performed in accordance with this UFP-QAPP.

Soil samples will be collected in accordance with the soil sampling procedure detailed in this UFP-QAPP and sent via chain-of-custody to ELLE for laboratory analysis.

2.1.1.1 Loeffel Route 203 Property

A total of 94 soil sampling locations comprising shallow soil borings (5 feet in depth or less) and deep soil borings (to depths of 10, 15, and 30 feet) will be advanced on the Loeffel Route 203 Property and will include the following locations:

- Shallow Soil Borings – Sixty-five continuously sampled shallow soil borings will be advanced on the Loeffel Route 203 Property from ground surface to 5 feet below grade, or refusal (if shallower). The sampling locations were selected to further characterize soil where total PCB concentrations detected during USEPA's investigation are greater than 1 part per million (ppm) (e.g., the Pond Area, Former AST/Potential Lagoon Area, and Drum Area) and to characterize soil in areas not previously investigated by USEPA (e.g., wooded area north of the pond and southern driveway, and proximal to the Eastern Drainageway).
    - Samples will be collected for laboratory analysis as follows:
        - 195 samples[1] will be analyzed for polychlorinated biphenyls (PCBs) using USEPA SW-846 Method 8082A, and an additional 130 samples[2] will be archived for contingent PCB analysis;
        - 10 samples will be analyzed for VOCs by USEPA SW-846 Method 8260C; semi-volatile organic compounds (SVOCs) by USEPA SW-846 Method 8270D; 1,4-dioxane by USEPA SW-846 Method 8270D SIM; pesticides by USEPA SW-846 Method 8081B; metals by USEPA SW-846 Method 6010D, mercury by USEPA SW-846 Method 7471B and total cyanide by USEPA SW-846 Method 9012B;
        - Five samples will be analyzed for total organic carbon (TOC) using the Lloyd Kahn method;
        - Five samples will be analyzed for grain size using ASTM D422 and bulk density using ASTM E-868-82.
- Deep Soil Borings - USEPA's previous investigation did not evaluate soil deeper than 4 feet at the Site. A total of 20 continuously sampled deep soil borings will be advanced on the Loeffel Route 203 Property from ground surface to up to 30 feet below grade or refusal (if shallower). Thirteen soil borings will be advanced to a maximum of 10 feet, two borings will be advanced to a maximum of 15 feet, and five borings will be advanced to a maximum of 30 feet. The sampling locations were selected to characterize subsurface soil around the UST, in the Former AST/Potential Lagoon Area, the Drum Area and other portions of the Loeffel Route 203 Property.
    - Samples will be collected from the deep soil borings for laboratory analysis as follows:
        - 80 samples[1] will be analyzed for PCBs using USEPA SW-846 Method 8082A, and an additional 40 samples[1] will be archived for contingent PCB analysis;
        - Five samples will be analyzed for VOCs by USEPA SW-846 Method 8260C; SVOCs by USEPA SW-846 Method 8270D; 1,4-dioxane by USEPA SW-846 Method 8270D SIM; pesticides by USEPA SW-846 Method 8081B; metals by USEPA SW-846 Method 6010D, mercury by USEPA SW-846 Method 7471B and total cyanide by USEPA SW-846 Method 9012B;
        - Five samples will be analyzed for TOC using the Lloyd Kahn method; and

[1] Refer to Section 2.7 of the RSWP which discusses potential alteration of sample intervals by either party in consultation with the other and with USEPA approval based on visual observations and field screening results.

        - Five samples will be analyzed for grain size using ASTM D422 and bulk density using ASTM E-868-82.

- Eastern Drainageway - Nine continuously sampled shallow soil borings will be advanced in the bed of the ephemeral stream associated with the Eastern Drainageway from ground surface to 3 feet below grade or refusal (if shallower). In addition, one soil boring will be advanced to a depth of 2 feet below grade in the upgradient portion of the ephemeral stream on the eastern side of Route 203, immediately east of the culvert. The sampling locations were selected to characterize soil in the potential surface migration pathway not previously evaluated during USEPA's investigation.

    - Samples will be collected for laboratory analysis as follows:

        - 27 samples[2] will be analyzed for PCBs using USEPA SW-846 Method 8082A, and an additional 18 samples[2] will be archived for contingent PCB analysis; and
        - One sample will be analyzed for VOCs by USEPA SW-846 Method 8260C; SVOCs by USEPA SW-846 Method 8270D; 1,4-dioxane by USEPA SW-846 Method 8270D SIM; pesticides by USEPA SW-846 Method 8081B; metals by USEPA SW-846 Method 6010D, mercury by USEPA SW-846 Method 7471B and total cyanide by USEPA SW-846 Method 9012B.

    - One additional soil boring will be advanced to a depth of 2 feet below grade in the upgradient portion of the ephemeral stream on the eastern side of Route 203, immediately east of the culvert. Samples will be collected for laboratory analysis as follows:

        - Two samples will be analyzed for PCBs using USEPA SW-846 Method 8082A, and an additional two samples will be archived for contingent PCB analysis.
        - One sample will be analyzed for VOCs by USEPA SW-846 Method 8260C; SVOCs by USEPA SW-846 Method 8270D; 1,4-dioxane by USEPA SW-846 Method 8270D SIM; pesticides by USEPA SW-846 Method 8081B; metals by USEPA SW-846 Method 6010D, mercury by USEPA SW-846 Method 7471B and total cyanide by USEPA SW-846 Method 9012B.

2.1.1.2 National Grid Property

USEPA previously collected soil samples at approximately 18 locations on the National Grid Property; one or more soil samples detected total PCB concentrations exceeding 1 ppm at five of the 18 sample locations. Nine continuously sampled shallow soil borings will be advanced from ground surface to 3 feet below grade or refusal (if shallower). The sampling locations were selected to further characterize soil where total PCB concentrations detected during USEPA's investigation are greater than 1 ppm.

Samples will be collected for laboratory analysis as follows:

- 27 samples[2] will be analyzed for PCBs using USEPA SW-846 Method 8082A;
- One sample will be analyzed for VOCs by USEPA SW-846 Method 8260C; SVOCs by USEPA SW-846 Method 8270D; 1,4-dioxane by USEPA SW-846 Method 8270D SIM; pesticides by USEPA SW-846 Method 8081B; metals by USEPA SW-846 Method 6010D, mercury by USEPA SW-846 Method 7471B and total cyanide by USEPA SW-846 Method 9012B.

2.1.1.3 Residential Property

USEPA previously collected soil samples at 10 locations on the Residential Property or immediately adjacent to it. Seven of these locations were distributed across the open grassy area south of the abandoned culvert that extends beneath Sweets Crossing Road from the southern tip of the pond; total PCBs did not exceed 1 ppm in any of these samples. Three locations were distributed along the drainage swale associated with the ephemeral stream that flows from the Route 203 Property through the twin culvert under Sweets Crossing Road. Total PCBs exceeded 1 ppm in one of the samples collected at the three drainage swale locations.

[2] Refer to Section 2.7 of the RSWP which discusses potential alteration of sample intervals by either party in consultation with the other and with USEPA approval based on visual observations and field screening results.

A total of 19 soil sampling locations will be advanced on the Residential Property to characterize shallow soil in or adjacent to the drainage swale and along the ephemeral stream. Of these, 16 continuously sampled shallow soil borings will be advanced from ground surface to 3 feet below grade. Four of these sampling locations will be advanced approximately 10 feet to the northeast, southeast, southwest, and northwest of the USEPA sample where total PCBs were detected above 1 ppm. Three of the 19 soil sampling locations will be advanced from ground surface to 1 foot below grade along and adjacent to the ephemeral stream where it enters a low-lying area in the southwestern corner of the Residential Property.

Samples will be collected for laboratory analysis as follows:

- 54 samples[3] will be analyzed for PCBs using USEPA SW-846 Method 8082A, and an additional 32 samples[3] will be archived for contingent PCB analysis.

2.1.2. Pond Sediment Sampling and Analysis

USEPA previously collected 30 sediment samples at 14 locations near the perimeter of the pond. Samples from the interior portion of the pond were unable to be collected because of winter weather conditions.

Sediment samples will be collected at an additional 31 sample locations to a depth of 3 feet below the top of sediment or refusal (if shallower). The sediment sampling locations are distributed across the pond in an approximately gridded pattern. Based on the depth of the pond and the estimated thickness of the pond sediments, the sediment sampling methods and number of vertical samples may need to be adjusted.

Samples will be collected for laboratory analysis as follows:

- 93 samples will be analyzed for PCBs using USEPA SW-846 Method 8082A, and an additional 62 samples will be archived for contingent PCB analysis;
- Five samples will be analyzed for VOCs by USEPA SW-846 Method 8260C; SVOCs by USEPA SW-846 Method 8270D; 1,4-dioxane by USEPA SW-846 Method 8270D SIM; pesticides by USEPA SW-846 Method 8081B; metals by USEPA SW-846 Method 6010D, mercury by USEPA SW-846 Method 7471B and total cyanide by USEPA SW-846 Method 9012B;
- 31 samples will be analyzed for TOC using the Lloyd Kahn method; and
- Five samples will be analyzed for grain size using ASTM D422 and bulk density using ASTM E-868-82.

Samples will be collected in accordance with the sediment sampling procedure detailed in this UFP-QAPP and sent via chain-of-custody to ELLE for laboratory analysis. QA/QC samples will be collected at a frequency of one per 20 environmental samples. QA/QC samples include blind duplicate samples and MS/MSD sample pairs. Equipment blanks (i.e., rinsate blanks) will be collected for non-dedicated sampling equipment. Trip blanks will be included with each sample cooler containing VOC samples.

2.1.3 Overburden Monitoring Well Installation and Development

Overburden monitoring wells will be installed at five locations on the Loeffel Route 203 Property. The installation of these wells will facilitate the collection of groundwater samples to characterize overburden groundwater and to evaluate groundwater flow direction. The 30-foot deep soil borings discussed in Section 2.1.1.1 above will be completed as overburden monitoring wells. Following installation, the overburden monitoring wells will be developed in accordance with this UFP-QAPP. Non-dedicated, non-disposable equipment used in the development process will be decontaminated before and after each use in accordance with the field equipment decontamination procedure provided in this UFP-QAPP.

2.1.4. Groundwater Sampling and Analysis

Groundwater samples will be collected from each of the newly-installed overburden monitoring wells at the Site after the completion of well development at each monitoring well. Concurrent with this sampling event, a sample will also

[3] Refer to Section 2.7 of the RSWP which discusses potential alteration of sample intervals by either party in consultation with the other and with USEPA approval based on visual observations and field screening results.

be collected from the supply well located in the southern portion of the Loeffel Route 203 Property near the commercial outbuildings. Non-dedicated, non-disposable sampling equipment will be decontaminated before and after sampling at each monitoring well in accordance with the field equipment decontamination procedure provided in this UFP-QAPP.

Groundwater samples from the five newly-installed overburden monitoring wells will be obtained using low-flow sampling techniques in accordance with the sampling procedure provided in this UFP-QAPP, while a sample will be collected from the supply well in accordance with the sampling procedure provided in this UFP-QAPP. Samples will be collected for laboratory analysis as follows:

- VOCs by USEPA SW-846 Method 8260C; SVOCs by USEPA SW-846 Method 8270D; 1,4-dioxane by USEPA SW-846 Method 8270D SIM; pesticides by USEPA SW-846 Method 8081B; PCBs by USEPA SW-846 Method 8082A; metals by USEPA SW-846 Method 6010D, mercury by USEPA SW-846 Method 7471B and total cyanide by USEPA SW-846 Method 9012B.
- Water quality parameters, including dissolved oxygen (DO), oxidation reduction potential (ORP), temperature, pH, specific conductivity and turbidity, will be measured using a flow-through cell during low-flow sampling of the newly-installed monitoring wells.

Water samples will be sent to ELLE under chain-of-custody procedures as provided in this UFP-QAPP. QA/QC samples will be collected in accordance with this UFP-QAPP at a frequency of one set per 20 environmental samples. QA/QC samples include blind duplicate samples, equipment blanks, and MS/MSD sample pairs. Trip blanks will be included with each sample cooler containing VOC samples.

2.1.5. Soft Dig and UST Contents Sampling

A 30,000-gallon UST is reportedly located in the south-central portion of the property proximal to the southeast corner of the easternmost commercial garage. Soft digging techniques will be used to expose the top of the UST. If possible, sample(s) of the aqueous and sludge contents of the UST, if present and accessible, will be collected for laboratory analysis as follows:

- VOCs using USEPA SW-846 Method 8260C; SVOCs using USEPA SW-846 Method 8270D; 1,4-dioxane by USEPA SW-846 Method 8270D SIM; pesticides using USEPA SW-846 Method 8081B; PCBs using USEPA SW-846 Method 8082A; metals using USEPA SW-846 6010D/6020B; mercury using USEPA SW-846 Method 7470A; and total cyanide by USEPA SW-846 Method 9012B.

If a sampling port or other readily accessible method of obtaining a sample cannot be identified on the UST, then no sample will be obtained.[4]

2.1.6. Management of Investigation-Derived Materials

IDM resulting from the various field activities in this investigation will require appropriate management. The IDM includes the following:

- Soil and drill cuttings;
- Sediment;
- Groundwater resulting from the drilling and development of the overburden monitoring wells;
- Purge water from well sampling;
- Decontamination fluids;
- Solids (if any) which settle out of groundwater and/or decontamination fluids; and
- Personnel protective equipment (PPE) and associated debris resulting from the execution of the various field activities (e.g., polyethylene sheeting, sample tubing, disposable equipment, etc.).

2.1.6.1. Soil and Drill Cuttings

Soil and Drill Cuttings - Any soil remaining from shallow and deep soil boring and monitoring well locations will be collected in a 5-gallon bucket or placed directly into a 55-gallon drum. If using a 5-gallon bucket, the bucket will be

[4] As discussed with USEPA, the integrity of the UST will not be intentionally compromised during this investigation to collect a sample.

periodically emptied into a 55-gallon drum. Soil excavated from the top of the UST will be replaced after the tank is accessed and sampled. Any 55-gallon drums will be transported to the temporary IDM staging location and labeled. 55-gallon drums will be labeled as outlined in Section 2.16.1. of the RSWP.

Representative samples of the drummed soil and drill cuttings will be collected and sent via chain-of-custody to ELLE for laboratory analysis for:

- TCLP sample preparation and analysis for VOCs by USEPA SW-846 Method 8260C; SVOCs by USEPA SW-846 Method 8270D; pesticides by USEPA SW-846 Method 8081B; herbicides by USEPA SW-846 Method 8151A; metals by USEPA SW-846 Method 6010D, and mercury by USEPA SW-846 Method 7471B.
- PCBs by USEPA SW-846 Method 8082A.
- Hazardous characteristic parameters including: ignitability by USEPA 40 CFR 261.21; flashpoint by USEPA SW-846 Method 1010A; reactive cyanide by USEPA SW-846 Chapter 7.3, Method 9012B and reactive sulfide by USEPA SW-846 Chapter 7.3, Method 9034B.

The final disposition of the drummed drill cuttings will be determined based on the results of the laboratory analysis. After receiving the necessary approval(s), the soil will be transported for off-site disposal at an approved facility.

2.1.6.2. Sediment

Any excess sediment collected will be placed in a 5-gallon bucket (or similar) and allowed to settle. Any excess water will be decanted off the top and containerized with the decontamination fluids IDM. The sediment will be containerized with the soil and drill cutting IDM.

2.1.6.3. Groundwater

Groundwater collected during the overburden well drilling, well development, and groundwater sampling event will be containerized in polyethylene storage tanks and/or 55-gallon drums and transported to the temporary IDM staging location and labeled.

Representative samples of the containerized groundwater will be collected and sent via chain-of-custody to ELLE for laboratory analysis of:

- TCLP sample preparation and analysis for VOCs by USEPA SW-846 Method 8260C; SVOCs by USEPA SW-846 Method 8270D; pesticides by USEPA SW-846 Method 8081B; herbicides by USEPA SW-846 Method 8151A; metals by USEPA SW-846 Method 6010D, and mercury by USEPA SW-846 Method 7470A.
- PCBs by USEPA SW-846 Method 8082A.
- Hazardous characteristic parameters including: corrosivity by USEPA SW-846 Chapter 7 / pH by USEPA Method 9045D; ignitability by USEPA 40 CFR 261.21; flashpoint by USEPA SW-846 Method 1010A; reactive cyanide by USEPA SW-846 Chapter 7.3, Method 9012B and reactive sulfide by USEPA SW-846 Chapter 7.3, Method 9034B.

The final disposition of the containerized groundwater will be determined based on the results of the laboratory analysis. After receiving the necessary approval(s), the groundwater will be transported for off-site disposal at an approved facility.

2.1.6.4. Decontamination Fluids and Settled Solids

Non-disposable equipment will be decontaminated prior to and after use at the Site. Liquid/solid mixtures generated during equipment decontamination and decontamination fluids will be stored in 5-gallon bucket(s) and/or 55-gallon drum(s) to allow solids to settle. Settled solids will be managed with the sediment soil and drill cuttings IDM.

Representative samples of the containerized decontamination fluids will be sent via chain-of-custody to ELLE for laboratory analysis of:

- TCLP sample preparation and analysis for VOCs by USEPA SW-846 Method 8260C; SVOCs by USEPA SW-846 Method 8270D; pesticides by USEPA SW-846 Method 8081B; herbicides by USEPA SW-846 Method 8151A; metals by USEPA SW-846 Method 6010D, and mercury by USEPA SW-846 Method 7470A.
- PCBs by USEPA SW-846 Method 8082A.

- Hazardous characteristic parameters including: corrosivity by USEPA SW-846 Chapter 7 / pH by USEPA Method 9045D; ignitability by USEPA 40 CFR 261.21; flashpoint by USEPA SW-846 Method 1010A; reactive cyanide by USEPA SW-846 Chapter 7.3, Method 9012B and reactive sulfide by USEPA SW-846 Chapter 7.3, Method 9034B.

The final disposition of the containerized decontamination fluids will be determined based on the results of the laboratory analysis. The decontamination fluids will be transported for off-site disposal at an approved facility.

2.1.6.5. PPE and Associated Debris

PPE generated during non-intrusive, non-sampling activities (e.g., Tyvek® coveralls used during site visits or reconnaissance activities for protection against aggressive fauna and flora [e.g., ticks and poison ivy]) will be bagged and transported off-site for disposal at a local, permitted sanitary landfill. All other PPE (e.g., polyethylene sheeting, sample tubing, disposable equipment, etc.), will be containerized in 55-gallon drums and transported to the temporary IDM staging location and labeled.

Representative samples of the containerized PPE/debris from intrusive/sampling activities will be collected and sent via chain-of-custody to ELLE for laboratory analysis as specified on Table 2-1 of the RSWP.

The final disposition of the containerized PPE and debris will be determined based on the results of the laboratory analysis. After receiving the necessary approval(s), the PPE/debris will be transported for off-site disposal at an approved facility.

2.2 Laboratory Analysis

ELLE, which is National Environmental Laboratory Accreditation Conference (NELAC) accredited (New York Certification # 10670), will perform the definitive and screening analytical services.

Appendix A contains Standard Operating Procedures (SOPs), Quality Assurance Manuals (QAMs) and NELAC certifications for ELLE. **Appendix B** provides field SOPs. **Appendix C** provides a description of the data validation approach that will be used for any laboratory data that USEPA and Respondent determine need to be validated (see Section 3.0 of the RSWP).

3.0 Project Objectives

The problem to be addressed by the project:

USEPA is performing a removal action and, although data are available from USEPA's prior investigation activities, additional data are needed to evaluate the scope of additional removal activities. The goal of the additional investigation activities is as follows:

- Characterization of the horizontal and vertical extent of contamination in sediment in the pond at the Site;
- Characterization of the horizontal and vertical extent of soil contamination surrounding the pond (within the Pond Area, which includes the shoreline areas), including on the National Grid Property);
- Characterization of the horizontal and vertical extent of soil contamination in the Former AST/Potential Lagoon Area at the Loeffel Route 203 Property;
- Identification and characterization of the extent of contamination in and around the UST at the Loeffel Route 203 Property;
- Characterization of the extent of contamination associated with drums in the Drum Area of the Loeffel Route 203 Property;
- Characterization of the horizontal and vertical extent of soil contamination in the Eastern Drainageway of the Loeffel Route 203 Property;
- Characterization of the horizontal and vertical extent of soil contamination in the drainage swale on the Residential Property south of Sweets Crossing Road;
- Assessment of background soil contamination in the Eastern Drainageway immediately upstream of the Loeffel Route 203 Property;
- Assessment of soil contamination in the Upland Area of the Loeffel Route 203 Property; and

- Investigation of the potential impacts to groundwater from the release of hazardous substances on the Loeffel Route 203 Property, by installing and sampling groundwater monitoring wells.

The environmental question being asked:

Obtain sufficient information to evaluate the scope of additional removal activities at the Site.

The possible classes of contaminants and the affected matrices:

Historical analytical samples collected by USEPA indicate the presence of VOCs, SVOCs, PCBs, and metals at concentrations exceeding USEPA's residential Removal Management Levels (RMLs).

The media listed below will be sampled:

Soil, sediment, groundwater, wastewater and sludge (if present) and IDM samples as described in Worksheet #18.

The rationale for inclusion of chemical and non-chemical analyses:

Historical analytical sample results from USEPA. Collection of additional chemical and non-chemical analyses for the purpose of evaluating the scope of additional removal activities.

The project tasks include:

Soil Sampling and Analysis - Soil sampling will be performed for overburden soil at the Loeffel Route 203 Property, the National Grid Property to the west, and the Residential Property to the south, and the samples will be submitted for laboratory analysis as described in this UFP-QAPP.

- Loeffel Route 203 Property - Shallow and Deep Soil Borings:
    - Shallow Soil Borings - Sixty-five continuously sampled shallow soil borings will be advanced on the Loeffel Route 203 Property from ground surface to 5 feet below grade, or refusal (if shallower). The sampling locations were selected to further characterize soil where total PCB concentrations detected during USEPA's investigation are greater than 1 ppm (e.g., the Pond Area, Former AST/Potential Lagoon Area, and Drum Area) and to characterize soil in areas not previously investigated by USEPA (e.g., wooded area north of the pond and southern driveway, and in and proximal to the Eastern Drainageway).
    - Deep Soil Borings - USEPA's previous investigation did not evaluate soil deeper than 4 feet at the Site. A total of 20 continuously sampled deep soil borings will be advanced on the Loeffel Route 203 Property from ground surface to up to 30 feet below grade or refusal (if shallower). Thirteen soil borings will be advanced to a maximum of 10 feet, two borings will be advanced to a maximum of 15 feet, and five borings will be advanced to a maximum of 30 feet. The sampling locations were selected to characterize subsurface soil around the UST, in the Former AST/Potential Lagoon Area, the Drum Area and other portions of the Loeffel Route 203 Property.
    - Eastern Drainageway - Nine continuously sampled shallow soil borings will be advanced in the bed of the ephemeral stream associated with the Eastern Drainageway from ground surface to 3 feet below grade or refusal (if shallower). In addition, one soil boring will be advanced to a depth of 2 feet below grade in the upgradient portion of the ephemeral stream on the eastern side of Route 203, immediately east of the culvert. The sampling locations were selected to characterize soil in the potential surface migration pathway not previously evaluated during USEPA's investigation.
- National Grid Property – Shallow Soil Borings:
    - USEPA previously collected soil samples at approximately 18 locations on the National Grid Property; one or more soil samples detected total PCB concentrations exceeding 1 ppm at five of the 18 sample locations. Nine continuously sampled shallow soil borings will be advanced from ground surface to 3 feet below grade or refusal (if shallower). The sampling locations were selected to further

characterize soil where total PCB concentrations detected during USEPA's investigation are greater than 1 ppm.

- Residential Property – Shallow Soil Borings:

    - USEPA previously collected soil samples at 10 locations on the Residential Property or immediately adjacent to it. Seven of these locations were distributed across the open grassy area south of Sweets Crossing Road from the southern tip of the pond; total PCBs did not exceed 1 ppm in any of these samples. Three locations were distributed along the drainage swale associated with the ephemeral stream that flows from the Route 203 Property through the twin culvert under Sweets Crossing Road. Total PCBs exceeded 1 ppm in one of the samples collected at the three drainage swale locations. A total of 19 soil sampling locations will be advanced on the Residential Property to characterize shallow soil in or adjacent to the drainage swale. Of these, 16 continuously sampled shallow soil borings will be advanced from ground surface to 3 feet below grade. Four of these sampling locations will be advanced approximately 10 feet to the northeast, southeast, southwest, and northwest of the USEPA sample where total PCBs were detected above 1 ppm. Three of the 19 soil sampling locations will be advanced from ground surface to 1 foot below grade along and adjacent to the drainage swale where it enters a low-lying area in the southwestern corner of the Residential Property.

Pond Sediment Sampling and Analysis - USEPA previously collected thirty sediment samples at 14 locations near the perimeter of the pond. Samples from the interior portion of the pond were unable to be collected because of winter weather conditions.

Sediment samples will be collected at an additional 31 sample locations to a depth of 3 feet below the top of sediment or refusal (if shallower). The sediment sampling locations are distributed across the pond in an approximately gridded pattern. Based on the depth of the pond and the estimated thickness of the pond sediments, the sediment sampling methods and number of vertical samples may need to be adjusted.

Groundwater Sampling and Analysis - Groundwater samples will be collected from each of the newly-installed overburden monitoring wells at the Site after the completion of well development at each monitoring well. Concurrent with this sampling event, a sample will also be collected from the supply well located in the southern portion of the Loeffel Route 203 Property near the commercial outbuildings.

UST Contents Sampling and Analysis - A 30,000-gallon UST is reportedly located in the south-central portion of the Loeffel Route 203 Property proximal to the southeast corner of the easternmost commercial garage. If possible and if present, aqueous and sludge UST sample(s) will be collected for laboratory analysis.

IDM Sampling and Analysis – IDM resulting from the various investigation activities in this investigation will require appropriate management. The IDM includes the following:

- Soil and drill cuttings;
- Sediment;
- Groundwater resulting from the development of the overburden monitoring wells;
- Purge water from well sampling;
- Decontamination fluids;
- Solids (if any) which settle out of groundwater and/or decontamination fluids; and
- PPE and associated debris resulting from the execution of the various field activities (e.g., polyethylene sheeting, sample tubing, disposable equipment, etc.).

The final disposition of the IDM will be determined based on the results of the laboratory analysis.

Project Decision:

The results of the investigation will augment prior investigation results and will be used to evaluate the scope of additional removal activities.

QAPP Worksheet #11: Project/Data Quality Objectives – Removal Action Investigation (UFP QAPP Manual Section 2.6.1) (EPA 2106-G-05 Section 2.2.6)

- ***Step 1 - State the Problem*** – To obtain additional data for soil and sediment and to obtain data on wastewater and sludge (if present) to evaluate the scope of additional removal activities at the Site. Also, to obtain additional information on groundwater quality at the Loeffel Route 203 Property, and obtain water levels to assess groundwater flow direction.
- ***Step 2 - Identify the Goal of the Study*** – To utilize both historic and newly-generated data to evaluate to scope of additional removal activities at the Site.
- ***Step 3 – Identify information inputs (the data types that will be required before project decisions can be made)*** – The primary required data types will be analytical results from soil, sediment, wastewater and sludge (if present), and groundwater collected from the Loeffel Route 203 Property, National Grid Property, and Residential Property.
- ***Step 4 - Define the Boundaries of the Study (the spatial and temporal features pertinent for decision making)*** – The Site is located approximately one mile south of the Village of Nassau in Rensselaer County, New York. The Site is situated in a glaciated valley with hummocky terrain characterized by low-lying areas (including wetlands, ponds, and lakes) between elongated hills. The Loeffel Route 203 Property is located within a rural area with a mix of residential properties and farms. To the north, the property is bounded by farmland. To the east, the property is bounded by Route 203 and then farmland. To the south, the property is bounded by Sweets Crossing Road and then residences. The National Grid Property bounds the property to the west and separates the Loeffel Route 203 Property from the small residential development (17 properties) farther west.
- ***Step 5 - Develop the analytic approach (how will the study results be analyzed and conclusions made from the data)*** – Data will be used as follows:

  Soil, sediment, wastewater and sludge (if present) samples will be collected at the Loeffel Route 203 Property, National Grid Property, and/or Residential Property to obtain additional information to evaluate the scope of additional removal activities at the Site. The analytical data will be evaluated in conjunction with the historical data. IDM samples will be collected to obtain the information needed to characterize the IDM for proper disposal. Groundwater samples will be collected to obtain additional information on groundwater quality at the Loeffel Route 203 Property.

  The objectives for these data will be:

  - Characterization of the horizontal and vertical extent of contamination in sediment in the pond at the Site;
  - Characterization of the horizontal and vertical extent of soil contamination surrounding the pond (within the Pond Area, which includes the shoreline areas), including on the National Grid Property);
  - Characterization of the horizontal and vertical extent of soil contamination in the Former AST/Potential Lagoon Area at the Loeffel Route 203 Property;
  - Identification and characterization of the extent of contamination in and around the UST at the Loeffel Route 203 Property;
  - Characterization of the extent of contamination associated with drums in the Drum Area of the Loeffel Route 203 Property;
  - Characterization of the horizontal and vertical extent of soil contamination in the Eastern Drainageway of the Loeffel Route 203 Property;
  - Characterization of the horizontal and vertical extent of soil contamination in the drainage swale on the Residential Property south of Sweets Crossing Road;
  - Assessment of background soil contamination in the Eastern Drainageway immediately upstream of the Loeffel Route 203 Property;
  - Assessment of soil contamination in the Upland Area of the Loeffel Route 203 Property; and
  - Investigation of the potential impacts to groundwater from the release of hazardous substances on the Loeffel Route 203 Property, by installing and sampling groundwater monitoring wells.

- ***Step 6 - Specify performance or acceptance criteria (performance or acceptance criteria that the collected data will need to achieve)*** - Performance criteria are presented in Worksheets #12, including precision, accuracy/bias, representativeness, comparability, sensitivity and completeness. Completeness is the measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under normal conditions. Based on evaluation of the data in terms of precision, accuracy, representativeness, comparability, and sensitivity, a completeness objective of 95 percent of the data set has been established for the groundwater and surface water sampling activities. If the completeness objective is not met, additional sampling may be warranted.
- ***Step 7 - Develop the plan for obtaining data*** - The samples will be collected, analyzed, and evaluated as described in this UFP-QAPP.

QAPP Worksheet #12-1: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	VOCs/USEPA Methods 1311/5030B/5035A/8260C
Concentration Level	Low (Aqueous, Solid, IDM) Medium (Solid, IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-1, WS #15-2, WS #15-3, Table 1	MS/MSD, field duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-1, WS #15-2, WS #15-3, Table 1	LCS, MS, surrogates, internal standards, instrument performance checks
Representativeness	Sample holding times and preservation requirements. Target analyte identification and quantitation. Contamination of sample with target analyte (Reference Table 1).	Evaluate target analyte holding times, preservation and quantitation Evaluation of method/preparation blank, trip blank, equipment blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-1, WS #15-2, WS #15-3, Table 1	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95% of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-2: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	SVOCs/USEPA Methods 1311/3510C/3546/8270D/8270D-SIM
Concentration Level	Low (Aqueous, Solid, IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-1, WS #15-2, WS #15-3, Table 2	MS/MSD, field duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-1, WS #15-2, WS #15-3, Table 2	LCS, MS, surrogates, internal standards, instrument performance checks
Representativeness	Sample holding times and preservation requirements. Target analyte identification and quantitation. Contamination of sample with target analyte (Reference Table 2).	Evaluate target analyte holding times, preservation and quantitation Evaluation of method/preparation blank, trip blank, equipment blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-1, WS #15-2, WS #15-3, Table 2	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95% of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-3: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	Pesticides/USEPA Methods 1311/3510C/3546/8081B
Concentration Level	Low (Aqueous, Solid, IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-1, WS #15-2, WS #15-3, Table 4	MS/MSD, field duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-1, WS #15-2, WS #15-3, Table 4	LCS, MS, surrogates, internal standards, instrument performance checks
Representativeness	Sample holding times and preservation requirements. Target analyte identification and quantitation. Contamination of sample with target analyte (Reference Table 4).	Evaluate target analyte holding times, preservation and quantitation Evaluation of method/preparation blank, trip blank, equipment blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-1, WS #15-2, WS #15-3, Table 4	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95% of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-4: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	PCBs/USEPA Methods 3510C/3546/8082A
Concentration Level	Low (Aqueous, Solid, IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-1, WS #15-2, WS #15-3, Table 3	MS/MSD, field duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-1, WS #15-2, WS #15-3, Table 3	LCS, MS, surrogates, internal standards, instrument performance checks
Representativeness	Sample holding times and preservation requirements. Target analyte identification and quantitation. Contamination of sample with target analyte (Reference Table 3).	Evaluate target analyte holding times, preservation and quantitation Evaluation of method/preparation blank, trip blank, equipment blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-1, WS #15-2, WS #15-3, Table 3	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95% of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-5: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	IDM
Analytical Group	Herbicides/USEPA Methods 1311/ 3510C/8151A
Concentration Level	Low (IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-3, Table 5	MS/MSD, field duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-3, Table 5	LCS, MS, surrogates, internal standards, instrument performance checks
Representativeness	Sample holding times and preservation requirements. Target analyte identification and quantitation. Contamination of sample with target analyte (Reference Table 5).	Evaluate target analyte holding times, preservation and quantitation Evaluation of method/preparation blank, trip blank, equipment blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-3, Table 5	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95% of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-6: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	Metals/USEPA Methods 1311/3005A/3010A/3050B/6010C/6020A
Concentration Level	Low (Aqueous, Solid, IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-1, WS #15-2, WS #15-3, Table 6	MS/MSD, field duplicate, laboratory duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-1, WS #15-2, WS #15-3, Table 6	LCS, MS, post spike, serial dilutions, internal standards, Interference check samples A and B, ICP serial dilution
Representativeness	Sample holding times and preservation requirements. Target analyte quantitation. Contamination of sample with target analyte (Reference Table 6).	Evaluate target analyte holding times, preservation and quantitation Evaluation of method blank, calibration blank, equipment blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-1, WS #15-2, WS #15-3, Table 6	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95% of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-7: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	Mercury/USEPA Methods 1311/7470A/7471B
Concentration Level	Low (Aqueous, Solid, IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-1, WS #15-2, WS #15-3, Table 7	MS/MSD, field duplicate, laboratory duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-1, WS #15-2, WS #15-3, Table 7	LCS, MS
Representativeness	Sample holding times and preservation requirements. Target analyte quantitation. Contamination of sample with target analyte (Reference Table 6.	Evaluate target analyte holding times, preservation and quantitation Evaluation of method blank, calibration blank, equipment blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-1, WS #15-2, WS #15-3, Table 7	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95% of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-8: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	Total Cyanide/USEPA Method 9012A
Concentration Level	Low (Aqueous, Solid)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-1, WS #15-2, Table 7	MS/MSD, field duplicate, laboratory duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-1, WS #15-2, Table 7	LCS, MS
Representativeness	Sample holding times and preservation requirements. Target analyte quantitation. Contamination of sample with target analyte (Reference Table 7).	Evaluate target analyte holding times, preservation and quantitation Evaluation of method blank, calibration blank, equipment blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-1, WS #15-2, Table 7	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95% of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-9: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	Shallow Soil Borings/Deep Soil Borings/Sediment
Analytical Group	Total Organic Carbon (TOC)/Lloyd Kahn Method
Concentration Level	Low (Solid)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-2, Table 8	Laboratory duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-2, Table 8	LCS
Representativeness	Sample holding times and preservation requirements. Target analyte quantitation. Contamination of sample with target analyte (Reference Table 8)	Evaluate target analyte holding times, preservation and quantitation Evaluation of method blank, calibration blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-2, Table 8	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95%of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-10: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	IDM
Analytical Group	Corrosivity USEPA SW846 Chapter 7/ pH/USEPA Method 9045D
Concentration Level	Low (IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-3, Table 8	Laboratory duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-3, Table 8	LCS
Representativeness	Sample holding times and preservation requirements. Target analyte quantitation. Contamination of sample with target analyte (Reference Table 8)	Evaluate target analyte holding times, preservation and quantitation Evaluation of method blank, calibration blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-3, Table 8	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95%of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-11: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	IDM
Analytical Group	Ignitability/ USEPA 40 CFR 261.21
Concentration Level	Low (IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-3, Table 8	Laboratory duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-3, Table 8	LCS
Representativeness	Sample holding times and preservation requirements. Target analyte quantitation. Contamination of sample with target analyte (Reference Table 8)	Evaluate target analyte holding times, preservation and quantitation Evaluation of method blank, calibration blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-3, Table 8	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95%of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-12: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	IDM
Analytical Group	Flashpoint/ USEPA Method 1010A
Concentration Level	Low (IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-3, Table 8	Laboratory duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-3, Table 8	LCS
Representativeness	Sample holding times and preservation requirements. Target analyte quantitation. Contamination of sample with target analyte (Reference Table 8)	Evaluate target analyte holding times, preservation and quantitation Evaluation of method blank, calibration blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-3, Table 8	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95%of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-13: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	IDM
Analytical Group	Reactive Cyanide/ USEPA Method SW846 Chapter 7.3, Method 9012B
Concentration Level	Low (IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-3, Table 8	Laboratory duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-3, Table 8	LCS
Representativeness	Sample holding times and preservation requirements. Target analyte quantitation. Contamination of sample with target analyte (Reference Table 8)	Evaluate target analyte holding times, preservation and quantitation Evaluation of method blank, calibration blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-3, Table 8	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95%of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-14: Measurement Performance Criteria - Definitive Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	IDM
Analytical Group	Reactive Sulfide/ USEPA Method SW846 Chapter 7.3, Method 9034
Concentration Level	Low (IDM)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Precision	RPD, Reference WS #15-3, Table 8	Laboratory duplicate
Accuracy/Bias	± Percent Recovery, Reference WS #15-3, Table 8	LCS
Representativeness	Sample holding times and preservation requirements. Target analyte quantitation. Contamination of sample with target analyte (Reference Table 8)	Evaluate target analyte holding times, preservation and quantitation Evaluation of method blank, calibration blank
Comparability	Qualitative evaluation of compliance with industry standard methods and reporting units.	Review of analytical methods applied to analysis
Sensitivity	Reference WS #15-3, Table 8	Calibrations within method criteria; QLs and MDLs meet UFP-QAPP requirements/regulatory guidance
Completeness	> 95%of the laboratory analyses must provide for data usable for project objectives.	Data usability check

Notes: RPD = relative percent difference; MS = matrix spike; MSD = matrix spike duplicate; LCS = laboratory control sample

QAPP Worksheet #12-15: Measurement Performance Criteria - Screening Data
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix	Shallow Soil Borings/Deep Soil Borings/Sediment
Analytical Group	Physical Properties – Grain Size - ASTM D422, Bulk Density- ASTM E-868-82
Concentration Level	Low (Solid)

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance[3]
Comparability	Qualitative evaluation of compliance with good laboratory practices.	Review of analytical methods applied to analysis
Completeness	> 95% of the laboratory analyses must provide for data usable for project objectives.	Data usability check

QAPP Worksheet #12-16: Measurement Performance Criteria - QA Objectives
(UFP QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

QA Objectives for Data Measurement

The overall QA/QC objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analyses, and reporting that will provide results that have a degree of accuracy adequate to complete the investigation. Specific procedures for sampling, chain-of-custody, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of equipment, and corrective action are described in this UFP-QAPP. The purpose of this section is to address the specific objectives for accuracy, precision, completeness, representativeness, and comparability.

General

Analytical levels as defined in the USEPA's Data Quality Objectives Process for Superfund, Interim Final Guidance (USEPA, 1993), are as follows:

Screening Data: Screening data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data provide analyte identification and quantitation, although the quantitation may be relatively imprecise. At least 10% of the screening data should be confirmed using analytical methods and QA/QC procedures and criteria associated with definitive data. Screening data without associated confirmation data are not considered to be data of known quality.

For the investigation the following laboratory analyses are considered screening data:

- ELLE for grainsize and bulk density analysis.

Definitive Data: Definitive data are generated using rigorous analytical methods, such as USEPA reference methods, and are also referred to as critical data. Data are analyte-specific, with confirmation of analyte identity and concentration. These methods produce tangible raw data in the form of paper printouts or computer-generated electronic files. Data may be generated at the site of at an off-site location, as long as the QA/QC requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined.

For the investigation the following laboratory analyses are considered definitive data:

- ELLE for VOCs using USEPA SW-846 Method 8260C, SVOCs using SW-846 USEPA Method 8270D, 1,4-dioxane using USEPA SW-846 Method 8270D SIM, pesticides using USEPA SW-846 Method 8081B, PCBs using USEPA SW-846 Method 8082A, herbicides using USEPA Method 8151A, metals using USEPA SW-846 Method 6010D/6020B, mercury using USEPA SW-846 Method 7470A/7471B, total cyanide using USEPA SW-846 Method 9012A, TOC using the Lloyd Kahn method, Corrosivity/pH by USEPA Method 9045D, Ignitability by 40 CFR 261.21, Flashpoint using USEPA Method 1010A, Reactive Cyanide using USEPA SW-846 Method 9012B and Reactive Sulfide using USEPA SW-846 Method 9034. Also, TCLP preparation and analysis for VOCs using USEPA SW-846 Method 8260C, SVOCs using USEPA SW-846 Method 8270D, pesticides using USEPA SW-846 Method 8081B; herbicides using USEPA SW-846 Method 8151A, metals using USEPA SW-846 Method 6010D/6020B, and mercury using USEPA SW-846 Method 7470A/7471B.

Precision: A measure of the reproducibility of data or measurements under specific conditions. Precision is a quantitative measure of the variability of a group of data compared to their average value. Duplicate precision is stated in terms of relative percent difference (RPD) or absolute difference between two measurements. Measurement of precision is dependent upon sampling technique and analytical method. Field duplicate and laboratory duplicate samples (and duplicate measurements for field parameters) will be used to measure precision. Both sampling and analysis will be as consistent as possible. For a pair of measurements, RPD (or absolute difference) will be used, as presented below:

$$RPD(\%) = \frac{|D_1 - D_2|}{\left[\frac{(D_1 + D_2)}{2}\right]} \times 100$$

where: D_1 and D_2 = the two replicate values.

RPD for field parameters will meet the measurement criteria specified in this worksheet.

Accuracy/Bias: A measure of the bias in a measurement system. Sources of error include the sampling process, field contamination, preservation, handling, shipping, sample matrix, sample preparation, and analysis technique. Accuracy will be assessed through duplicate measurements with calibration samples or quality check samples, where applicable. In general, accuracy is measured in terms of percent recovery (%R):

$$\%R = \frac{(SSR - SR)}{SA} \times 100$$

where: SSR = spike sample result (assume same as SA)
SR = sample result (e.g., actual measurement with field instrument)
SA = spike added to spiking matrix (e.g., calibration sample concentration or value)

Representativeness: Expresses the degree to which data accurately and precisely reflects a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that is dependent upon the proper design and implementation of the sampling program and proper laboratory protocol. The sampling design created for this project was designed to provide data representative of Site conditions. During the development of the sampling designs, consideration was given to the past history of contamination in the study area, existing analytical data, physical setting, and processes. Representativeness will be satisfied by determining that the UFP-QAPP is followed, proper sampling techniques, preservation, and handling are used, proper analytical procedures are followed, and holding times for the samples are not exceeded in the laboratory.

Comparability: A measure of the confidence with which one data set can be compared to another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data are expected to provide comparable data. The procedures used will be USEPA methodologies or other test methods which are well recognized and commonly used for environmental and geotechnical investigations.

Sensitivity: Depending upon the use of the data and the type of test parameter, specific Quantitation Limits (QLs) will be required. Worksheet #15 lists the required QLs. In each case these are below the regulatory levels which are also listed. The analytical methods used for this project should have sensitivities well below these criteria.

Completeness: Completeness is a measure of the amount of usable data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. It is expected that the laboratories used for this project will provide data that meet the QC acceptance criteria for 95 percent, or more, of all samples analyzed. Following the completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{COMPLETENESS } (\%) = \frac{\text{number of usable data}}{\text{number of samples collected for each parameter analyzed}} \times 100$$

The completeness acceptance criterion for samples collected in the field will be 95 percent of the quantity of samples planned for collection in the work plan(s). Corrective action may be implemented to re-collect samples where necessary and possible (e.g., modifying a planned sample location, sample jars broken during shipment). Laboratory notification sample receipt and conditions will be used to identify as soon as possible, whether any problems during sample shipment would necessitate recollection of samples.

QAPP Worksheet #13: Secondary Data Uses and Limitations
(UFP QAPP Manual Section 2.7)
(EPA 2106-G-05 Chapter 3: QAPP Elements for Evaluating Existing Data)

Data type	Source	Data uses relative to current project	Factors affecting the reliability of data and limitations on data use
Historical data consisting of surface water, groundwater, sediment, and soil data.	Historical reports and data sets provided by USEPA's contractor.	Data may be compared with historical surface water, groundwater, sediment, and soil sampling data for secondary purposes; historical data will may be used in fulfilling the primary data quality objectives for the project.	No known limitations.

QAPP Worksheet #14/16: Project Tasks & Schedule
(UFP QAPP Manual Section 2.8.2)
(EPA 2106-G-05 Section 2.2.4)

Refer to the Removal Sampling Work Plan for more details.

Activity	Responsible party	Planned start date	Planned completion date	Deliverable(s)	Deliverable due date
USEPA approval or approval w/ modifications of Removal Sampling Work Plan and UFP-QAPP	OBG	September 2019	February 2020	• Final RSWP • Final UFP-QAPP	February 2020
Obtain access	OBG	February 2020	March 2020	NA	NA
Utility mark-out/surface geophysical survey	OBG	April 2020	May 2020	• Survey Results	May 2020
UST sampling	OBG	April 2020	May 2020	• Report of Analyses • Laboratory Data package	May 2020
Soil sampling	OBG	May 2020	June 2020	• Report of Analyses • Laboratory Data package	June 2020
Pond investigation, including bathymetry survey, sediment probing and sediment sampling	OBG	April 2020	June 2020	• Survey results • Report of Analyses • Laboratory Data package	June 2020
Staff gauge installation	OBG	May 2020	May 2020	NA	NA
Overburden monitoring well installation, development and sampling, including supply well sampling	OBG	June 2020	July 2020	• Report of Analyses • Laboratory Data package	July 2020
Management of IDM	OBG	July 2020	November 2020	• Report of Analyses • Laboratory Data package	August 2020
Interim Deliverable, including a meeting to present findings	OBG	July 2020	September 2020	• Interim Deliverable	September 2020
Final Investigation Report	OBG	September 2020	March 2021	• Final Investigation Report	March 2021

QAPP Worksheet #15-1 - Project Action Limits and Laboratory-Specific Detection/Quantitation Limits- Definitive Data (UFP QAPP Manual Section 2.6.2.3 and Figure 15)

Matrix: Aqueous - Definitive Analytical Methods
Analytical Groups for Definitive Data: VOCs, SVOCs, PCBs, Pesticides, Metals, Mercury

Sample Associated with Analysis - Aqueous (Groundwater) matrices associated with the Sampling as described in the QAPP.

Analytical Method	Laboratory Performing Analysis	Reference	CAS Number	Target Analyte	Laboratory Detection Limits			Surrogate Recovery Control Limits (%R)	LCS Recovery Control Limits (%R)	MS/MSD Recovery Control Limits (%R)	MS/MSD Precision (RPD)	LCS/LCSD Precision (RPD)	NYSDOH Drinking Water MCLs[1]	USEPA RMLs, HQ1 Tapwater[2]	USEPA RMLs, HQ3 Tapwater[2]	USEPA Drinking Water MCLs[3]
					MDLs	QLs	Units									
TCL VOCs																
USEPA Method 8260C	ELLE	1	71-55-6	**1,1,1-Trichloroethane**	0.3	1	ug/L	NA	67-126	67-126	30	30	5	8000	24000	200
USEPA Method 8260C	ELLE	1	79-34-5	**1,1,2,2-Tetrachloroethane**	0.2	1	ug/L	NA	72-120	72-120	30	30	5	7.6	7.6	NA
USEPA Method 8260C	ELLE	1	76-13-1	**1,1,2-Trichloro-1,2,2-trifluoroethane**	0.2	10	ug/L	NA	73-139	73-139	30	30	NA	10000	31000	NA
USEPA Method 8260C	ELLE	1	79-00-5	**1,1,2-Trichloroethane**	0.2	1	ug/L	NA	80-120	80-120	30	30	5	0.41	1.2	5
USEPA Method 8260C	ELLE	1	75-34-3	**1,1-Dichloroethane**	0.2	1	ug/L	NA	80-120	80-120	30	30	5	280	280	NA
USEPA Method 8260C	ELLE	1	75-35-4	**1,1-Dichloroethene**	0.2	1	ug/L	NA	80-131	80-131	30	30	5	280	850	7
USEPA Method 8260C	ELLE	1	87-61-6	**1,2,3-Trichlorobenzene**	0.4	5	ug/L	NA	66-120	66-120	30	30	5	7	21	NA
USEPA Method 8260C	ELLE	1	120-82-1	**1,2,4-Trichlorobenzene**	0.3	5	ug/L	NA	63-120	63-120	30	30	5	4	12	70
USEPA Method 8260C	ELLE	1	96-12-8	**1,2-Dibromo-3-chloropropane**	0.3	5	ug/L	NA	47-131	47-131	30	30	0.2	0.033	0.033	0.2
USEPA Method 8260C	ELLE	1	106-93-4	**1,2-Dibromoethane**	0.2	1	ug/L	NA	77-120	77-120	30	30	0.05	0.75	0.75	0.05
USEPA Method 8260C	ELLE	1	95-50-1	**1,2-Dichlorobenzene**	0.2	5	ug/L	NA	80-120	80-120	30	30	5	300	910	600
USEPA Method 8260C	ELLE	1	107-06-2	**1,2-Dichloroethane**	0.3	1	ug/L	NA	73-124	73-124	30	30	5	13	17	5
USEPA Method 8260C	ELLE	1	156-59-2	**1,2-Dichloroethene (cis)**	0.2	1	ug/L	NA	80-125	80-120	30	30	5	36	110	70
USEPA Method 8260C	ELLE	1	156-60-5	**1,2-Dichloroethene (trans)**	0.2	1	ug/L	NA	80-126	80-120	30	30	5	360	1100	100
USEPA Method 8260C	ELLE	1	78-87-5	**1,2-Dichloropropane**	0.2	1	ug/L	NA	80-120	80-120	30	30	5	8.2	25	5
USEPA Method 8260C	ELLE	1	541-73-1	**1,3-Dichlorobenzene**	0.2	5	ug/L	NA	80-120	80-120	30	30	5	NA	NA	NA
USEPA Method 8260C	ELLE	1	10061-01-5	**cis-1,3-Dichloropropene**	0.2	1	ug/L	NA	75-120	75-120	30	30	5[9]	39[9]	47[9]	NA
USEPA Method 8260C	ELLE	1	10061-02-6	**trans-1,3-Dichloropropene**	0.2	1	ug/L	NA	67-120	67-120	30	30	5[9]	39[9]	47[9]	NA
USEPA Method 8260C	ELLE	1	106-46-7	**1,4-Dichlorobenzene**	0.2	5	ug/L	NA	80-120	80-120	30	30	5	48	48	75
USEPA Method 8260C	ELLE	1	78-93-3	**2-Butanone**	0.3	10	ug/L	NA	59-135	59-135	30	30	50	5600	17000	NA
USEPA Method 8260C	ELLE	1	591-78-6	**2-Hexanone**	0.3	10	ug/L	NA	56-135	56-135	30	30	50	38	110	NA
USEPA Method 8260C	ELLE	1	108-10-1	**4-Methyl-2-pentanone**	0.5	10	ug/L	NA	62-133	62-133	30	30	50	6300	19000	NA
USEPA Method 8260C	ELLE	1	67-64-1	**Acetone**	0.7	20	ug/L	NA	54-157	54-157	30	30	50	14000	42000	NA
USEPA Method 8260C	ELLE	1	71-43-2	**Benzene**	0.2	1	ug/L	NA	80-120	80-120	30	30	5	33	46	5
USEPA Method 8260C	ELLE	1	74-97-5	**Bromochloromethane**	0.2	5	ug/L	NA	80-120	80-120	30	30	5	83	250	NA
USEPA Method 8260C	ELLE	1	75-27-4	**Bromodichloromethane**	0.2	1	ug/L	NA	71-120	71-120	30	30	50	13	13	80
USEPA Method 8260C	ELLE	1	75-25-2	**Bromoform**	1	4	ug/L	NA	51-120	51-120	30	30	50	330	330	80
USEPA Method 8260C	ELLE	1	74-83-9	**Bromomethane**	0.3	1	ug/L	NA	53-128	53-128	30	30	5	7.5	23	NA
USEPA Method 8260C	ELLE	1	75-15-0	**Carbon Disulfide**	0.2	5	ug/L	NA	65-128	65-128	30	30	50	810	2400	NA
USEPA Method 8260C	ELLE	1	56-23-5	**Carbon Tetrachloride**	0.2	1	ug/L	NA	64-134	64-134	30	30	5	46	46	5
USEPA Method 8260C	ELLE	1	108-90-7	**Chlorobenzene**	0.2	1	ug/L	NA	80-120	80-120	30	30	5	78	230	100
USEPA Method 8260C	ELLE	1	75-00-3	**Chloroethane**	0.2	1	ug/L	NA	55-123	55-123	30	30	5	21000	63000	NA
USEPA Method 8260C	ELLE	1	67-66-3	**Chloroform**	0.2	1	ug/L	NA	80-120	80-120	30	30	50	22	22	80
USEPA Method 8260C	ELLE	1	74-87-3	**Chloromethane**	0.2	1	ug/L	NA	56-121	56-121	30	30	5	190	560	NA
USEPA Method 8260C	ELLE	1	110-82-7	**Cyclohexane**	1	5	ug/L	NA	68-126	68-126	30	30	50	13000	38000	NA
USEPA Method 8260C	ELLE	1	124-48-1	**Dibromochloromethane**	0.2	1	ug/L	NA	71-120	71-120	30	30	50	87	87	80
USEPA Method 8260C	ELLE	1	75-71-8	**Dichlorodifluoromethane**	0.2	1	ug/L	NA	41-127	41-127	30	30	5	200	590	NA
USEPA Method 8260C	ELLE	1	100-41-4	**Ethylbenzene**	0.4	1	ug/L	NA	80-120	80-120	30	30	5	150	150	700
USEPA Method 8260C	ELLE	1	98-82-8	**Isopropylbenzene**	0.2	5	ug/L	NA	80-120	80-120	30	30	5	450	1400	NA
USEPA Method 8260C	ELLE	1	79-20-9	**Methyl Acetate**	0.2	5	ug/L	NA	54-136	54-136	30	30	50	20000	60000	NA
USEPA Method 8260C	ELLE	1	1634-04-4	**Methyl tert butyl ether**	0.2	1	ug/L	NA	69-122	69-122	30	30	10	1400	1400	NA
USEPA Method 8260C	ELLE	1	108-87-2	**Methylcyclohexane**	0.5	5	ug/L	NA	67-121	67-121	30	30	50	NA	NA	NA
USEPA Method 8260C	ELLE	1	75-09-2	**Methylene Chloride**	0.3	1	ug/L	NA	80-120	80-120	30	30	5	110	320	5
USEPA Method 8260C	ELLE	1	100-42-5	**Styrene**	0.2	5	ug/L	NA	80-120	80-120	30	30	5	1200	3600	100
USEPA Method 8260C	ELLE	1	127-18-4	**Tetrachloroethene**	0.2	1	ug/L	NA	80-120	80-120	30	30	5	41	120	5
USEPA Method 8260C	ELLE	1	108-88-3	**Toluene**	0.2	1	ug/L	NA	80-120	80-120	30	30	5	1100	3300	1000
USEPA Method 8260C	ELLE	1	95-47-6	**o-Xylene**	0.4	1	ug/L	NA	80-120	80-120	30	30	5[5]	190	580	10000[5]
USEPA Method 8260C	ELLE	1	179601-23-1	**m,p-Xylene**	1	5	ug/L	NA	80-120	80-120	30	30	5[5]	190	580	10000[5]
USEPA Method 8260C	ELLE	1	79-01-6	**Trichloroethene**	0.2	1	ug/L	NA	80-120	80-120	30	30	5	2.8	8.5	5
USEPA Method 8260C	ELLE	1	75-69-4	**Trichlorofluoromethane**	0.2	1	ug/L	NA	55-135	55-135	30	30	5	5200	15000	NA
USEPA Method 8260C	ELLE	1	75-01-4	**Vinyl Chloride**	0.2	1	ug/L	NA	56-120	56-120	30	30	2	1.9	1.9	2
USEPA Method 8260C	ELLE	1	1868-53-7	**Dibromofluoromethane**	NA	NA	NA	80 - 120	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8260C	ELLE	1	17060-07-0	**1,2-Dichloroethane-d4**	NA	NA	NA	80 - 120	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8260C	ELLE	1	2037-26-5	**Toluene-d8**	NA	NA	NA	80 - 120	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8260C	ELLE	1	460-00-4	**4-Bromofluorobenzene**	NA	NA	NA	80 - 120	NA	NA	NA	NA	NA	5	14	NA
TCL SVOCs																
USEPA Method 8270D SIM	ELLE	2	123-91-1	**1,4-Dioxane SIM**	0.1	0.3	ug/l	NA	18-91	18-91	30	30	50	46	46	NA
USEPA Method 8270D	ELLE	2	92-52-4	**1,1'-Biphenyl**	3	10	ug/L	NA	51-112	51-112	30	30	NA	0.83	2.5	NA
USEPA Method 8270D	ELLE	2	95-94-3	**1,2,4,5- Tetrachlorobenzene**	0.5	2	ug/L	NA	33-105	33-105	30	30	5	1.7	5.1	NA
USEPA Method 8270D	ELLE	2	95-95-4	**2,4,5-Trichlorophenol**	0.5	2	ug/L	NA	66-118	66-118	30	30	5	1200	3500	NA
USEPA Method 8270D	ELLE	2	88-06-2	**2,4,6-Trichlorophenol**	0.5	2	ug/L	NA	69-122	69-122	30	30	5	12	36	NA
USEPA Method 8270D	ELLE	2	120-83-2	**2,4-Dichlorophenol**	0.5	2	ug/L	NA	58-114	58-114	30	30	NA	46	140	NA
USEPA Method 8270D	ELLE	2	105-67-9	**2,4-Dimethylphenol**	3	10	ug/L	NA	48-91	48-91	30	30	50	360	1100	NA
USEPA Method 8270D	ELLE	2	51-28-5	**2,4-Dinitrophenol**	14	30	ug/L	NA	44-134	44-134	30	30	NA	39	120	NA
USEPA Method 8270D	ELLE	2	121-14-2	**2,4-Dinitrotoluene**	1	5	ug/L	NA	69-117	69-117	30	30	5	24	24	NA
USEPA Method 8270D	ELLE	2	606-20-2	**2,6-Dinitrotoluene**	0.5	2	ug/L	NA	63-122	63-122	30	30	5	4.9	4.9	NA
USEPA Method 8270D	ELLE	2	91-58-7	**2-Chloronapthalene**	0.4	1	ug/L	NA	42-111	42-111	30	30	5	750	2200	NA
USEPA Method 8270D	ELLE	2	95-57-8	**2-Chlorophenol**	0.5	2	ug/L	NA	52-109	52-109	30	30	5	91	270	NA
USEPA Method 8270D	ELLE	2	91-57-6	**2-Methylnapthalene**	0.1	0.5	ug/L	NA	44-111	44-111	30	30	50	36	110	NA
USEPA Method 8270D	ELLE	2	95-48-7	**2-Methylphenol**	0.5	2	ug/L	NA	53-107	53-107	30	30	50	930	2800	NA
USEPA Method 8270D	ELLE	2	88-74-4	**2-Nitroaniline**	2	7	ug/L	NA	66-126	66-126	30	30	5	190	570	NA
USEPA Method 8270D	ELLE	2	88-75-5	**2-Nitrophenol**	3	10	ug/L	NA	57-116	57-116	30	30	50	NA	NA	NA
USEPA Method 8270D	ELLE	2	58-90-2	**2,3,4,6-Tetrachlorophenol**	4	10	ug/L	NA	68-118	68-118	30	30	5	240	710	NA
USEPA Method 8270D	ELLE	2	91-94-1	**3,3'-Dichlorobenzidine**	3	10	ug/L	NA	42-107	42-107	30	30	5	13	13	NA
USEPA Method 8270D	ELLE	2	99-09-2	**3-Nitroaniline**	3	7	ug/L	NA	47-119	47-119	30	30	5	NA	NA	NA
USEPA Method 8270D	ELLE	2	101-55-3	**4-Bromophenyl Phenyl Ether**	0.5	2	ug/L	NA	53-117	53-117	30	30	50	NA	NA	NA
USEPA Method 8270D	ELLE	2	59-50-7	**4-Chloro-3-methylphenol**	0.5	2	ug/L	NA	60-118	60-118	30	30	5	1400	4300	NA
USEPA Method 8270D	ELLE	2	106-47-8	**4-Chloroaniline**	4	10	ug/L	NA	35-108	35-108	30	30	5	37	37	NA
USEPA Method 8270D	ELLE	2	7005-72-3	**4-Chlorophenyl phenyl ether**	0.5	2	ug/L	NA	46-113	46-113	30	30	50	NA	NA	NA
USEPA Method 8270D	ELLE	2	100-01-6	**4-Nitroaniline**	0.9	3	ug/L	NA	45-107	45-107	30	30	5	78	230	NA
USEPA Method 8270D	ELLE	2	106-44-5	**4-Methylphenol**	0.5	2	ug/L	NA	49-108	49-108	30	30	50	1900	5600	NA
USEPA Method 8270D	ELLE	2	100-02-7	**4-Nitrophenol**	10	30	ug/L	NA	23-89	23-89	30	30	50	NA	NA	NA
USEPA Method 8270D	ELLE	2	534-52-1	**4,6-Dinitro-2-methylphenol**	8	21	ug/L	NA	63-129	63-129	30	30	50	1.5	4.5	NA
USEPA Method 8270D	ELLE	2	83-32-9	**Acenaphthene**	0.1	0.5	ug/L	NA	52-114	52-114	30	30	50	530	1600	NA
USEPA Method 8270D	ELLE	2	208-96-8	**Acenapthylene**	0.1	0.5	ug/L	NA	57-121	57-121	30	30	50	NA	NA	NA
USEPA Method 8270D	ELLE	2	98-86-2	**Acetophenone**	4	10	ug/L	NA	61-114	61-114	30	30	50	1900	5800	NA
USEPA Method 8270D	ELLE	2	120-12-7	**Anthracene**	0.1	0.5	ug/L	NA	62-116	62-116	30	30	50	1800	5300	NA
USEPA Method 8270D	ELLE	2	1912-24-9	**Atrazine**	2	5	ug/L	NA	71-133	71-133	30	30	3	30	30	3
USEPA Method 8270D	ELLE	2	100-52-7	**Benzaldehyde**	3	10	ug/L	NA	48-118	48-118	30	30	NA	1900	1900	NA
USEPA Method 8270D	ELLE	2	56-55-3	**Benzo(a)anthracene**	0.1	0.5	ug/L	NA	70-118	70-118	30	30	50	3	3	NA
USEPA Method 8270D	ELLE	2	205-99-2	**Benzo(b)fluoranthene**	0.1	0.5	ug/L	NA	71-115	71-115	30	30	50	25	25	NA
USEPA Method 8270D	ELLE	2	191-24-2	**Benzo(g,h,i)perylene**	0.1	0.5	ug/L	NA	60-119	60-119	30	30	50	NA	NA	NA
USEPA Method 8270D	ELLE	2	207-08-9	**Benzo(k)fluoranthene**	0.1	0.5	ug/L	NA	71-116	71-116	30	30	50	250	250	NA
USEPA Method 8270D	ELLE	2	50-32-8	**Benzo[a]pyrene**	0.1	0.5	ug/L	NA	71-117	71-117	30	30	0.2	2.5	2.5	0.2
USEPA Method 8270D	ELLE	2	85-68-7	**Benzylbutylphthalate**	2	5	ug/L	NA	44-124	44-124	30	30	50	1600	1600	NA
USEPA Method 8270D	ELLE	2	111-91-1	**bis(2-Chloroethoxy)methane**	0.5	2	ug/L	NA	53-119	53-119	30	30	5	59	180	NA
USEPA Method 8270D	ELLE	2	111-44-4	**Bis(2-chloroethyl)ether**	0.5	2	ug/L	NA	49-110	49-110	30	30	5	1.4	1.4	NA
USEPA Method 8270D	ELLE	2	117-81-7	**Bis(2-ethylhexyl)phthalate**	5	11	ug/L	NA	68-120	68-120	30	30	6	400	560	6
USEPA Method 8270D	ELLE	2	108-60-1	**bis-2 Chloroisopropyl ether 2,2'-oxybis(1-Chloropropane)**	0.5	2	ug/L	NA	40-110	40-110	30	30	5	710	2100	NA
USEPA Method 8270D	ELLE	2	86-74-8	**Carbazole**	0.5	2	ug/L	NA	64-127	64-127	30	30	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	105-60-2	**Caprolactam**	5	11	ug/L	NA	10-57	10-57	30	30	NA	9900	30000	NA
USEPA Method 8270D	ELLE	2	218-01-9	**Chrysene**	0.1	0.5	ug/L	NA	69-116	69-116	30	30	50	2500	2500	NA
USEPA Method 8270D	ELLE	2	53-70-3	**Dibenzo(a,h)anthracene**	0.1	0.5	ug/L	NA	68-121	68-121	30	30	50	2.5	2.5	NA
USEPA Method 8270D	ELLE	2	132-64-9	**Dibenzofuran**	0.5	2	ug/L	NA	53-114	53-114	30	30	50	7.9	24	NA
USEPA Method 8270D	ELLE	2	84-74-2	**Di-n-butylphthalate**	2	5	ug/L	NA	62-118	62-118	30	30	50	900	2700	NA
USEPA Method 8270D	ELLE	2	84-66-2	**Diethylphthalate**	2	5	ug/L	NA	48-113	48-113	30	30	50	15000	45000	NA

QAPP Worksheet #15-1 - Project Action Limits and Laboratory-Specific Detection/Quantitation Limits- Definitive Data (UFP QAPP Manual Section 2.6.2.3 and Figure 15)

Matrix: Aqueous - Definitive Analytical Methods

Analytical Groups for Definitive Data: VOCs, SVOCs, PCBs, Pesticides, Metals, Mercury

Sample Associated with Analysis - Aqueous (Groundwater) matrices associated with the Sampling as described in the QAPP.

Analytical Method	Laboratory Performing Analysis	Reference	CAS Number	Target Analyte	Laboratory Detection Limits			Surrogate Recovery Control Limits (%R)	LCS Recovery Control Limits (%R)	MS/MSD Recovery Control Limits (%R)	MS/MSD Precision (RPD)	LCS/LCSD Precision (RPD)	NYSDOH Drinking Water MCLs[1]	USEPA RMLs, HQ1 Tapwater[2]	USEPA RMLs, HQ3 Tapwater[2]	USEPA Drinking Water MCLs[3]
					MDLs	QLs	Units									
USEPA Method 8270D	ELLE	2	131-11-3	**Dimethylphthalate**	2	5	ug/L	NA	14-123	14-123	30	30	50	NA	NA	NA
USEPA Method 8270D	ELLE	2	117-84-0	**Di-n-octylphthalate**	5	11	ug/L	NA	67-120	67-120	30	30	50	200	600	NA
USEPA Method 8270D	ELLE	2	206-44-0	**Fluoranthene**	0.1	0.5	ug/L	NA	63-122	63-122	30	30	50	800	2400	NA
USEPA Method 8270D	ELLE	2	86-73-7	**Fluorene**	0.1	0.5	ug/L	NA	56-115	56-115	30	30	50	290	880	NA
USEPA Method 8270D	ELLE	2	118-74-1	**Hexachlorobenzene**	0.1	0.5	ug/L	NA	60-117	60-117	30	30	1	0.98	0.98	1
USEPA Method 8270D	ELLE	2	87-68-3	**Hexachlorobutadiene**	0.5	2	ug/L	NA	20-108	20-108	30	30	5	6.5	14	NA
USEPA Method 8270D	ELLE	2	77-47-4	**Hexachlorocyclopentadiene**	5	11	ug/L	NA	10-91	10-91	30	30	5	0.41	1.2	50
USEPA Method 8270D	ELLE	2	67-72-1	**Hexachloroethane**	1	5	ug/L	NA	23-95	23-95	30	30	5	6.2	19	NA
USEPA Method 8270D	ELLE	2	193-39-5	**Indeno(1,2,3-cd)pyrene**	0.1	0.5	ug/L	NA	63-114	63-114	30	30	50	25	25	NA
USEPA Method 8270D	ELLE	2	78-59-1	**Isophorone**	0.5	2	ug/L	NA	56-120	56-120	30	30	50	3800	7800	NA
USEPA Method 8270D	ELLE	2	91-20-3	**Naphthalene**	0.1	0.5	ug/L	NA	45-105	45-105	30	30	50	6.1	17	NA
USEPA Method 8270D	ELLE	2	98-95-3	**Nitrobenzene**	0.5	2	ug/L	NA	49-113	49-113	30	30	5	13	14	NA
USEPA Method 8270D	ELLE	2	621-64-7	**N-Nitroso-di-n-propylamine**	0.7	3	ug/L	NA	51-122	51-122	30	30	50	1.1	1.1	NA
USEPA Method 8270D	ELLE	2	86-30-6	**N-Nitrosodiphenylamine**	0.7	3	ug/L	NA	63-119	63-119	30	30	50	1200	1200	NA
USEPA Method 8270D	ELLE	2	87-86-5	**Pentachlorophenol**	1	5	ug/L	NA	54-131	54-131	30	30	1	4.1	4.1	1
USEPA Method 8270D	ELLE	2	85-01-8	**Phenanthrene**	0.1	0.5	ug/L	NA	65-113	65-113	30	30	50	NA	NA	NA
USEPA Method 8270D	ELLE	2	108-95-2	**Phenol**	0.5	2	ug/L	NA	19-79	19-79	30	30	50	5800	17000	NA
USEPA Method 8270D	ELLE	2	129-00-0	**Pyrene**	0.1	0.5	ug/L	NA	65-115	65-115	30	30	50	120	360	NA
USEPA Method 8270D	ELLE	2	13127-88-3	**Phenol-d6**	NA	NA	NA	10 - 67	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	367-12-4	**2-Fluorophenol**	NA	NA	NA	10 - 84	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	118-79-6	**2,4,6-Tribromophenol**	NA	NA	NA	23 - 135	NA	NA	NA	NA	NA	120	360	NA
USEPA Method 8270D	ELLE	2	4165-60-0	**Nitrobenzene-d5**	NA	NA	NA	33 - 113	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	321-60-8	**2-Fluorobiphenyl**	NA	NA	NA	44 - 102	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	1718-51-0	**Terphenyl-d14**	NA	NA	NA	39 - 125	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	4165-60-0	**Nitrobenzene-d5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	321-60-8	**2-Fluorobiphenyl**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	1718-51-0	**Terphenyl-d14**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	93951-69-0	**Fluoranthene-d10**	NA	NA	NA	48 - 128	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	63466-71-7	**Benzo(a)pyrene-d12**	NA	NA	NA	18 - 129	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	38072-94-5	**1-Methylnaphthalene-d10**	NA	NA	NA	30 - 114	NA	NA	NA	NA	NA	NA	NA	NA
TCL Pesticides																
USEPA Method 8081B	ELLE	2	72-55-9	**4,4'-DDE**	0.005	0.02	ug/l	NA	42-148	42-148	30	30	NA	4.6	4.6	NA
USEPA Method 8081B	ELLE	2	50-29-3	**4,4'-DDT**	0.005	0.02	ug/l	NA	22-138	22-138	30	30	5	10	23	NA
USEPA Method 8081B	ELLE	2	72-54-8	**4,4'-DDD**	0.0052	0.02	ug/l	NA	40-145	40-145	30	30	5	0.063	0.19	NA
USEPA Method 8081B	ELLE	2	309-00-2	**Aldrin**	0.002	0.01	ug/l	NA	28-119	28-119	30	30	5	0.092	0.092	NA
USEPA Method 8081B	ELLE	2	319-84-6	**Alpha BHC**	0.003	0.01	ug/l	NA	47-132	47-132	30	30	5	0.72	0.72	NA
USEPA Method 8081B	ELLE	2	319-85-7	**Beta BHC**	0.0034	0.01	ug/l	NA	27-143	27-143	30	30	5	2.5	2.5	NA
USEPA Method 8081B	ELLE	2	319-86-8	**Delta BHC**	0.0034	0.01	ug/l	NA	28-141	28-141	30	30	5	NA	NA	NA
USEPA Method 8081B	ELLE	2	58-89-9	**Gamma BHC (Lindane)**	0.002	0.01	ug/l	NA	29-136	29-136	30	30	0.2	3.6	4.2	0.2
USEPA Method 8081B	ELLE	2	60-57-1	**Dieldrin**	0.0053	0.02	ug/l	NA	31-145	31-145	30	30	5	0.18	0.18	NA
USEPA Method 8081B	ELLE	2	959-98-8	**Endosulfan I**	0.0043	0.01	ug/l	NA	40-138	40-138	30	30	50 [+]	100 [+]	300 [+]	NA
USEPA Method 8081B	ELLE	2	33213-65-9	**Endosulfan II**	0.015	0.03	ug/l	NA	27-138	27-138	30	30	50 [+]	100 [+]	300 [+]	NA
USEPA Method 8081B	ELLE	2	1031-07-8	**Endosulfan Sulfate**	0.0058	0.02	ug/l	NA	41-133	41-133	30	30	50	110	320	NA
USEPA Method 8081B	ELLE	2	72-20-8	**Endrin**	0.0081	0.02	ug/l	NA	35-143	35-143	30	30	2	2.3	6.9	2
USEPA Method 8081B	ELLE	2	7421-93-4	**Endrin Aldehyde**	0.02	0.1	ug/l	NA	40-135	40-135	20	20	5	NA	NA	NA
USEPA Method 8081B	ELLE	2	76-44-8	**Heptachlor**	0.002	0.01	ug/l	NA	38-135	38-135	30	30	0.4	0.14	0.14	0.4
USEPA Method 8081B	ELLE	2	1024-57-3	**Heptachlor Epoxide**	0.0023	0.01	ug/l	NA	28-146	28-146	30	30	0.2	0.12	0.14	0.2
USEPA Method 8081B	ELLE	2	5103-71-9	**alpha-Chlordane**	0.003	0.01	ug/l	NA	28-136	28-136	30	30	2 [#]	0.74 [#]	2 [#]	2 [#]
USEPA Method 8081B	ELLE	2	5103-74-2	**gamma-Chlordane**	0.007	0.02	ug/l	NA	53-130	53-130	30	30	2 [#]	0.74 [#]	2 [#]	2 [#]
USEPA Method 8081B	ELLE	2	72-43-5	**Methoxychlor**	0.03	0.1	ug/l	NA	39-143	39-143	30	30	40	37	110	40
USEPA Method 8081B	ELLE	2	53494-70-5	**Endrin Ketone**	0.005	0.02	ug/l	NA	44-136	44-136	30	30	NA	NA	NA	NA
USEPA Method 8081B	ELLE	2	8001-35-2	**Toxaphene**	0.3	1	ug/l	NA	48-148	48-148	30	30	3	1.8	5.4	3
USEPA Method 8081B	ELLE	2	877-09-8	**Tetrachloro-m-xylene**	NA	NA	NA	29 - 129	NA	NA	N/A	NA	NA	NA	NA	NA
USEPA Method 8081B	ELLE	2	2051-24-3	**Decachlorobiphenyl**	NA	NA	NA	32 - 149	NA	NA	N/A	NA	NA	NA	NA	NA
TCL PCBs																
USEPA Method 8082A	ELLE	2	12674-11-2	**Aroclor 1016**	0.1	0.5	ug/l	NA	60-117	60-117	30	30	0.5	1.4	4.2	0.5
USEPA Method 8082A	ELLE	2	11104-28-2	**Aroclor 1221**	0.1	0.5	ug/l	NA	NA	NA	NA	NA	0.5	0.47	0.47	0.5
USEPA Method 8082A	ELLE	2	11141-16-5	**Aroclor 1232**	0.2	0.5	ug/l	NA	NA	NA	NA	NA	0.5	0.47	0.47	0.5
USEPA Method 8082A	ELLE	2	53469-21-9	**Aroclor 1242**	0.1	0.5	ug/l	NA	NA	NA	NA	NA	0.5	0.78	0.78	0.5
USEPA Method 8082A	ELLE	2	12672-29-6	**Aroclor 1248**	0.1	0.5	ug/l	NA	NA	NA	NA	NA	0.5	0.78	0.78	0.5
USEPA Method 8082A	ELLE	2	11097-69-1	**Aroclor 1254**	0.1	0.5	ug/l	NA	NA	NA	NA	NA	0.5	0.4	0.78	0.5
USEPA Method 8082A	ELLE	2	11096-82-5	**Aroclor 1260**	0.15	0.5	ug/l	NA	57-134	57-134	30	30	0.5	0.78	0.78	0.5
USEPA Method 8082A	ELLE	2	37324-23-5	**Aroclor 1262**	0.2	0.5	ug/l	NA	NA	NA	NA	NA	0.5	NA	NA	0.5
USEPA Method 8082A	ELLE	2	11100-14-4	**Aroclor 1268**	0.16	0.5	ug/l	NA	NA	NA	NA	NA	0.5	NA	NA	0.5
Cyanide)																
USEPA Method 6010D	ELLE	2	7429-90-5	**Aluminum**	0.107	0.3	mg/l	NA	80-120	75-125	20	20	NA	20	60	NA
USEPA Method 6010D	ELLE	2	7439-89-6	**Iron**	0.04	0.2	mg/l	NA	80-120	75-125	20	20	0.3	14	42	NA
USEPA Method 6010D	ELLE	2	7439-92-1	**Lead**	0.0071	0.015	mg/l	NA	80-120	75-125	20	20	0.015	0.015	0.015	0.015
USEPA Method 6010D	ELLE	2	7439-96-5	**Manganese**	0.003	0.01	mg/l	NA	80-120	75-125	20	20	0.3	0.43	1.3	NA
USEPA Method 7470A	ELLE	3	7439-97-6	**Mercury**	0.00005	0.0002	mg/l	NA	80-110	80-120	20	20	0.002	0.00063	0.0019	0.002
USEPA Method 6010D	ELLE	2	7440-02-0	**Nickel**	0.0021	0.01	mg/l	NA	80-120	75-125	20	20	NA	0.39	1.2	NA
USEPA Method 6010D	ELLE	2	7440-22-4	**Silver**	0.005	0.01	mg/l	NA	80-120	75-125	20	20	0.1	0.094	0.28	NA
USEPA Method 6010D	ELLE	2	7440-28-0	**Thallium**	0.0081	0.03	mg/l	NA	80-120	75-125	20	20	0.002	0.0002	0.0006	0.002
USEPA Method 6010D	ELLE	2	7440-36-0	**Antimony**	0.016	0.05	mg/l	NA	80-120	75-125	20	20	0.006	0.0078	0.023	0.006
USEPA Method 6010D	ELLE	2	7440-38-2	**Arsenic**	0.016	0.03	mg/l	NA	80-120	75-125	20	20	0.01	0.0052	0.0052	0.01
USEPA Method 6010D	ELLE	2	7440-39-3	**Barium**	0.001	0.005	mg/l	NA	80-120	75-125	20	20	2	3.8	11	2
USEPA Method 6010D	ELLE	2	7440-41-7	**Beryllium**	0.001	0.005	mg/l	NA	80-120	75-125	20	20	0.004	0.025	0.074	0.004
USEPA Method 6010D	ELLE	2	7440-43-9	**Cadmium**	0.001	0.005	mg/l	NA	80-120	83-116	20	20	0.005	9.2	28.0	5.000
USEPA Method 6010D	ELLE	2	7440-47-3	**Chromium**	0.0016	0.015	mg/l	NA	80-120	75-125	20	20	0.1	NA	NA	0.1
USEPA Method 6010D	ELLE	2	7440-48-4	**Cobalt**	0.0015	0.005	mg/l	NA	80-120	75-125	20	20	NA	0.006	0.018	NA
USEPA Method 6010D	ELLE	2	7440-50-8	**Copper**	0.012	0.02	mg/l	NA	80-120	86-122	20	20	1.3	0.8	2.4	1.3
USEPA Method 6010D	ELLE	2	7440-70-2	**Calcium**	0.096	0.2	mg/l	NA	80-120	75-125	20	20	NA	NA	NA	NA
USEPA Method 6010D	ELLE	2	2023-69-5	**Potassium**	0.204	0.5	mg/l	NA	80-120	75-125	20	20	NA	NA	NA	NA
USEPA Method 6010D	ELLE	2	7440-23-5	**Sodium**	0.239	1	mg/l	NA	80-120	75-125	20	20	NA	NA	NA	NA
USEPA Method 6010D	ELLE	2	7440-62-2	**Vanadium**	0.0019	0.01	mg/l	NA	80-120	75-125	20	20	NA	0.086	0.26	NA
USEPA Method 6010D	ELLE	2	7440-66-6	**Zinc**	0.0037	0.02	mg/l	NA	80-120	75-125	20	20	5	6	18	NA
USEPA Method 6010D	ELLE	2	7782-49-2	**Selenium**	0.016	0.05	mg/l	NA	80-120	75-125	20	20	0.05	0.1	0.3	0.05
USEPA Method 6010D	ELLE	2	7439-95-4	**Magnesium**	0.04	0.1	mg/l	NA	80-120	75-125	20	20	NA	NA	NA	NA
USEPA Method 6020B	ELLE	2	7429-90-5	**Aluminum**	0.0197	0.4	mg/l	NA	88-114	75-125	20	20	NA	20	60	NA
USEPA Method 6020B	ELLE	2	7439-89-6	**Iron**	0.0228	0.05	mg/l	NA	87-114	75-125	20	20	0.3	14	42	NA
USEPA Method 6020B	ELLE	2	7439-92-1	**Lead**	0.000071	0.0005	mg/l	NA	90-110	75-125	20	20	0.015	0.015	0.015	0.015
USEPA Method 6020B	ELLE	2	7439-96-5	**Manganese**	0.00063	0.002	mg/l	NA	89-120	75-125	20	20	0.3	0.43	1.3	NA
USEPA Method 6020B	ELLE	2	7440-02-0	**Nickel**	0.00005	0.0002	mg/l	NA	80-110	80-120	20	20	NA	0.39	1.2	NA
USEPA Method 6020B	ELLE	2	7440-22-4	**Silver**	0.0006	0.001	mg/l	NA	90-114	75-125	20	20	0.1	0.094	0.28	NA
USEPA Method 6020B	ELLE	2	7440-28-0	**Thallium**	0.00017	0.0005	mg/l	NA	88-113	75-125	20	20	0.002	0.0002	0.0006	0.002
USEPA Method 6020B	ELLE	2	7440-36-0	**Antimony**	0.00013	0.0005	mg/l	NA	80-120	75-125	20	20	0.006	0.0078	0.0230	0.006
USEPA Method 6020B	ELLE	2	7440-38-2	**Arsenic**	0.00041	0.001	mg/l	NA	80-120	75-125	20	20	0.01	0.0052	0.0052	0.01
USEPA Method 6020B	ELLE	2	7440-39-3	**Barium**	0.00068	0.002	mg/l	NA	85-120	75-125	20	20	2	3.8	11	2
USEPA Method 6020B	ELLE	2	7440-41-7	**Beryllium**	0.00075	0.002	mg/l	NA	80-120	75-125	20	20	0.004	0.025	0.074	0.004
USEPA Method 6020B	ELLE	2	7440-43-9	**Cadmium**	0.00012	0.0005	mg/l	NA	90-112	75-125	20	20	0.005	9.2	28	5
USEPA Method 6020B	ELLE	2	7440-47-3	**Chromium**	0.00015	0.0005	mg/l	NA	84-120	75-125	20	20	0.1	NA	NA	0.1
USEPA Method 6020B	ELLE	2	7440-48-4	**Cobalt**	0.00033	0.001	mg/l	NA	90-115	75-125	20	20	NA	0.006	0.018	NA
USEPA Method 6020B	ELLE	2	7440-50-8	**Copper**	0.00016	0.0005	mg/l	NA	86-113	75-125	20	20	1.3	0.8	2.4	1.3
USEPA Method 6020B	ELLE	2	7440-70-2	**Calcium**	0.00036	0.001	mg/l	NA	89-120	75-125	20	20	NA	NA	NA	NA
USEPA Method 6020B	ELLE	2	2023-69-5	**Potassium**	0.0598	0.7	mg/l	NA	85-120	75-125	20	20	NA	NA	NA	NA
USEPA Method 6020B	ELLE	2	7440-23-5	**Sodium**	0.107	0.2	mg/l	NA	90-112	75-125	20	20	NA	NA	NA	NA
USEPA Method 6020B	ELLE	2	7440-62-2	**Vanadium**	0.05	0.2	mg/l	NA	89-112	75-125	20	20	NA	0.086	0.260	NA
USEPA Method 6020B	ELLE	2	7440-66-6	**Zinc**	0.00024	0.0005	mg/l	NA	90-115	75-125	20	20	5	6	18	NA

QAPP Worksheet #15-1 - Project Action Limits and Laboratory-Specific Detection/Quantitation Limits- Definitive Data (UFP QAPP Manual Section 2.6.2.3 and Figure 15)

Matrix: Aqueous - Definitive Analytical Methods

Analytical Groups for Definitive Data: VOCs, SVOCs, PCBs, Pesticides, Metals, Mercury

Sample Associated with Analysis - Aqueous (Groundwater) matrices associated with the Sampling as described in the QAPP.

Analytical Method	Laboratory Performing Analysis	Reference	CAS Number	Target Analyte	Laboratory Detection Limits			Surrogate Recovery Control Limits (%R)	LCS Recovery Control Limits (%R)	MS/MSD Recovery Control Limits (%R)	MS/MSD Precision (RPD)	LCS/LCSD Precision (RPD)	NYSDOH Drinking Water MCLs[1]	USEPA RMLs, HQ1 Tapwater[2]	USEPA RMLs, HQ3 Tapwater[2]	USEPA Drinking Water MCLs[3]
					MDLs	QLs	Units									
USEPA Method 6020B	ELLE	2	7782-49-2	**Selenium**	0.0062	0.01	mg/l	NA	90-115	75-125	20	20	0.05	0.1	0.3	0.05
USEPA Method 6020B	ELLE	2	7439-95-4	**Magnesium**	0.00028	0.001	mg/l	NA	90-113	75-125	20	20	NA	NA	NA	NA
USEPA Method 9012B	ELLE	4	57-12-5	**Total cyanide**	0.005	0.01	mg/l	NA	90-110	72-114	20	20	0.2	0.0015	0.0044	0.2

Notes:

MDL indicates method detection limit.

QL indicates quantitation limit.

NA indicates not applicable.

ND indicates a non-detectable concentration by the approved analytical methods referenced in section 700.3.

MS/MSD indicates matrix spike/ matrix spike duplicate.

LCS Indicates laboratory control sample.

%R indicates percent recovery.

RPD indicates relative percent difference.

ELLE indicates Eurofins Lancaster Laboratory Environmental LLC of Lancaster, PA.

* Applies to the sum of cis- and trans-1,3-dichloropropene, CAS Nos. 10061-01-5 and 10061-02-6, respectively.

** Applies individually to m-xylene (1,3-xylene) and p-xylene (1,4-xylene).

*** Applies to the sum of Phenols, total chlorinated.

[i] Applies to the sum of Phenolic compounds, total phenols.

[^] Applies to the sum of Polychlorinated biphenyls.

[d] MCL is sum of cis- and trans-1,3-dichloropropene

[o] MCL is sum of o- and m,p-xylenes

[†] MCL is sum of endosulfan I and II

[#] MCL is sum of alpha- and gamma-chlordane

QLs and MDLs were provided by ELLE, current as of November 2019.

Source List:

Target compound list (TCL) resource - USEPA. 2007. Multi-Media, Multi-Concentration Organic Analytical Service for Superfund (SOM01.2). Washington, D.C.

Target analyte list (TAL) resource - USEPA. 2010. Multi-Media, Multi-Concentration Inorganic Analysis, ISMO1.3. Washington, D.C.

References (See Worksheet 23 for laboratory SOPs):

1- USEPA. 2006. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition. Washington D.C.

2- USEPA. 2007. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition, Update IV. Washington D.C.

3- USEPA. 1994. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition, Update II. Washington D.C.

4- USEPA. 1996. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition, Update III. Washington D.C.

Regulatory Criteria Reference:

1- NYSDOH Part 5 Drinking Water Supplies, Subpart 5-1 Public Water Systems, current through May 16, 2018.

2- USEPA Regional Removal Management Levels (RMLs), current as of November 2019.

3- USEPA National Primary Drinking Water Regulations, Maximum Contaminant Levels (MCLs).

QAPP Worksheet #15-2 - Project Action Limits and Laboratory-Specific Detection/Quantitation Limits - Definitive Data (UFP QAPP Manual Section 2.6.2.3 and Figure 15)

Matrix: Solid - Definitive Analytical Methods

Analytical Groups for Definitive Data: VOCs, SVOCs, PCBs, Pesticides, Metals, Mercury, Total Cyanide, TOC, Physical Tests. Sample Associated with Analysis - Soil and Sediment associated with the Sampling as described in the QAPP.

					Laboratory Detection Limits - Low Level			Laboratory Detection Limits - Medium Level														
Analytical Method	Laboratory Performing Analysis	Reference	CAS Number	Target Analyte	MDLs	RLs	Units	MDLs	RLs	Units	Surrogate Recovery Control Limits (%R)	Low Level LCS Recovery Control Limits (%R)	Low Level MS/MSD Recovery Control Limits (%R)	Low Level MS/MSD Precision (RPD)	Low Level LCS/LCSD Precision (RPD)	Medium Level LCS Recovery Control Limits (%R)	Medium Level MS/MSD Recovery Control Limits (%R)	Medium Level MS/MSD Precision (RPD)	Low Level LCS/LCSD Precision (RPD)	USEPA RMLs, HQ1 Residential Soil[1]	USEPA RMLs, HQ1 Industrial Soil[1]	USEPA RMLs, HQ3 Residential Soil[1]	USEPA RMLs, HQ3 Industrial Soil[1]
TCL VOCs																						
USEPA Method 8260C	ELLE	1	71-55-6	**1,1,1-Trichloroethane**	0.6	5	ug/Kg	30	250	ug/Kg	NA	69-123	69-123	30	30	69-123	69-123	30	30	8100000	36000000	24000000	110000000
USEPA Method 8260C	ELLE	1	79-34-5	**1,1,2,2-Tetrachloroethane**	0.4	5	ug/Kg	20	250	ug/Kg	NA	69-125	69-125	30	30	69-125	69-125	30	30	60000	270000	60000	270000
USEPA Method 8260C	ELLE	1	76-13-1	**Freon 113**	0.6	10	ug/Kg	30	500	ug/Kg	NA	64-135	64-135	30	30	64-135	64-135	30	30	6700000	28000000	20000000	84000000
USEPA Method 8260C	ELLE	1	79-00-5	**1,1,2-Trichloroethane**	0.5	5	ug/Kg	25	250	ug/Kg	NA	80-120	80-120	30	30	80-120	80-120	30	30	1500	6300	4500	19000
USEPA Method 8260C	ELLE	1	75-34-3	**1,1-Dichloroethane**	0.5	5	ug/Kg	25	250	ug/Kg	NA	79-120	79-120	30	30	79-120	79-120	30	30	360000	1600000	360000	1600000
USEPA Method 8260C	ELLE	1	75-35-4	**1,1-Dichloroethene**	0.5	5	ug/Kg	25	250	ug/Kg	NA	73-129	73-129	30	30	73-129	73-129	30	30	230000	1000000	680000	3000000
USEPA Method 8260C	ELLE	1	87-61-6	**1,2,3-Trichlorobenzene**	5	10	ug/Kg	250	500	ug/Kg	NA	57-131	57-131	30	30	57-131	57-131	30	30	63000	930000	190000	2800000
USEPA Method 8260C	ELLE	1	120-82-1	**1,2,4-Trichlorobenzene**	5	10	ug/Kg	250	500	ug/Kg	NA	56-130	56-130	30	30	56-130	56-130	30	30	58000	260000	170000	770000
USEPA Method 8260C	ELLE	1	96-12-8	**1,2-Dibromo-3-chloropropane**	0.5	5	ug/Kg	25	250	ug/Kg	NA	48-134	48-134	30	30	48-134	48-134	30	30	530	6400	530	6400
USEPA Method 8260C	ELLE	1	106-93-4	**1,2-Dibromoethane**	0.4	5	ug/Kg	20	250	ug/Kg	NA	76-120	76-120	30	30	76-120	76-120	30	30	3600	16000	3600	16000
USEPA Method 8260C	ELLE	1	95-50-1	**1,2-Dichlorobenzene**	0.5	5	ug/Kg	25	250	ug/Kg	NA	76-120	76-120	30	30	76-120	76-120	30	30	1800000	9300000	5400000	28000000
USEPA Method 8260C	ELLE	1	107-06-2	**1,2-Dichloroethane**	0.6	5	ug/Kg	30	250	ug/Kg	NA	71-128	71-128	30	30	71-128	71-128	30	30	31000	140000	46000	200000
USEPA Method 8260C	ELLE	1	156-59-2	**cis-1,2-Dichloroethene**	0.5	5	ug/Kg	25	250	ug/Kg	NA	80-125	80-123	30	30	80-125	80-123	30	30	160000	2300000	470000	7000000
USEPA Method 8260C	ELLE	1	156-60-5	**trans-1,2-Dichloroethene**	0.5	5	ug/Kg	25	250	ug/Kg	NA	80-126	80-125	30	30	80-126	80-125	30	30	1600000	23000000	4700000	70000000
USEPA Method 8260C	ELLE	1	78-87-5	**1,2-Dichloropropane**	0.5	5	ug/Kg	25	250	ug/Kg	NA	80-120	80-120	30	30	80-120	80-120	30	30	16000	66000	47000	200000
USEPA Method 8260C	ELLE	1	541-73-1	**1,3-Dichlorobenzene**	0.5	5	ug/Kg	25	250	ug/Kg	NA	75-120	75-120	30	30	75-120	75-120	30	30	NA	NA	NA	NA
USEPA Method 8260C	ELLE	1	10061-01-5	**cis-1,3-Dichloropropene**	0.4	5	ug/Kg	20	250	ug/Kg	NA	66-120	66-120	30	30	66-120	66-120	30	30	720000[3]	3100003	1800003	8200003
USEPA Method 8260C	ELLE	1	10061-02-6	**trans-1,3-Dichloropropene**	0.5	5	ug/Kg	25	250	ug/Kg	NA	68-122	68-122	30	30	68-122	68-122	30	30	720003	3100003	1800003	8200003
USEPA Method 8260C	ELLE	1	106-46-7	**1,4-Dichlorobenzene**	0.4	5	ug/Kg	20	250	ug/Kg	NA	80-120	80-120	30	30	80-120	80-120	30	30	260000	1100000	260000	1100000
USEPA Method 8260C	ELLE	1	78-93-3	**2-Butanone**	1	10	ug/Kg	50	500	ug/Kg	NA	57-128	57-128	30	30	57-128	57-128	30	30	27000000	190000000	81000000	580000000
USEPA Method 8260C	ELLE	1	591-78-6	**2-Hexanone**	1	10	ug/Kg	50	500	ug/Kg	NA	54-140	54-140	30	30	54-140	54-140	30	30	200000	1300000	600000	4000000
USEPA Method 8260C	ELLE	1	108-10-1	**4-Methyl-2-pentanone**	1	10	ug/Kg	50	500	ug/Kg	NA	67-128	67-128	30	30	67-128	67-128	30	30	33000000	140000000	99000000	420000000
USEPA Method 8260C	ELLE	1	67-64-1	**Acetone**	6	20	ug/Kg	300	1000	ug/Kg	NA	41-150	41-150	30	30	41-150	41-150	30	30	61000000	670000000	180000000	2000000000
USEPA Method 8260C	ELLE	1	71-43-2	**Benzene**	0.5	5	ug/Kg	25	250	ug/Kg	NA	80-120	80-120	30	30	80-120	80-120	30	30	82000	420000	120000	510000
USEPA Method 8260C	ELLE	1	74-97-5	**Bromochloromethane**	0.6	5	ug/Kg	30	250	ug/Kg	NA	72-124	72-124	30	30	72-124	72-124	30	30	150000	630000	450000	1900000
USEPA Method 8260C	ELLE	1	75-27-4	**Bromodichloromethane**	0.4	5	ug/Kg	20	250	ug/Kg	NA	70-120	70-120	30	30	70-120	70-120	30	30	29000	130000	29000	130000
USEPA Method 8260C	ELLE	1	75-25-2	**Bromoform**	5	10	ug/Kg	250	500	ug/Kg	NA	51-127	51-127	30	30	51-127	51-127	30	30	1600000	8600000	1900000	8600000
USEPA Method 8260C	ELLE	1	74-83-9	**Bromomethane**	0.7	5	ug/Kg	35	250	ug/Kg	NA	45-140	45-140	30	30	45-140	45-140	30	30	6800	30000	21000	90000
USEPA Method 8260C	ELLE	1	75-15-0	**Carbon Disulfide**	0.6	5	ug/Kg	30	250	ug/Kg	NA	64-133	64-133	30	30	64-133	64-133	30	30	770000	3500000	2300000	10000000
USEPA Method 8260C	ELLE	1	56-23-5	**Carbon Tetrachloride**	0.5	5	ug/Kg	25	250	ug/Kg	NA	64-134	64-134	30	30	64-134	64-134	30	30	65000	290000	65000	290000
USEPA Method 8260C	ELLE	1	108-90-7	**Chlorobenzene**	0.5	5	ug/Kg	25	250	ug/Kg	NA	80-120	80-120	30	30	80-120	80-120	30	30	280000	1300000	830000	4000000
USEPA Method 8260C	ELLE	1	75-00-3	**Chloroethane**	1	5	ug/Kg	50	250	ug/Kg	NA	43-135	43-135	30	30	43-135	43-135	30	30	14000000	57000000	41000000	170000000
USEPA Method 8260C	ELLE	1	67-66-3	**Chloroform**	0.6	5	ug/Kg	30	250	ug/Kg	NA	80-120	80-120	30	30	80-120	80-120	30	30	32000	140000	32000	140000
USEPA Method 8260C	ELLE	1	74-87-3	**Chloromethane**	0.6	5	ug/Kg	30	250	ug/Kg	NA	56-120	56-120	30	30	56-120	56-120	30	30	110000	460000	330000	1400000
USEPA Method 8260C	ELLE	1	110-82-7	**Cyclohexane**	0.5	5	ug/Kg	25	250	ug/Kg	NA	58-126	58-126	30	30	58-126	58-126	30	30	65000000	27000000	20000000	82000000
USEPA Method 8260C	ELLE	1	124-48-1	**Dibromochloromethane**	0.5	5	ug/Kg	25	250	ug/Kg	NA	69-125	69-125	30	30	69-125	69-125	30	30	830000	3900000	830000	3900000
USEPA Method 8260C	ELLE	1	75-71-8	**Dichlorodifluoromethane**	0.6	5	ug/Kg	30	250	ug/Kg	NA	21-127	21-127	30	30	21-127	21-127	30	30	87000	370000	260000	1100000
USEPA Method 8260C	ELLE	1	100-41-4	**Ethylbenzene**	0.4	5	ug/Kg	20	250	ug/Kg	NA	78-120	78-120	30	30	78-120	78-120	30	30	580000	2500000	580000	2500000
USEPA Method 8260C	ELLE	1	98-82-8	**Isopropylbenzene**	0.4	5	ug/Kg	20	250	ug/Kg	NA	77-120	77-120	30	30	77-120	77-120	30	30	1900000	9900000	5800000	30000000
USEPA Method 8260C	ELLE	1	79-20-9	**Methyl Acetate**	1	5	ug/Kg	50	250	ug/Kg	NA	67-128	67-128	30	30	67-128	67-128	30	30	78000000	1200000000	230000000	3500000000
USEPA Method 8260C	ELLE	1	1634-04-4	**Methyl Tertiary Butyl Ether**	0.5	5	ug/Kg	25	250	ug/Kg	NA	72-120	72-120	30	30	72-120	72-120	30	30	4700000	21000000	4700000	21000000
USEPA Method 8260C	ELLE	1	108-87-2	**Methylcyclohexane**	0.6	5	ug/Kg	30	250	ug/Kg	NA	61-124	61-124	30	30	61-124	61-124	30	30	NA	NA	NA	NA
USEPA Method 8260C	ELLE	1	75-09-2	**Methylene Chloride**	2	5	ug/Kg	100	250	ug/Kg	NA	76-122	76-122	30	30	76-122	76-122	30	30	350000	3200000	1000000	9500000
USEPA Method 8260C	ELLE	1	100-42-5	**Styrene**	0.4	5	ug/Kg	20	250	ug/Kg	NA	76-120	76-120	30	30	76-120	76-120	30	30	6000000	35000000	18000000	100000000
USEPA Method 8260C	ELLE	1	127-18-4	**Tetrachloroethene**	0.5	5	ug/Kg	25	250	ug/Kg	NA	73-120	73-120	30	30	73-120	73-120	30	30	81000	390000	240000	1200000
USEPA Method 8260C	ELLE	1	108-88-3	**Toluene**	0.6	5	ug/Kg	30	250	ug/Kg	NA	80-120	80-120	30	30	80-120	80-120	30	30	4900000	47000000	15000000	140000000
USEPA Method 8260C	ELLE	1	95-47-6	**o-Xylene**	0.4	5	ug/Kg	20	250	ug/Kg	NA	75-120	75-120	30	30	75-120	75-120	30	30	650000	2800000	1900000	8400000
USEPA Method 8260C	ELLE	1	179601-23-1	**m+p-Xylene**	1	5	ug/Kg	50	250	ug/Kg	NA	80-120	80-120	30	30	80-120	80-120	30	30	550000	2400000	1700000	7100000
USEPA Method 8260C	ELLE	1	79-01-6	**Trichloroethene**	0.5	5	ug/Kg	25	250	ug/Kg	NA	80-120	80-120	30	30	80-120	80-120	30	30	4100	19000	12000	56000
USEPA Method 8260C	ELLE	1	75-69-4	**Trichlorofluoromethane**	0.7	5	ug/Kg	35	250	ug/Kg	NA	55-134	55-134	30	30	55-134	55-134	30	30	23000000	350000000	70000000	1100000000
USEPA Method 8260C	ELLE	1	75-01-4	**Vinyl Chloride**	0.6	5	ug/Kg	30	250	ug/Kg	NA	52-120	52-120	30	30	52-120	52-120	30	30	5900	170000	5900	170000
USEPA Method 8260C	ELLE	1	1868-53-7	**Dibromofluoromethane**	NA	NA	NA	NA	NA	NA	50 - 141	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8260C	ELLE	1	17060-07-0	**1,2-Dichloroethane-d4**	NA	NA	NA	NA	NA	NA	54 - 135	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8260C	ELLE	1	2037-26-5	**Toluene-d8**	NA	NA	NA	NA	NA	NA	52 - 141	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8260C	ELLE	1	460-00-4	**4-Bromofluorobenzene**	NA	NA	NA	NA	NA	NA	50 - 131	NA	NA	NA	NA	NA	NA	NA	NA	23000	350000	70000	1100000
TCL SVOCs																						
USEPA Method 8270D	ELLE	2	92-52-4	**1,1'-Biphenyl**	17	37	ug/Kg	NA	NA	NA	NA	59-106	59-106	30	30	NA	NA	NA	NA	47000	200000	140000	600000
USEPA Method 8270D	ELLE	2	95-94-3	**1,2,4,5- Tetrachlorobenzene**	17	37	ug/Kg	NA	NA	NA	NA	54-101	54-101	30	30	NA	NA	NA	NA	23000	350000	70000	1100000
USEPA Method 8270D	ELLE	2	95-95-4	**2,4,5-Trichlorophenol**	30	67	ug/Kg	NA	NA	NA	NA	60-116	60-116	30	30	NA	NA	NA	NA	6300000	82000000	19000000	250000000
USEPA Method 8270D	ELLE	2	88-06-2	**2,4,6-Trichlorophenol**	27	57	ug/Kg	NA	NA	NA	NA	60-120	60-120	30	30	NA	NA	NA	NA	63000	820000	190000	2500000
USEPA Method 8270D	ELLE	2	120-83-2	**2,4-Dichlorophenol**	20	43	ug/Kg	NA	NA	NA	NA	58-107	58-107	30	30	NA	NA	NA	NA	190000	2500000	570000	7400000
USEPA Method 8270D	ELLE	2	105-67-9	**2,4-Dimethylphenol**	30	67	ug/Kg	NA	NA	NA	NA	46-89	46-89	30	30	NA	NA	NA	NA	1300000	16000000	3800000	49000000
USEPA Method 8270D	ELLE	2	51-28-5	**2,4-Dinitrophenol**	330	1,000	ug/Kg	NA	NA	NA	NA	10-138	10-138	30	30	NA	NA	NA	NA	130000	1600000	380000	4900000
USEPA Method 8270D	ELLE	2	121-14-2	**2,4-Dinitrotoluene**	67	170	ug/Kg	NA	NA	NA	NA	61-121	61-121	30	30	NA	NA	NA	NA	130000	740000	170000	740000
USEPA Method 8270D	ELLE	2	606-20-2	**2,6-Dinitrotoluene**	23	50	ug/Kg	NA	NA	NA	NA	64-115	64-115	30	30	NA	NA	NA	NA	19000	150000	36000	150000
USEPA Method 8270D	ELLE	2	91-58-7	**2-Chloronapthalene**	7	33	ug/Kg	NA	NA	NA	NA	43-124	43-124	30	30	NA	NA	NA	NA	4800000	60000000	14000000	180000000
USEPA Method 8270D	ELLE	2	95-57-8	**2-Chlorophenol**	17	37	ug/Kg	NA	NA	NA	NA	47-103	47-103	30	30	NA	NA	NA	NA	390000	5800000	1200000	18000000
USEPA Method 8270D	ELLE	2	91-57-6	**2-Methylnapthalene**	3	33	ug/Kg	NA	NA	NA	NA	52-104	52-104	30	30	NA	NA	NA	NA	240000	3000000	720000	9000000
USEPA Method 8270D	ELLE	2	95-48-7	**2-Methylphenol**	17	67	ug/Kg	NA	NA	NA	NA	41-113	41-113	30	30	NA	NA	NA	NA	3200000	41000000	9500000	120000000
USEPA Method 8270D	ELLE	2	88-74-4	**2-Nitroaniline**	17	50	ug/Kg	NA	NA	NA	NA	65-119	65-119	30	30	NA	NA	NA	NA	630000	8000000	1900000	24000000
USEPA Method 8270D	ELLE	2	88-75-5	**2-Nitrophenol**	27	57	ug/Kg	NA	NA	NA	NA	50-107	50-107	30	30	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	58-90-2	**2,3,4,6-Tetrachlorophenol**	67	170	ug/Kg	NA	NA	NA	NA	62-116	62-116	30	30	NA	NA	NA	NA	1900000	25000000	5700000	74000000
USEPA Method 8270D	ELLE	2	91-94-1	**3,3'-Dichlorobenzidine**	100	330	ug/Kg	NA	NA	NA	NA	16-107	16-107	30	30	NA	NA	NA	NA	120000	510000	120000	510000
USEPA Method 8270D	ELLE	2	99-09-2	**3-Nitroaniline**	67	170	ug/Kg	NA	NA	NA	NA	58-115	58-115	30	30	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	101-55-3	**4-Bromophenyl Phenyl Ether**	23	50	ug/Kg	NA	NA	NA	NA	63-115	63-115	30	30	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	59-50-7	**4-Chloro-3-methylphenol**	23	50	ug/Kg	NA	NA	NA	NA	62-109	62-109	30	30	NA	NA	NA	NA	6300000	82000000	19000000	250000000
USEPA Method 8270D	ELLE	2	106-47-8	**4-Chloroaniline**	33	170	ug/Kg	NA	NA	NA	NA	14-97	14-97	30	30	NA	NA	NA	NA	250000	1100000	270000	1100000
USEPA Method 8270D	ELLE	2	7005-72-3	**4-Chlorophenyl phenyl ether**	20	43	ug/Kg	NA	NA	NA	NA	58-110	58-110	30	30	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	100-01-6	**4-Nitroaniline**	67	170	ug/Kg	NA	NA	NA	NA	41-91	41-91	30	30	NA	NA	NA	NA	250000	3300000	760000	9800000
USEPA Method 8270D	ELLE	2	106-44-5	**4-Methylphenol**	17	50	ug/Kg	NA	NA	NA	NA	46-112	46-112	30	30	NA	NA	NA	NA	6300000	82000000	19000000	250000000
USEPA Method 8270D	ELLE	2	100-02-7	**4-Nitrophenol**	170	500	ug/Kg	NA	NA	NA	NA	54-107	54-107	30	30	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	534-52-1	**4,6-Dinitro-2-methylphenol**	230	500	ug/Kg	NA	NA	NA	NA	45-134	45-134	30	30	NA	NA	NA	NA	5100	66000	15000	200000
USEPA Method 8270D	ELLE	2	83-32-9	**Acenaphthene**	3	17	ug/Kg	NA	NA	NA	NA	58-107	58-107	30	30	NA	NA	NA	NA	3600000	45000000	11000000	140000000
USEPA Method 8270D	ELLE	2	208-96-8	**Acenapthylene**	3	17	ug/Kg	NA	NA	NA	NA	62-115	62-115	30	30	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	98-86-2	**Acetophenone**	17	50	ug/Kg	NA	NA	NA	NA	47-102	47-102	30	30	NA	NA	NA	NA	7800000	120000000	23000000	350000000
USEPA Method 8270D	ELLE	2	120-12-7	**Anthracene**	3	17	ug/Kg	NA	NA	NA	NA	67-111	67-111	30	30	NA	NA	NA	NA	18000000	230000000	54000000	680000000
USEPA Method 8270D	ELLE	2	1912-24-9	**Atrazine**	200	430	ug/Kg	NA	NA	NA	NA	68-122	68-122	30	30	NA	NA	NA	NA	240000	1000000	240000	1000000
USEPA Method 8270D	ELLE	2	100-52-7	**Benzaldehyde**	67	170	ug/Kg	NA	NA	NA	NA	20-101	20-101	30	30	NA	NA	NA	NA	7800000	82000000	17000000	82000000
USEPA Method 8270D	ELLE	2	56-55-3	**Benzo(a)anthracene**	7	17	ug/Kg	NA	NA	NA	NA	67-112	67-112	30	30	NA	NA	NA	NA	110000	2100000	110000	2100000
USEPA Method 8270D	ELLE	2	205-99-2	**Benzo(b)fluoranthene**	3	17	ug/Kg	NA	NA	NA	NA	65-117	65-117	30	30	NA	NA	NA	NA	110000	2100000	110000	2100000
USEPA Method 8270D	ELLE	2	191-24-2	**Benzo(g,h,i)perylene**	3	17	ug/Kg	NA	NA	NA	NA	65-119	65-119	30	30	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	207-08-9	**Benzo(k)fluoranthene**	3	17	ug/Kg	NA	NA	NA	NA	66-122	66-122	30	30	NA	NA	NA	NA	1100000	21000000	1100000	21000000
USEPA Method 8270D	ELLE	2	50-32-8	**Benzo[a]pyrene**	3	17	ug/Kg	NA	NA	NA	NA	68-119	68-119	30	30	NA	NA	NA	NA	11000	210000	11000	210000
USEPA Method 8270D	ELLE	2	85-68-7	**Benzylbutylphthalate**	67	170	ug/Kg	NA	NA	NA	NA	67-115	67-115	30	30	NA	NA	NA	NA	13000000	120000000	29000000	120000000
USEPA Method 8270D	ELLE	2	111-91-1	**bis(2-Chloroethoxy)methane**	17	37	ug/Kg	NA	NA	NA	NA	50-103	50-103	30	30	NA	NA	NA	NA	190000	2500000	570000	7400000
USEPA Method 8270D	ELLE	2	111-44-4	**Bis(2-chloroethyl)ether**	23	50	ug/Kg	NA	NA	NA	NA	40-99	40-99	30	30	NA	NA	NA	NA	23000	100000	23000	100000
USEPA Method 8270D	ELLE	2	117-81-7	**Bis(2-ethylhexyl)phthalate**	67	170	ug/Kg	NA	NA	NA	NA	66-121	66-121	30	30	NA	NA	NA	NA	1300000	16000000	3800000	16000000
USEPA Method 8270D	ELLE	2	108-60-1	**bis-Chloroisopropyl ether 2,2'-oxybis(1-Chloropropane)**	20	43	ug/Kg	NA	NA	NA	NA	37-96	37-96	30	30	NA	NA	NA	NA	3100000	47000000	9400000	140000000
USEPA Method 8270D	ELLE	2	86-74-8	**Carbazole**	17	37	ug/Kg	NA	NA	NA	NA	72-114	72-114	30	30	NA	NA	NA	NA	NA			
USEPA Method 8270D	ELLE	2	105-60-2	**Caprolactam**	33	170	ug/Kg	NA	NA	NA	NA	61-113	61-113	30	30	NA	NA	NA	NA	31000000	400000000	94000000	1200000000
USEPA Method 8270D	ELLE	2	218-01-9	**Chrysene**	3	17	ug/Kg	NA	NA	NA	NA	66-111	66-111	30	30	NA	NA	NA	NA	11000000	210000000	11000000	210000000
USEPA Method 8270D	ELLE	2	53-70-3	**Dibenzo(a,h)anthracene**	7	17	ug/Kg	NA	NA	NA	NA	72-127	72-127	30	30	NA	NA	NA	NA	4200	18000	4200	18000
USEPA Method 8270D	ELLE	2	132-64-9	**Dibenzofuran**	17	37	ug/Kg	NA	NA	NA	NA	60-108	60-108	30	30	NA	NA	NA	NA	73000	1000000	220000	3100000
USEPA Method 8270D	ELLE	2	84-74-2	**Di-n-butylphthalate**	67	170	ug/Kg	NA	NA	NA	NA	67-118	67-118	30	30	NA	NA	NA	NA	6300000	82000000	19000000	250000000
USEPA Method 8270D	ELLE	2	84-66-2	**Diethylphthalate**	67	170	ug/Kg	NA	NA	NA	NA	58-115	58-115	30	30	NA	NA	NA	NA	51000000	660000000	150000000	2000000000
USEPA Method 8270D	ELLE	2	131-11-3	**Dimethylphthalate**	67	170	ug/Kg	NA	NA	NA	NA	56-116	56-116	30	30	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	117-84-0	**Di-n-octylphthalate**	67	170	ug/Kg	NA	NA	NA	NA	64-125	64-125	30	30	NA	NA	NA	NA	630000	8200000	1900000	25000000
USEPA Method 8270D	ELLE	2	206-44-0	**Fluoranthene**	3	17	ug/Kg	NA	NA	NA	NA	65-114	65-114	30	30	NA	NA	NA	NA	2400000	30000000	7200000	90000000
USEPA Method 8270D	ELLE	2	86-73-7	**Fluorene**	3	17	ug/Kg	NA	NA	NA	NA	62-110	62-110	30	30	NA	NA	NA	NA	2400000	30000000	7200000	90000000
USEPA Method 8270D	ELLE	2	118-74-1	**Hexachlorobenzene**	7	17	ug/Kg	NA	NA	NA	NA	57-123	57-123	30	30	NA	NA	NA	NA	21000	96000	21000	96000
USEPA Method 8270D	ELLE	2	87-68-3	**Hexachlorobutadiene**	37	77	ug/Kg	NA	NA	NA	NA	32-123	32-123	30	30	NA	NA	NA	NA	78000	530000	120000	530000
USEPA Method 8270D	ELLE	2	77-47-4	**Hexachlorocyclopentadiene**	200	500	ug/Kg	NA	NA	NA	NA	14-109	14-109	30	30	NA	NA	NA	NA	1800	7500	5300	22000
USEPA Method 8270D	ELLE	2	67-72-1	**Hexachloroethane**	33	170	ug/Kg	NA	NA	NA	NA	25-107	25-107	30	30	NA	NA	NA	NA	45000	460000	130000	800000
USEPA Method 8270D	ELLE	2	193-39-5	**Indeno(1,2,3-cd)pyrene**	3	17	ug/Kg	NA	NA	NA	NA	67-119	67-119	30	30	NA	NA	NA	NA	110000	2100000	110000	2100000
USEPA Method 8270D	ELLE	2	78-59-1	**Isophorone**	17	37	ug/Kg	NA	NA	NA	NA	49-103	49-103	30	30	NA	NA	NA	NA	13000000	160000000	38000000	240000000
USEPA Method 8270D	ELLE	2	91-20-3	**Naphthalene**	7	17	ug/Kg	NA	NA	NA	NA	46-99	46-99	30	30	NA	NA	NA	NA	130000	590000	380000	1700000
USEPA Method 8270D	ELLE	2	98-95-3	**Nitrobenzene**	27	67	ug/Kg	NA	NA	NA	NA	33-115	33-115	30	30	NA	NA	NA	NA	130000	1300000	380000	2200000
USEPA Method 8270D	ELLE	2	621-64-7	**N-Nitroso-di-n-propylamine**	23	50	ug/Kg	NA	NA	NA	NA	43-100	43-100	30	30	NA	NA	NA	NA	7800	33000	7800	33000
USEPA Method 8270D	ELLE	2	86-

QAPP Worksheet #15-2 - Project Action Limits and Laboratory-Specific Detection/Quantitation Limits - Definitive Data (UFP QAPP Manual Section 2.6.2.3 and Figure 15)

Matrix: Solid - Definitive Analytical Methods

Analytical Groups for Definitive Data: VOCs, SVOCs, PCBs, Pesticides, Metals, Mercury, Total Cyanide, TOC, Physical Tests.
Sample Associated with Analysis - Soil and Sediment associated with the Sampling as described in the QAPP.

					Laboratory Detection Limits - Low Level			Laboratory Detection Limits - Medium Level														
Analytical Method	Laboratory Performing Analysis	Reference	CAS Number	Target Analyte	MDLs	RLs	Units	MDLs	RLs	Units	Surrogate Recovery Control Limits (%R)	Low Level LCS Recovery Control Limits (%R)	Low Level MS/MSD Recovery Control Limits (%R)	Low Level MS/MSD Precision (RPD)	Low Level LCS/LCSD Precision (RPD)	Medium Level LCS Recovery Control Limits (%R)	Medium Level MS/MSD Recovery Control Limits (%R)	Medium Level MS/MSD Precision (RPD)	Low Level LCS/LCSD Precision (RPD)	USEPA RMLs, HQ1 Residential Soil[1]	USEPA RMLs, HQ1 Industrial Soil[1]	USEPA RMLs, HQ3 Residential Soil[1]	USEPA RMLs, HQ3 Industrial Soil[1]
USEPA Method 8270D	ELLE	2	63466-71-7	**Benzo(a)pyrene-d12**	NA	NA	NA	NA	NA	NA	28 - 124	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8270D	ELLE	2	38072-94-5	**1-Methylnaphthalene-d10**	NA	NA	NA	NA	NA	NA	27 - 107	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCL Pesticides																							
USEPA Method 8081B	ELLE	2	72-55-9	**4,4'-DDE**	0.33	1.7	ug/kg	NA	NA	NA	NA	69-138	69-138	50	50	NA	NA	NA	NA	23000	350000	70000	930000
USEPA Method 8081B	ELLE	2	50-29-3	**4,4'-DDT**	0.33	1.7	ug/kg	NA	NA	NA	NA	68-146	68-146	50	50	NA	NA	NA	NA	37000	520000	110000	850000
USEPA Method 8081B	ELLE	2	72-54-8	**4,4'-DDD**	0.79	1.7	ug/kg	NA	NA	NA	NA	67-135	67-135	50	50	NA	NA	NA	NA	1900	25000	5700	74000
USEPA Method 8081B	ELLE	2	309-00-2	**Aldrin**	0.17	0.83	ug/kg	NA	NA	NA	NA	60-117	60-117	50	50	NA	NA	NA	NA	2300	18000	3900	18000
USEPA Method 8081B	ELLE	2	319-84-6	**Alpha BHC**	0.17	0.83	ug/kg	NA	NA	NA	NA	65-124	65-124	50	50	NA	NA	NA	NA	8600	36000	8600	36000
USEPA Method 8081B	ELLE	2	319-85-7	**Beta BHC**	0.44	1	ug/kg	NA	NA	NA	NA	68-129	68-129	50	50	NA	NA	NA	NA	30000	130000	30000	130000
USEPA Method 8081B	ELLE	2	33213-65-9	**Endosulfan II**	1.1	2.3	ug/kg	NA	NA	NA	NA	65-126	65-126	50	50	NA	NA	NA	NA	470000 *	7000000 *	1400000 *	21000000 *
USEPA Method 8081B	ELLE	2	60-57-1	**Dieldrin**	0.33	1.7	ug/kg	NA	NA	NA	NA	63-126	63-126	50	50	NA	NA	NA	NA	3200	14000	3400	14000
USEPA Method 8081B	ELLE	2	959-98-8	**Endosulfan I**	0.22	0.83	ug/kg	NA	NA	NA	NA	62-119	62-119	50	50	NA	NA	NA	NA	470000 *	7000000 *	1400000 *	21000000 *
USEPA Method 8081B	ELLE	2	1031-07-8	**Endosulfan Sulfate**	0.33	1.7	ug/kg	NA	NA	NA	NA	71-132	71-132	50	50	NA	NA	NA	NA	380000	4900000	1100000	15000000
USEPA Method 8081B	ELLE	2	72-20-8	**Endrin**	0.68	1.7	ug/kg	NA	NA	NA	NA	86-135	86-135	50	50	NA	NA	NA	NA	19000	250000	57000	740000
USEPA Method 8081B	ELLE	2	7421-93-4	**Endrin Aldehyde**	0.33	1.7	ug/kg	NA	NA	NA	NA	59-122	59-122	50	50	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8081B	ELLE	2	58-89-9	**Gamma BHC (Lindane)**	0.21	0.83	ug/kg	NA	NA	NA	NA	68-133	68-133	50	50	NA	NA	NA	NA	21000	250000	57000	250000
USEPA Method 8081B	ELLE	2	76-44-8	**Heptachlor**	0.31	0.83	ug/kg	NA	NA	NA	NA	66-118	66-118	50	50	NA	NA	NA	NA	13000	63000	13000	63000
USEPA Method 8081B	ELLE	2	1024-57-3	**Heptachlor Epoxide**	0.17	0.83	ug/kg	NA	NA	NA	NA	74-128	74-128	50	50	NA	NA	NA	NA	1000	15000	3100	33000
USEPA Method 8081B	ELLE	2	5103-71-9	**alpha-Chlordane**	0.17	0.83	ug/kg	NA	NA	NA	NA	73-131	73-131	50	50	NA	NA	NA	NA	35000 #	450000 #	100000 #	770000 #
USEPA Method 8081B	ELLE	2	5103-74-2	**gamma-Chlordane**	0.25	0.83	ug/kg	NA	NA	NA	NA	76-134	76-134	50	50	NA	NA	NA	NA	35000 #	450000 #	100000 #	770000 #
USEPA Method 8081B	ELLE	2	319-86-8	**Delta BHC**	0.45	1	ug/kg	NA	NA	NA	NA	45-151	45-151	50	50	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8081B	ELLE	2	72-43-5	**Methoxychlor**	1.8	6.7	ug/kg	NA	NA	NA	NA	88-145	88-145	50	50	NA	NA	NA	NA	320000	4100000	950000	12000000
USEPA Method 8081B	ELLE	2	53494-70-5	**Endrin Ketone**	0.6	2	ug/kg	NA	NA	NA	NA	85-131	85-131	50	50	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8081B	ELLE	2	8001-35-2	**Toxaphene**	14	33	ug/kg	NA	NA	NA	NA	NA	70-120	50	NA	NA	NA	NA	NA	5700	74000	17000	210000
USEPA Method 8081B	ELLE	2	877-09-8	**Tetrachloro-m-xylene**	NA	NA	NA	NA	NA	NA	19 - 136	NA	NA	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8081B	ELLE	2	2051-24-3	**Decachlorobiphenyl**	NA	NA	NA	NA	NA	NA	46 - 152	NA	NA	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCL PCBs																							
USEPA Method 8082A	ELLE	2	12674-11-2	**Aroclor 1016**	3.6	17	ug/kg	NA	NA	NA	NA	76-121	76-121	50	50	NA	NA	NA	NA	4100	51000	12000	150000
USEPA Method 8082A	ELLE	2	11104-28-2	**Aroclor 1221**	4.6	17	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20000	83000	20000	83000
USEPA Method 8082A	ELLE	2	11141-16-5	**Aroclor 1232**	8	17	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	17000	72000	17000	72000
USEPA Method 8082A	ELLE	2	53469-21-9	**Aroclor 1242**	3.3	17	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	23000	95000	23000	95000
USEPA Method 8082A	ELLE	2	12672-29-6	**Aroclor 1248**	3.3	17	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	23000	94000	23000	94000
USEPA Method 8082A	ELLE	2	11097-69-1	**Aroclor 1254**	3.3	17	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1200	15000	3500	44000
USEPA Method 8082A	ELLE	2	11096-82-5	**Aroclor 1260**	4.9	17	ug/kg	NA	NA	NA	NA	79-130	79-130	50	50	NA	NA	NA	NA	24000	99000	24000	99000
USEPA Method 8082A	ELLE	2	37324-23-5	**Aroclor 1262**	3.3	17	ug/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 8082A	ELLE	2	11100-14-4	**Aroclor 1268**	3.3	17	ug/kg	NA	NA	NA	NA	NA	NA	50	NA	NA	NA	NA	NA	NA	NA	NA	NA
TAL Metals (Metals, Mercury and Total Cyanide)																							
USEPA Method 6010C	ELLE	2	7429-90-5	**Aluminum**	10.6	20	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	77000	1100000	230000	3400000
USEPA Method 6010C	ELLE	2	7439-89-6	**Iron**	6.2	20	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	55000	820000	160000	2500000
USEPA Method 6010C	ELLE	2	7439-92-1	**Lead**	0.6	1.5	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	400	800	400	800
USEPA Method 6010C	ELLE	2	7439-96-5	**Manganese**	0.52	1	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	1800	26000	5500	77000
USEPA Method 7471B	ELLE	2	7439-97-6	**Mercury**	0.015	0.06	mg/kg	NA	NA	NA	NA	80-115	80-120	20	20	NA	NA	NA	NA	11	46	33	140
USEPA Method 6010C	ELLE	2	7440-02-0	**Nickel**	0.26	1	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	1500	22000	4600	67000
USEPA Method 6010C	ELLE	2	7440-22-4	**Silver**	0.4	1	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	390	5800	1200	18000
USEPA Method 6010C	ELLE	2	7440-28-0	**Thallium**	1.3	3	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	0.78	12	2.3	35
USEPA Method 6010C	ELLE	2	7440-36-0	**Antimony**	1.7	5	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	31	470	94	1400
USEPA Method 6010C	ELLE	2	7440-38-2	**Arsenic**	1.2	3	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	35	300	68	300
USEPA Method 6010C	ELLE	2	7440-39-3	**Barium**	0.15	0.5	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	15000	220000	46000	650000
USEPA Method 6010C	ELLE	2	7440-41-7	**Beryllium**	0.1	0.5	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	160	2300	470	6900
USEPA Method 6010C	ELLE	2	7440-43-9	**Cadmium**	0.1	0.5	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	71	980	210	2900
USEPA Method 6010C	ELLE	2	7440-47-3	**Chromium**	0.18	1.5	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	30 / 120000 *	630 / 1800000 *	30 / 350000 *	630 / 530000 *
USEPA Method 6010C	ELLE	2	7440-48-4	**Cobalt**	0.146	0.5	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	23	350	70	1000
USEPA Method 6010C	ELLE	2	7440-50-8	**Copper**	0.77	2	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	3100	47000	9400	140000
USEPA Method 6010C	ELLE	2	7440-70-2	**Calcium**	12	20	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 6010C	ELLE	2	2023-69-5	**Potassium**	20.4	30	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 6010C	ELLE	2	7440-23-5	**Sodium**	46.2	100	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 6010C	ELLE	2	7440-62-2	**Vanadium**	0.43	1	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	390	5800	1200	17000
USEPA Method 6010C	ELLE	2	7440-66-6	**Zinc**	1	2	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	23000	350000	70000	1100000
USEPA Method 6010C	ELLE	2	7782-49-2	**Selenium**	1.5	5	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	390	5800	1200	18000
USEPA Method 6010C	ELLE	2	7439-95-4	**Magnesium**	4	10	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 6020B	ELLE	2	7429-90-5	**Aluminum**	4.37	10	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	77000	1100000	230000	3400000
USEPA Method 6020B	ELLE	2	7439-89-6	**Iron**	3.75	10	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	55000	820000	160000	2500000
USEPA Method 6020B	ELLE	2	7439-92-1	**Lead**	0.0252	0.1	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	400	800	400	800
USEPA Method 6020B	ELLE	2	7439-96-5	**Manganese**	0.106	0.2	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	1800	26000	5500	77000
USEPA Method 6020B	ELLE	2	7440-02-0	**Nickel**	0.015	0.06	mg/kg	NA	NA	NA	NA	80-115	80-120	20	20	NA	NA	NA	NA	1500	22000	4600	67000
USEPA Method 6020B	ELLE	2	7440-22-4	**Silver**	0.17	0.4	mg/kg	NA	NA	NA	NA	86-120	75-125	20	20	NA	NA	NA	NA	390	5800	1200	18000
USEPA Method 6020B	ELLE	2	7440-28-0	**Thallium**	0.0203	0.05	mg/kg	NA	NA	NA	NA	84-120	75-125	20	20	NA	NA	NA	NA	0.78	12	2.3	35
USEPA Method 6020B	ELLE	2	7440-36-0	**Antimony**	0.0196	0.05	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	31	470	94	1400
USEPA Method 6020B	ELLE	2	7440-38-2	**Arsenic**	0.0632	0.1	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	35	300	68	300
USEPA Method 6020B	ELLE	2	7440-39-3	**Barium**	0.0669	0.2	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	15000	220000	46000	650000
USEPA Method 6020B	ELLE	2	7440-41-7	**Beryllium**	0.0915	0.2	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	160	2300	470	6900
USEPA Method 6020B	ELLE	2	7440-43-9	**Cadmium**	0.0119	0.03	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	71	980	210	2900
USEPA Method 6020B	ELLE	2	7440-47-3	**Chromium**	0.0252	0.05	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	30 / 120000 *	630 / 1800000 *	30 / 350000 *	630 / 530000 *
USEPA Method 6020B	ELLE	2	7440-48-4	**Cobalt**	0.167	0.4	mg/kg	NA	NA	NA	NA	86-120	75-125	20	20	NA	NA	NA	NA	23	350	70	1000
USEPA Method 6020B	ELLE	2	7440-50-8	**Copper**	0.0292	0.1	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	3100	47000	9400	140000
USEPA Method 6020B	ELLE	2	7440-70-2	**Calcium**	1.79	4	mg/kg	NA	NA	NA	NA	85-120	75-125	20	20	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 6020B	ELLE	2	2023-69-5	**Potassium**	34.1	70	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 6020B	ELLE	2	7440-23-5	**Sodium**	9.52	20	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 6020B	ELLE	2	7440-62-2	**Vanadium**	13.4	25	mg/kg	NA	NA	NA	NA	88-112	75-125	20	20	NA	NA	NA	NA	390	5800	1200	17000
USEPA Method 6020B	ELLE	2	7440-66-6	**Zinc**	0.0429	0.1	mg/kg	NA	NA	NA	NA	86-120	75-125	20	20	NA	NA	NA	NA	23000	350000	70000	1100000
USEPA Method 6020B	ELLE	2	7782-49-2	**Selenium**	0.268	1	mg/kg	NA	NA	NA	NA	85-120	75-125	20	20	NA	NA	NA	NA	390	5800	1200	18000
USEPA Method 6020B	ELLE	2	7439-95-4	**Magnesium**	0.0652	0.2	mg/kg	NA	NA	NA	NA	85-120	75-125	20	20	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Method 9012B	ELLE	3	57-12-5	**Total cyanide**	1.57	5	mg/kg	NA	NA	NA	NA	80-120	75-125	20	20	NA	NA	NA	NA	23	150	69	440
TOC																							
USEPA Lloyd Kahn	ELLE	4	7429-90-5	**Total Organic Carbon (TOC)**	100	300	mg/kg	NA	NA	NA	NA	47-143	47-143	20	20	NA	NA	NA	NA	NA	NA	NA	NA
Physical Tests																							
ASTM D422	ELLE	5	"-"	**Grain Size**	0.5	0.5	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ASTM E868-82	ELLE	5	"-"	**Bulk Density**	0.08	0.3	g/cc	NA	NA	NA	NA	NA	75-125	20	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

MDL indicates method detection limit.
QL indicates quantitation limit.
NA indicates not applicable.
MS/MSD indicates matrix spike/ matrix spike duplicate.
LCS Indicates laboratory control sample.
%R indicates percent recovery.
RPD indicates relative percent difference.
ELLE indicates Eurofins Lancaster Laboratories Environmental LLC of Lancaster, PA.
QLs and MDLs were provided by ELLE, current as of November 2019.
* Applies to Xylene (mixed).
** Soil Cleanup Objective is the sum of endosulfan I, endosulfan II and endosulfan sulfate.
*** Applies to Polychlorinated biphenyls (CAS Number 1336-36-3).
**** Applies to Total mercury.
^ Applies to hexavalent chromium (CAS Number 18540-29-9) and trivalent chromium (CAS Number 16065-83-1), respectively.
# MCL is sum of cis- and trans-1,3-dichloropropene
^ MCL is sum of endosulfan I and II
^ MCL is sum of alpha- and gamma-chlordane

Source List:

Target compound list (TCL) resource -USEPA. 2007. Multi-Media, Multi-Concentration Organic Analytical Service for Superfund (SOM01.2). Washington, D.C.
Target analyte list (TAL) resource - USEPA. 2010. Multi-Media, Multi-Concentration Inorganic Analysis, ISMO1.3. Washington, D.C.

References (See Worksheet 23 for laboratory SOPs):

1- USEPA. 2006. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition. Washington D.C.
2- USEPA. 2007. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition, Update IV. Washington D.C.
3- USEPA. 2004. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition, Update IIIB. Washington D.C.
4- USEPA. 1988. Determination of Total Organic Carbon in Sediment (Lloyd Kahn Method). Environmental Services Division, Edison, NJ.
5- ASTM. 2002. West Conshohocken, PA.

Regulatory Criteria References:

1- USEPA Regional Removal Management Levels (RMLs), current as of November 2019.

QAPP Worksheet #15-3 - Project Action Limits and Laboratory-Specific Detection/Quantitation Limits - Definitive Data (UFP QAPP Manual Section 2.6.2.3 and Figure 15)

Matrix: IDM - Definitive Analytical Methods

Analytical Groups for Definitive Data: VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Mercury, Corrosivity, Ignitability, Flashpoint, Reactivity.

Sample Associated with Analysis - IDM associated with the Sampling as described in the QAPP.

Analytical Method	Laboratory Performing Analysis	Reference	CAS Number	Target Analyte	Laboratory Detection Limits - TCLP[1]			Surrogate Recovery Control Limits (%R)	Low Level LCS Recovery Control Limits (%R)	Low Level MS/MSD Recovery Control Limits (%R)	MS/MSD Precision (RPD)	LCS/LCSD Precision (RPD)	TCLP Limits[1]
					MDLs	RLs	Units						
TCLP Volatile Organic Compounds (VOCs)													
USEPA Method 1311/8260C	ELLE	1	75-35-4	**1,1-Dichloroethene**	0.004	0.02	mg/L	NA	80-131	80-131	30	30	0.7
USEPA Method 1311/8260C	ELLE	1	107-06-2	**1,2-Dichloroethane**	0.006	0.02	mg/L	NA	73-124	73-124	30	30	0.5
USEPA Method 1311/8260C	ELLE	1	106-46-7	**1,4-Dichlorobenzene**	0.004	0.1	mg/L	NA	80-120	80-120	30	30	7.5
USEPA Method 1311/8260C	ELLE	1	78-93-3	**2-Butanone (Methylethyl ketone)**	0.006	0.2	mg/L	NA	59-135	59-135	30	30	200
USEPA Method 1311/8260C	ELLE	1	71-43-2	**Benzene**	0.004	0.02	mg/L	NA	80-120	80-120	30	30	0.5
USEPA Method 1311/8260C	ELLE	1	56-23-5	**Carbon tetrachloride**	0.004	0.02	mg/L	NA	64-134	64-134	30	30	0.5
USEPA Method 1311/8260C	ELLE	1	108-90-7	**Chlorobenzene**	0.004	0.02	mg/L	NA	80-120	80-120	30	30	100
USEPA Method 1311/8260C	ELLE	1	67-66-3	**Chloroform**	0.004	0.02	mg/L	NA	80-120	80-120	30	30	6
USEPA Method 1311/8260C	ELLE	1	127-18-4	**Tetrachloroethene**	0.004	0.02	mg/L	NA	80-120	80-120	30	30	0.7
USEPA Method 1311/8260C	ELLE	1	79-01-6	**Trichloroethene**	0.004	0.02	mg/L	NA	80-120	80-120	30	30	0.5
USEPA Method 1311/8260C	ELLE	1	75-01-4	**Vinyl chloride**	0.004	0.02	mg/L	NA	56-120	56-120	30	30	0.2
USEPA Method 1311/8260C	ELLE	1	1868-53-7	**Dibromofluoromethane**	NA	NA	NA	80 - 120	NA	NA	NA	NA	NA
USEPA Method 1311/8260C	ELLE	1	17060-07-0	**1,2-Dichloroethane-d4**	NA	NA	NA	80 - 120	NA	NA	NA	NA	NA
USEPA Method 1311/8260C	ELLE	1	2037-26-5	**Toluene-d8**	NA	NA	NA	80 - 120	NA	NA	NA	NA	NA
USEPA Method 1311/8260C	ELLE	1	460-00-4	**4-Bromofluorobenzene**	NA	NA	NA	80 - 120	NA	NA	NA	NA	NA
TCLP Semivolatile Organic Compounds (SVOCs)													
USEPA Method 1311/8270D	ELLE	2	95-95-4	**2,4,5-Trichlorophenol**	0.003	0.01	mg/L	NA	66-118	66-118	30	30	400
USEPA Method 1311/8270D	ELLE	2	88-06-2	**2,4,6-Trichlorophenol**	0.003	0.01	mg/L	NA	69-122	69-122	30	30	2
USEPA Method 1311/8270D	ELLE	2	121-14-2	**2,4-Dinitrotoluene**	0.005	0.025	mg/L	NA	64-112	64-112	30	30	0.13
USEPA Method 1311/8270D	ELLE	2	95-48-7	**2-Methylphenol**	0.003	0.01	mg/L	NA	53-107	53-107	30	30	200
USEPA Method 1311/8270D	ELLE	2	NA	**3 & 4 -Methylphenol**	0.003	0.01	mg/L	NA	49-108	49-108	30	30	200
USEPA Method 1311/8270D	ELLE	2	118-74-1	**Hexachlorobenzene**	0.0005	0.003	mg/L	NA	60-117	60-117	30	30	0.13
USEPA Method 1311/8270D	ELLE	2	87-68-3	**Hexachlorobutadiene**	0.003	0.01	mg/L	NA	20-108	20-108	30	30	0.5
USEPA Method 1311/8270D	ELLE	2	67-72-1	**Hexachloroethane**	0.005	0.025	mg/L	NA	23-95	23-95	30	30	3
USEPA Method 1311/8270D	ELLE	2	98-95-3	**Nitrobenzene**	0.003	0.01	mg/L	NA	49-113	49-113	30	30	2
USEPA Method 1311/8270D	ELLE	2	87-86-5	**Pentachlorophenol**	0.005	0.025	mg/L	NA	54-131	54-131	30	30	100
USEPA Method 1311/8270D	ELLE	2	110-86-1	**Pyridine**	0.01	0.025	mg/L	NA	21-61	21-61	30	30	5
USEPA Method 1311/8270D	ELLE	2	367-12-4	**2-Fluorophenol**	NA	NA	NA	10 - 84	NA	NA	NA	NA	NA
USEPA Method 1311/8270D	ELLE	2	118-79-6	**2,4,6-Tribromophenol**	NA	NA	NA	23 - 135	NA	NA	NA	NA	NA
USEPA Method 1311/8270D	ELLE	2	4165-60-0	**Nitrobenzene-d5**	NA	NA	NA	33 - 113	NA	NA	NA	NA	NA
USEPA Method 1311/8270D	ELLE	2	321-60-8	**2-Fluorobiphenyl**	NA	NA	NA	44 - 102	NA	NA	NA	NA	NA
USEPA Method 1311/8270D	ELLE	2	1718-51-0	**Terphenyl-d14**	NA	NA	NA	39 - 125	NA	NA	NA	NA	NA
TCLP Pesticides													
USEPA Method 8081B	ELLE	2	72-20-8	**Endrin**	0.00004	0.0001	mg/L	NA	35-143	60-151	30	30	0.02
USEPA Method 8081B	ELLE	2	58-89-9	**Gamma BHC (Lindane)**	0.00001	0.00005	mg/L	NA	51-132	51-132	30	30	0.4
USEPA Method 8081B	ELLE	2	76-44-8	**Heptachlor**	0.00002	0.00005	mg/L	NA	38-135	38-135	30	30	0.008
USEPA Method 8081B	ELLE	2	1024-57-3	**Heptachlor Epoxide**	0.000012	0.00005	mg/L	NA	56-132	56-132	30	30	0.008
USEPA Method 8081B	ELLE	2	5103-71-9	**Chlordane**	0.0008	0.0025	mg/L	NA	55-124	80-120	30	30	0.03
USEPA Method 8081B	ELLE	2	72-43-5	**Methoxychlor**	0.00015	0.0005	mg/L	NA	39-143	58-165	30	30	10
USEPA Method 8081B	ELLE	2	8001-35-2	**Toxaphene**	0.005	0.015	mg/L	NA	48-148	69.996-120.004	30	30	0.5
USEPA Method 8081B	ELLE	2	877-09-8	**Tetrachloro-m-xylene**	NA	NA	NA	39 - 139	NA	NA	N/A	NA	NA
USEPA Method 8081B	ELLE	2	2051-24-3	**Decachlorobiphenyl**	NA	NA	NA	10 - 164	NA	NA	N/A	NA	NA

QAPP Worksheet #15-3 - Project Action Limits and Laboratory-Specific Detection/Quantitation Limits - Definitive Data (UFP QAPP Manual Section 2.6.2.3 and Figure 15)

Matrix: IDM - Definitive Analytical Methods

Analytical Groups for Definitive Data: VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Mercury, Corrosivity, Ignitability, Flashpoint, Reactivity.

Sample Associated with Analysis - IDM associated with the Sampling as described in the QAPP.

Analytical Method	Laboratory Performing Analysis	Reference	CAS Number	Target Analyte	Laboratory Detection Limits - TCLP[1]			Surrogate Recovery Control Limits (%R)	Low Level LCS Recovery Control Limits (%R)	Low Level MS/MSD Recovery Control Limits (%R)	MS/MSD Precision (RPD)	LCS/LCSD Precision (RPD)	TCLP Limits[1]
					MDLs	RLs	Units						
TCLP Herbicides													
USEPA Method 8151A	ELLE	3	94-78-7	**2,4-D**	0.016	0.05	mg/L	NA	42-147	42-147	30	30	10
USEPA Method 8151A	ELLE	3	93-72-1	**2,4,5-TP (Silvex)**	0.001	0.005	mg/L	NA	58-148	35-155	30	0	1
USEPA Method 8151A	ELLE	3	19719-28-9	**2,4-DCAA**	NA	NA	NA	26-136	NA	NA	NA	NA	NA
TCL PCBs													
USEPA Method 8082A	ELLE	2	12674-11-2	**Aroclor 1016**	3.6	17	ug/kg	NA	76-121	76-121	50	50	NA
USEPA Method 8082A	ELLE	2	11104-28-2	**Aroclor 1221**	4.6	17	ug/kg	NA	NA	NA	NA	NA	NA
USEPA Method 8082A	ELLE	2	11141-16-5	**Aroclor 1232**	8	17	ug/kg	NA	NA	NA	NA	NA	NA
USEPA Method 8082A	ELLE	2	53469-21-9	**Aroclor 1242**	3.3	17	ug/kg	NA	NA	NA	NA	NA	NA
USEPA Method 8082A	ELLE	2	12672-29-6	**Aroclor 1248**	3.3	17	ug/kg	NA	NA	NA	NA	NA	NA
USEPA Method 8082A	ELLE	2	11097-69-1	**Aroclor 1254**	3.3	17	ug/kg	NA	NA	NA	NA	NA	NA
USEPA Method 8082A	ELLE	2	11096-82-5	**Aroclor 1260**	4.9	17	ug/kg	NA	79-130	79-130	50	50	NA
USEPA Method 8082A	ELLE	2	37324-23-5	**Aroclor 1262**	3.3	17	ug/kg	NA	NA	NA	NA	NA	NA
USEPA Method 8082A	ELLE	2	11100-14-4	**Aroclor 1268**	3.3	17	ug/kg	NA	NA	NA	50	NA	NA
TCLP Metals													
USEPA Method 1311/6010C	ELLE	4	7440-38-2	**Arsenic**	0.016	0.03	mg/L	NA	80-120	75-125	20	20	5
USEPA Method 1311/6010C	ELLE	4	7440-39-3	**Barium**	0.001	0.005	mg/L	NA	80-120	75-125	20	20	100
USEPA Method 1311/6010C	ELLE	4	7440-43-9	**Cadmium**	0.001	0.005	mg/L	NA	80-120	83-116	20	20	1
USEPA Method 1311/6010C	ELLE	4	7440-47-3	**Chromium**	0.0016	0.015	mg/L	NA	80-120	75-125	20	20	5
USEPA Method 1311/6010C	ELLE	4	7439-92-1	**Lead**	0.0071	0.015	mg/L	NA	80-120	75-125	20	20	5
USEPA Method 7470A	ELLE	4	7439-97-6	**Mercury**	0.00005	0.0002	mg/L	NA	80-110	80-120	20	20	0.2
USEPA Method 1311/6010C	ELLE	4	7782-49-2	**Selenium**	0.016	0.05	mg/L	NA	80-120	75-125	20	20	1
USEPA Method 1311/6010C	ELLE	4	7440-22-4	**Silver**	0.005	0.01	mg/L	NA	80-120	75-125	20	20	5
USEPA Method 1311/6020B	ELLE	4	7440-38-2	**Arsenic**	0.00068	0.002	mg/l	NA	85-120	75-125	20	20	5
USEPA Method 1311/6020B	ELLE	4	7440-39-3	**Barium**	0.00075	0.002	mg/l	NA	80-120	75-125	20	20	100
USEPA Method 1311/6020B	ELLE	4	7440-43-9	**Cadmium**	0.00015	0.0005	mg/l	NA	84-120	75-125	20	20	1
USEPA Method 1311/6020B	ELLE	4	7440-47-3	**Chromium**	0.00033	0.001	mg/l	NA	90-115	75-125	20	20	5
USEPA Method 1311/6020B	ELLE	4	7439-92-1	**Lead**	0.000071	0.0005	mg/l	NA	90-110	75-125	20	20	5
USEPA Method 1311/6020B	ELLE	4	7782-49-2	**Selenium**	0.00005	0.0002	mg/l	NA	80-110	80-120	20	20	1
USEPA Method 1311/6020B	ELLE	4	7440-22-4	**Silver**	0.00028	0.001	mg/l	NA	90-113	75-125	20	20	5

QAPP Worksheet #15-3 - Project Action Limits and Laboratory-Specific Detection/Quantitation Limits - Definitive Data (UFP QAPP Manual Section 2.6.2.3 and Figure 15)

Matrix: IDM - Definitive Analytical Methods

Analytical Groups for Definitive Data: VOCs, SVOCs, PCBs, Pesticides, Herbicides, Metals, Mercury, Corrosivity, Ignitability, Flashpoint, Reactivity.

Sample Associated with Analysis - IDM associated with the Sampling as described in the QAPP.

Analytical Method	Laboratory Performing Analysis	Reference	CAS Number	Target Analyte	Laboratory Detection Limits - TCLP[1]			Surrogate Recovery Control Limits (%R)	Low Level LCS Recovery Control Limits (%R)	Low Level MS/MSD Recovery Control Limits (%R)	MS/MSD Precision (RPD)	LCS/LCSD Precision (RPD)	TCLP Limits[1]
					MDLs	RLs	Units						
Other Hazardous Characterization Methods													
USEPA Chapter 7 / Method 9045D	ELLE	5	-	**Corrosivity /pH**	NA	NA	Std Units	NA	NA	NA	NA	NA	NA
EPA 40 CFR 261.21	ELLE	7	-	**Ignitability (Solids)**	NA	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Chapter 7.3- 9012B	ELLE	3	-	**Rective Cyanide**	20	60	mg/kg	NA	NA	NA	NA	NA	NA
USEPA Chapter 7.3- 9034	ELLE	3	-	**Reactive Sulfide**	53.6	160	mg/kg	NA	NA	NA	NA	NA	NA
USEPA Method 1010A	ELLE	5	-	**Flashpoint (Liquids)**	NA	NA	° F	NA	NA	NA	NA	NA	NA
SM20 2540G	ELLE	6	-	**Percent Solids**	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

MDL indicates method detection limit.

QL indicates quantitation limit.

NA indicates not applicable.

MS/MSD indicates matrix spike/ matrix spike duplicate.

LCS Indicates laboratory control sample.

%R indicates percent recovery.

RPD indicates relative percent difference.

TCLP indicates toxicity characteristic leaching procedure. "1" indicates no TCLP limits for polychlorinated biphenyls.

ELLE indicates Eurofins Lancaster Laboratories Environmental LLC of Lancaster, PA.

QLs and MDLs were provided by ELLE, current as of November 2019.

Source List:

TCLP Target List - 40 CFR target compound list.

PCB Target List - Target compound list (TCL) resource - USEPA. 2007. Multi-Media, Multi-Concentration Organic Analytical Service for Superfund (SOM01.2). Washington, D.C.

References (See Worksheet 23 for laboratory SOPs):

1- USEPA. 2006. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition. Washington D.C.

2- USEPA. 2007. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition, Update IV. Washington D.C.

3- USEPA. 1996. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition, Update III. Washington D.C.

4. USEPA. 2014. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition, Update V. Washington D.C.

5. USEPA. 2004. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846, 3rd Edition, Update IIIB. Washington D.C.

6. AWWA, APHA and WEF. 1998. Standard Methods for the Examination of Water and Wastewater, 20th Edition. Washington, D.C.

7. USEPA. 2001. 40 CFR, Appendix A. Washington, D.C.

Regulatory Criteria References:

1- USEPA 40 CFR 261.24 - Toxicity Characteristic.

QAPP Worksheet #17: Sampling Design and Rationale (UFP QAPP Manual Section 3.1.1) (EPA 2106-G-05 Section 2.3.1)

Sample matrices and laboratory analyses that will be performed for this investigation are presented in Worksheet #18. Method target analyte lists and detection limits are presented in Worksheet #15-1, #15-2 and #15-3.

Soil Sampling

Soil sampling will be performed to augment the sample results from USEPA's investigation and to further characterize Loeffel Route 203 Property-related contaminants in soil at the Site, including on the National Grid Property and Residential Property.

Soil sampling will be performed at overburden soil at the Loeffel Route 203 Property, the National Grid Property to the west, and the Residential Property to the south. In general, continuous soil cores will be collected using a single or dual tube sampling system lined with an acetate sleeve advanced with a direct-push unit operated by Parratt-Wolff, Inc. or other qualified drilling firm. Continuous soil cores will be collected from ground surface to a depth of either 1 foot, 3 feet, 5 feet, 15 feet, or 30 feet below grade depending on location. If refusal is encountered shallower than the depth specified for a given location and the actual boring depth is approximately 50% or more of the intended depth, then the boring will be considered complete. If refusal occurs at a depth of less than approximately 50% of the intended boring depth, then up two additional attempts will be made per location to attempt to bypass the refusal surface. In addition to a direct-push rig, shallow borings (i.e., 5 feet or less) may be advanced using manual methods including hand-auger or manual direct push methods or powered hand-tool.

Soil samples will be collected and classified in the field by an OBG geologist using the Modified Burmeister and Unified Classification Systems. In addition to logging the geologic descriptions, observations including soil texture, composition, color, consistency, moisture content, recovery, and the observance of noticeable odors or stains will be recorded on the boring log by the geologist. Portions of the samples will also be collected for headspace analysis screening using a hand-held photoionization detector (PID).

QA/QC samples will be collected at a frequency of one per 20 environmental samples. QA/QC samples include blind duplicate samples and MS/MSD sample pairs. Equipment blanks (i.e., rinsate blanks) will be collected for non-dedicated sampling equipment (e.g., hand auger). Trip blanks will be included with each sample cooler containing VOC samples.

Upon completion, soil borings less than 5 feet in depth will be backfilled to grade with granular bentonite, which will be tamped into placed. Soil borings deeper than 5 feet will be tremie grouted and/or backfilled to grade using granular bentonite. Soil boring locations will be marked in the field using wooden stakes and survey flagging (or equivalent) and surveyed for horizontal and vertical control by a licensed Professional Land Surveyor. Non-dedicated sampling equipment decontamination will be performed.

Loeffel Route 203 Property - Shallow and Deep Soil Borings - A total of 94 soil sampling locations comprising shallow soil borings (5 feet in depth or less) and deep soil borings (to depths of 10, 15, and 30 feet) will be advanced on the Loeffel Route 203 Property.

- Shallow Soil Borings - Sixty-five continuously sampled shallow soil borings will be advanced on the Loeffel Route 203 Property from ground surface to 5 feet below grade, or refusal (if shallower). The sampling locations were selected to further characterize soil where total PCB concentrations detected during USEPA's investigation are greater than 1 part per million (ppm) (e.g., the Pond Area, Former AST/Potential Lagoon Area, and Drum Area) and to characterize soil in areas not previously investigated by USEPA (e.g., wooded area north of the pond and southern driveway, and in and proximal to the Eastern Drainageway).

- Deep Soil Borings - USEPA's previous investigation did not evaluate soil deeper than 4 feet at the Site. A total of 20 continuously sampled deep soil borings will be advanced on the Loeffel Route 203 Property from

ground surface to up to 30 feet below grade or refusal (if shallower). Thirteen soil borings will be advanced to a maximum of 10 feet, two borings will be advanced to a maximum of 15 feet, and five borings will be advanced to a maximum of 30 feet. The sampling locations were selected to characterize subsurface soil around the UST, in the Former AST/Potential Lagoon Area, the Drum Area and other portions of the Loeffel Route 203 Property.

- Eastern Drainageway - Nine continuously sampled shallow soil borings will be advanced in the bed of the ephemeral stream associated with the Eastern Drainageway from ground surface to 3 feet below grade or refusal (if shallower). In addition, one soil boring will be advanced to a depth of 2 feet below grade in the upgradient portion of the ephemeral stream on the eastern side of Route 203, immediately east of the culvert. The sampling locations were selected to characterize soil in the potential surface migration pathway not previously evaluated during USEPA's investigation.

National Grid Property - USEPA previously collected soil samples at approximately 18 locations on the National Grid Property; one or more soil samples detected total PCB concentrations exceeding 1 ppm at five of the 18 sample locations. Nine continuously sampled shallow soil borings will be advanced from ground surface to 3 feet below grade or refusal (if shallower). The sampling locations were selected to further characterize soil where total PCB concentrations detected during USEPA's investigation are greater than 1 ppm.

Residential Property - USEPA previously collected soil samples at 10 locations on the Residential Property or immediately adjacent to it. Seven of these locations were distributed across the open grassy area south of the abandoned culvert that extends beneath Sweets Crossing Road from the southern tip of the pond; total PCBs did not exceed 1 ppm in any of these samples. Three locations were distributed along the drainage swale associated with the ephemeral stream that flows from the Route 203 Property through the twin culvert under Sweets Crossing Road. Total PCBs exceeded 1 ppm in one of the samples collected at the three drainage swale locations.

A total of 19 soil sampling locations will be advanced on the Residential Property to characterize shallow soil in or adjacent to the drainage swale and along the ephemeral stream. Of these, 16 continuously sampled shallow soil borings will be advanced from ground surface to 3 feet below grade. Four of these sampling locations will be advanced approximately 10 feet to the northeast, southeast, southwest, and northwest of the USEPA sample where total PCBs were detected above 1 ppm. Three of the 19 soil sampling locations will be advanced from ground surface to 1 foot below grade along and adjacent to the ephemeral stream where it enters a low-lying area in the southwestern corner of the Residential Property.

Sediment Sampling

Thirty sediment samples were collected at 14 locations near the perimeter of the pond during USEPA's investigation. Samples from the interior portion of the pond were unable to be collected because of winter weather conditions.

Sediment samples will be obtained at an additional 31 sample locations to a depth of 3 feet below the top of sediment or refusal (if shallower). The sediment sampling locations are distributed across the pond in an approximately gridded pattern. Based on the depth of the pond and the estimated thickness of the pond sediments obtained during the bathymetric survey and soft sediment probing, the sediment sampling methods and number of vertical samples may need to be adjusted. The soft sediment samples will be collected using a combination of techniques using Lexan or aluminum tubes (or equivalent) advanced manually or with hand-held equipment.

Overburden Monitoring Well Installation

Overburden monitoring wells will be installed at five locations on the Loeffel Route 203 Property. The installation of these wells will facilitate the collection of groundwater samples to characterize overburden groundwater and to evaluate groundwater flow direction. The 30-foot deep soil borings will be completed as overburden monitoring wells.

The five monitoring wells will be installed and constructed such that the screened portion of the wells intersect the

water table within the unconsolidated deposits to allow the collection of groundwater samples and water level measurements from the uppermost portion of the saturated zone. Therefore, the depths of the wells will be determined based on the depth at which groundwater is first encountered in the overburden at each location.

The wells will be constructed with 10 feet of 2-inch inner diameter, 0.010-inch or 0.020-inch slot schedule 40 polyvinyl chloride (PVC), pre-packed (No. 1 or No. 2 size sand) well screen flush-threaded to appropriate lengths of 2-inch inner diameter schedule 40 PVC riser casing necessary to bring the top of the well to grade. Each new overburden monitoring well will be completed with keyed-alike padlocks with J-plugs, and steel casing equipped with a locking cap placed over the monitoring well. The protective casing will extend at least two feet below ground surface and will be cemented in place. In some areas it may be necessary to complete the wells with flush-mounted, bolt-down steel manholes set within approximately 2-foot by 2-foot square protective concrete pads, a minimum of 4-inches thick.

Overburden Monitoring Well Development

Following installation of the overburden monitoring wells, each overburden well will be developed prior to performing the additional hydrogeologic investigation activities described in the following sections. The overburden wells will be developed to:

- Remove fine-grained particulates from the well and filter pack
- Reduce the turbidity within the water column
- Enhance the hydraulic connection between each well and the surrounding formation.

Monitoring well development will be completed in accordance with SOP 007. Each newly-constructed monitoring well will be developed as soon as practicable, but no sooner than 24 hours after installation. Non-dedicated, non-disposable equipment used in the development process will be decontaminated before and after each use in accordance with the SOP 005.

Groundwater Sampling and Analysis

Groundwater samples will be collected from each of the newly-installed overburden monitoring wells at the Site shortly after monitoring well installation and development activities are completed. Concurrent with this sampling event, a sample will also be collected from the supply well located in the southern portion of the Loeffel Route 203 Property near the commercial buildings.

New Monitoring Wells – Groundwater samples will be collected no less than two weeks after the completion of well development activities at each newly-installed monitoring well. Non-dedicated, non-disposable sampling equipment will be decontaminated before and after sampling at each monitoring well in accordance with the field equipment decontamination procedure SOP 005. Groundwater samples will be obtained using low-flow sampling techniques in accordance with SOP 008. To provide additional information on the general groundwater conditions, water quality parameters will be measured using a flow-through cell during low-flow sampling. Measurements of dissolved oxygen (DO), oxidation reduction potential (ORP), temperature, pH, specific conductivity and turbidity will be obtained for each monitoring well sampled.

During the sampling event, water level measurements will be collected from the monitoring wells and newly-installed pond staff gage in accordance with the water level measurement procedure in SOP 006.
Supply Well – The supply well located at the southern end of the Loeffel Route 203 Property will be sampled concurrently with the five new overburden wells. Based on the limited information in the available well record, the supply well was drilled to a depth of 100 feet with casing installed to a depth of 38 feet. It is assumed that the well was installed into bedrock which is reported to be “slate rock” with a reported yield of 50 gallons per minute (gpm). The supply well was previously sampled by USEPA and the results were below the federal Maximum Contaminant Levels (MCLs).

Soft Dig and UST Contents Sampling

As discussed above, a 30,000-gallon UST is reportedly located in the south-central portion of the property proximal to the southeast corner of the easternmost commercial garage. Soft digging techniques will be used to expose the top of the UST. If possible, sample(s) of the aqueous and sludge contents of the UST will be collected for laboratory analysis.

Management of IDM

IDM resulting from the various investigation activities will require appropriate management. The IDM includes the following:

- Soil and drill cuttings
- Sediment
- Groundwater resulting from the development of the overburden monitoring wells
- Purge water from well sampling
- Decontamination fluids
- Solids (if any) which settle out of groundwater and/or decontamination fluids
- Personnel protective equipment (PPE) and associated debris resulting from the execution of the various field activities (e.g., polyethylene sheeting, sample tubing, disposable equipment, etc.).

Soil and Drill Cuttings

Any soil remaining from shallow and deep soil boring and monitoring well locations will be collected in a 5-gallon bucket or placed directly into a 55-gallon drum. If using a 5-gallon bucket, the bucket will be periodically emptied into a 55-gallon drum. Soil excavated from the top of the UST will be replaced after the tank is accessed and sampled. Any 55-gallon drums will be transported to the temporary IDM staging location and labeled. 55-gallon drums will be labeled as outlined in Section 2.16.1. of the RSWP.

The drum(s) of excess soil from the investigation will be transported to the designated temporary IDM staging area at the Loeffel Route 203 Property and will be labeled with the appropriate location identification(s), the dates on which the cuttings were containerized, and a description of the type of material (i.e., overburden drill cuttings). Representative samples of the drummed soil and drill cuttings will be collected and analyzed. The final disposition of the drummed drill cuttings will be determined based on the results of the laboratory analysis. After receiving the necessary approval(s), the soil will be transported for off-site disposal at an approved facility.

Sediment

Any excess sediment collected will be placed in a 5-gallon bucket (or similar) and allowed to settle. Any excess water will be decanted off the top and containerized with the decontamination fluids IDM. The sediment will be containerized with the soil and drill cutting IDM.

Groundwater

Groundwater collected during the overburden well drilling, well development, and groundwater sampling event will be containerized in polyethylene storage tanks and/or 55-gallon drums and transported to the designated temporary IDM staging location at the Loeffel Route 203 Property and appropriately labeled. A representative sample or samples of the containerized groundwater will be collected and analyzed. The final disposition of the containerized groundwater will be determined based on the results of the laboratory analysis. After receiving the necessary approval(s), the groundwater will be transported for off-site disposal at an approved facility.

Decontamination Fluids and Settled Solids

To the extent possible, non-disposable equipment will be decontaminated at the Loeffel Route 203 Property prior to

and after use at the Site. Liquid/solid mixtures generated during equipment decontamination will be temporarily stored in 5-gallon bucket(s) and/or 55-gallon drum(s) to allow solids to settle. Settled solids (e.g., sediment) will be containerized, characterized and managed with the soil and drill cuttings IDM.

Decontamination fluids generated during the investigation activities will be containerized in 55-gallon drums and transported to the designated temporary IDM staging location at the Loeffel Route 203 Property and appropriately labeled. A representative sample or samples of the containerized decontamination fluids will be collected and analyzed. The final disposition of the containerized decontamination fluids will be determined based on the results of the laboratory analysis. After receiving the necessary approval(s), the decontamination fluids will be transported for off-site disposal at an approved facility.

Personal Protective Equipment and Associated Debris

PPE generated during non-intrusive, non-sampling activities (e.g., Tyvek® coveralls used during site visits or reconnaissance activities for protection against aggressive fauna and flora [e.g., ticks and poison ivy]) will be bagged and transported off-site for disposal at a local, permitted sanitary landfill. All other PPE (e.g., polyethylene sheeting, sample tubing, disposable equipment, etc.), will be containerized in 55-gallon drums and transported to the temporary IDM staging location and labeled.

Representative samples of the containerized PPE/debris from intrusive/sampling activities will be collected, as necessary and required, and sent via chain-of-custody to ELLE for laboratory analysis as specified on Table 2-1 of the RSWP and Worksheet #18.

The final disposition of the containerized PPE and debris will be determined based on the results of the laboratory analysis, as necessary and required. After receiving the necessary approval(s), the PPE/debris will be transported for off-site disposal at an approved facility.

Worksheet 18

Sample Summary Table
Loeffel Route 203 Property
Nassau, New York

Sampling Dates	Sampling Locations	Number of Sample Locations	Matrix	Sample Description	Sample Depth/Interval	Laboratory Analysis*	Field Analysis	Total Number of Environmental Samples	Estimated Number of QC Samples**
Surface and Near-Surface Soil Sampling									
Shallow Soil Borings - Loeffel Route 203 Property									
TBD	SS-P001-001-mmddyyyy to SS-P001-065-mmddyyyy***	65	Soil	Shallow soil sampling to 5 fbgs	0-6"; 18-24"; 30-36"	PCBs by 8082A	NA	195	10 Field Duplicates, 10 MS/MSD Sets
					TBD	VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		10	1 Trip Blank for each sample cooler with VOCs; 1 Field Duplicate, 1 MS/MSD Set
					TBD	TOC by Lloyd Kahn		5	NA
					TBD	Grain Size / Bulk Density		5	NA
				Shallow soil samples to be archived for potential analysis	42-48"; 54-60"	PCBs by 8082A		TBD	TBD - Field Duplicate, TBD - MS/MSD Set
Shallow Soil Borings - Eastern Drainageway - Loeffel Route 203 Property									
TBD	SS-EDW-P001-001-mmddyyyy to SS-EDW-P001-009-mmddyyyy***	9	Soil	Shallow soil sampling in ditch to 3 fbgs	0-6"; 6-12"; 18-24"	PCBs by 8082A	NA	27	2 Field Duplicates, 2 MS/MSD Sets
					TBD	VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		1	1 Trip Blank for each sample cooler with VOCs; 1 Field Duplicate, 1 MS/MSD Set
				Shallow soil samples from ditch to be archived for potential analysis	12-18"; 30-36"	PCBs by 8082A		TBD	TBD - Field Duplicate, TBD - MS/MSD Set
Shallow Soil Borings - Eastern Drainageway - Route 203 Right-of-Way									
TBD	SS-EDW-ROW-001-mmddyyyy	1	Soil	Shallow soil sampling in ditch to 2 fbgs	0-6"; 6-12"	PCBs by 8082A	NA	2	1 Field Duplicate, 1 MS/MSD Set
					TBD	VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		1	1 Trip Blank for each sample cooler with VOCs; 1 Field Duplicate, 1 MS/MSD Set
				Shallow soil samples from ditch to be archived for potential analysis	12-18"; 18-24"	PCBs by 8082A		TBD	TBD - Field Duplicate, TBD - MS/MSD Set
Shallow Soil Borings - Residential Property									
TBD	SS-P021-001-mmddyyyy to SS-P021-016-mmddyyyy***	16	Soil	Shallow soil sampling to 3 fbgs	0-6"; 6-12"; 18-24"	PCBs by 8082A	NA	48	3 Field Duplicates, 3 MS/MSD Sets
				Shallow soil samples to be archived for potential analysis	12-18"; 30-36"	PCBs by 8082A		TBD	TBD - Field Duplicate, TBD - MS/MSD Set
	SS-P021-017-mmddyyyy to SS-P021-019-mmddyyyy	3		Shallow soil sampling to 1 fbgs	0-6"; 6-12"	PCBs by 8082A		6	1 Field Duplicate, 1 MS/MSD Set
Shallow Soil Borings - National Grid Property									
TBD	SS-P026-001-mmddyyyy to SS-P026-009-mmddyyyy***	9	Soil	Shallow soil sampling to 3 fbgs	0-6"; 18-24"; 30-36"	PCBs by 8082A	NA	27	2 Field Duplicates, 2 MS/MSD Sets
					TBD	VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		1	1 Trip Blank for each sample cooler with VOCs; 1 Field Duplicate, 1 MS/MSD Set
Deep Soil Borings									
Deep Soil Borings to 30 Feet Below Ground Surface (or refusal if shallower)									
TBD	SB-P001-001-mmddyyyy to SB-P001-005-mmddyyyy***	5	Soil	Deep soil boring sampling to 30 fbgs	0-6"; 18-24"; 30-36"; 54-60"	PCBs by 8082A	NA	20	1 Field Duplicate, 1 MS/MSD Set
					TBD	VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		1	1 Trip Blank for each sample cooler with VOCs; 1 Field Duplicate, 1 MS/MSD Set
					TBD	TOC by Lloyd Kahn		5	NA
					TBD	Grain Size / Bulk Density		5	NA
				Soil samples from deep soil borings to 30 fbgs to be archived for potential analysis	72-84"; 108-120"	PCBs by 8082A		TBD	TBD - Field Duplicate, TBD - MS/MSD Set
Deep Soil Borings to 15 Feet Below Ground Surface (or refusal if shallower)									
TBD	SB-P001-006-mmddyyyy to SB-P001-007-mmddyyyy***	2	Soil	Deep soil boring sampling to 15 fbgs	0-6"; 18-24"; 30-36"; 54-60"	PCBs by 8082A	NA	8	1 Field Duplicate, 1 MS/MSD Set
					TBD	VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		1	1 Trip Blank for each sample cooler with VOCs; 1 Field Duplicate, 1 MS/MSD Set
				Soil samples from deep soil borings to 15 fbgs to be archived for potential analysis	72-84"; 108-120"	PCBs by 8082A		TBD	TBD - Field Duplicate, TBD - MS/MSD Set
Deep Soil Borings to 10 Feet Below Ground Surface (or refusal if shallower)									
TBD	SB-P001-008-mmddyyyy to SB-P001-020-mmddyyyy***	13	Soil	Deep soil boring sampling to 10 fbgs	0-6"; 18-24"; 30-36"; 54-60"	PCBs by 8082A	NA	52	3 Field Duplicates, 3 MS/MSD Sets
					TBD	VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		3	1 Trip Blank for each sample cooler with VOCs; 1 Field Duplicate, 1 MS/MSD Set
				Soil samples from deep soil borings to 10 fbgs to be archived for potential analysis	72-84"; 108-120"	PCBs by 8082A		TBD	TBD - Field Duplicate, TBD - MS/MSD Set
Pond Sediment Sampling									
TBD	SD-PND-P001-01-mmddyyyy to SD-PND-P001-31-mmddyyyy	31	Sediment	Pond sediment sampling	0-6"; 6-12"; 18-24"	PCBs by 8082A	NA	93	5 Field Duplicates, 5 MS/MSD Sets, 5 Equipment Blanks
					TBD	VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; metals by 6010D, mercury by 7471B and total cyanide by 9012B		5	1 Trip Blank for each sample cooler with VOCs; 1 Field Duplicate, 1 MS/MSD Set, 1 Equipment Blank
					0-6"	TOC by Lloyd Kahn		31	NA
					0-6"	Grain Size / Bulk Density		5	NA
				Pond sediment samples to be archived for potential analysis	12-18"; 24-36"	PCBs by 8082A		TBD	TBD - Field Duplicate, TBD - MS/MSD Set, TBD - Equipment Blank
Groundwater Sampling - Overburden Monitoring Wells/Supply Well									
TBD	MW-OVB-P001-Well-01-mmddyyyy to MW-OVB-P001-Well-05-mmddyyyy	5	Overburden Groundwater	Synoptic groundwater sampling event including newly installed overburden monitoring wells on property P001	TBD - Typically well screen mid-point	VOCs by 8260C; 1,4-dioxane by 8270D SIM; SVOCs by 8270D; pesticides by 8081B; PCBs by 8082A; total and dissolved metals by 6010D, mercury by 7470A and total cyanide by 9012B	pH, Temperature, Specific Conductivity, Dissolved Oxygen, Oxidation-Reduction Potential, Turbidity	5	1 Trip Blank for each sample cooler with VOCs; 1 Field Duplicate, 1 MS/MSD Set, 1 Equipment Blank
	TW-BR-P001-001-mmddyyyy	1	Bedrock Groundwater	Supply well adjacent to commercial building on property P001	Supply well pump depth	VOCs by 8260C; 1,4-dioxane by 8270D SIM; SVOCs by 8270D; pesticides by 8081B; PCBs by 8082A; total and dissolved metals by 6010D, mercury by 7470A and total cyanide by 9012B	NA	1	1 Trip Blank for each sample cooler with VOCs; 1 Field Duplicate, 1 MS/MSD Set
UST Contents Sampling - Tank Content									
TBD	TBD	1	Liquid (Tank Content)	Samples of tank content (if accessible and liquid present)	NA	VOCs by 8260C; SVOCs by 8270D; pesticides by 8081B; PCBs by 8082A; total and dissolved metals by 6010D, mercury by 7470A and total cyanide by 9012B	NA	1	NA

Worksheet 18

Sample Summary Table
Loeffel Route 203 Property
Nassau, New York

Sampling Dates	Sampling Locations	Number of Sample Locations	Matrix	Sample Description	Sample Depth/Interval	Laboratory Analysis*	Field Analysis	Total Number of Environmental Samples	Estimated Number of QC Samples**
IDM - Soil/Liquid Disposal Characterization - Tank Content									
TBD	TBD	TBD	IDM - Solid (Soil, Tank Content)	Samples of soil (select locations and depths) and tank content (if accessible and solids present)	NA	TCLP Preparation Method 1311 – Analysis for VOCs by 8260C, SVOCs by 8270D; pesticides by 8081B; herbicides by 8151A; metals by 6010D and mercury by 7470A; PCBs by 8082A.	NA	TBD	NA
					NA	Ignitability by 40 CFR 261.21; reactive cyanide by USEPA Method SW-846 Chapter 7.3, Method 9012, reactive sulfide by USEPA Method SW-846 Chapter 7.3, Method 9034B	NA	TBD	NA
	TBD	TBD	IDM - Liquid (Tank Content)	Samples of tank content (if accessible and liquid present)	NA	TCLP Preparation Method 1311 – Analysis for VOCs by 8260C, SVOCs by 8270D; pesticides by 8081B; herbicides by 8151A; metals by 6010D and mercury by 7470A. PCBs by 8082A.	NA	TBD	NA
					NA	Corrosivity USEPA SW-846 Chapter 7/ pH/USEPA Method 9045D; ignitability by USEPA 40 CFR 261.21; flashpoint by USEPA Method 1010A; reactive cyanide by USEPA Method SW-846 Chapter 7.3, Method 9012, reactive sulfide by USEPA Method SW-846 Chapter 7.3, Method 9034B	NA	TBD	NA
IDM - IDM Characterization - Solid and Liquid									
TBD	TBD	TBD	IDM - Solid	Samples of investigation IDM (e.g., excess soil, PPE/debris, etc.)	NA	TCLP Preparation Method 1311 – Analysis for VOCs by 8260C, SVOCs by 8270D; pesticides by 8081B; herbicides by 8151A; metals by 6010D and mercury by 7470A; PCBs by 8082A.	NA	TBD	NA
						Ignitability by 40 CFR 261.21; reactive cyanide by USEPA Method SW-846 Chapter 7.3, Method 9012, reactive sulfide by USEPA Method SW-846 Chapter 7.3, Method 9034B	NA	TBD	NA
	TBD	TBD	IDM - Liquid	Samples of investigation IDM (e.g., decontamination fluids, well development, well purging, etc.)	NA	TCLP Preparation Method 1311 – Analysis for VOCs by 8260C, SVOCs by 8270D; pesticides by 8081B; herbicides by 8151A; metals by 6010D and mercury by 7470A; PCBs by 8082A.	NA	TBD	NA
						Corrosivity USEPA SW-846 Chapter 7/ pH/USEPA Method 9045D; ignitability by USEPA 40 CFR 261.21; flashpoint by USEPA Method 1010A; reactive cyanide by USEPA Method SW-846 Chapter 7.3, Method 9012, reactive sulfide by USEPA Method SW-846 Chapter 7.3, Method 9034B	NA	TBD	NA

Notes:
*** Target analyses for each analysis are presented in Worksheet 15-1, 15-2 and 15-3.**

**** Estimated number of QC samples based on the following collection frequency, but may be adjusted based on actual number of non-QC samples (see Section 2.7 of the RSWP):**

1 Trip Blank for each sample cooler with VOCs; 1 Field Duplicate for every 20 samples; 1 Matrix Spike (MS)/Matrix Spike Duplicate (MSD) set for every 20 samples; Equipment Blanks (i.e., rinsate blanks) will be collected with non-dedicated sampling equipment.

***** Refer to Section 2.7 of the Removal Sampling Work Plan, which discusses potential alteration of PCB sample intervals by either party in consultation with the other and with USEPA approval based on visual observations and field screening results.**

VOCs = volatile organic compounds
SVOCs = semivolatile organic compounds
SIM = selected ion monitoring
PCBs = polychlorinated biphenyls
EDW = Eastern Drainageway
fbgs = feet below ground surface
IDM = investigation-derived material
NA = not applicable
ROW = right-of-way
TBD = to be determined
TOC = total organic carbon
TW = tap water
UST = underground storage tank
Grain size and bulk density by ASTM D422 and ASTM E-868-82, respectively

Project Sample Designation:
Sample location designations will be as follows: A-B-C-D-E where:

A = sample type; examples:
BR = bedrock
GW = groundwater
SB = soil boring
SD = sediment
SS = soil sample
MW-OVB = overburden monitoring well

B = sample field location; examples:
P001 = 5225-5239 Route 203 property
P021 = residential property south of P001
P026 = National Grid property west of P001
PND = pond

C = sample well location number or sample number:
WELL-01 = well number 01 (new well)
001 = sample number 001

D = mmddyyyy = month/day/year of sample collection

E = QC sample types:
MS = Matrix Spike
MSD = Matrix Spike Dupl
EB= Equipment Blank
TB= Trip Blank
FD= Field Duplicate

Example- SS-P001-001-01152020-MS indicates a Soil sample collected at the Loeffel Route 203 Property on January 15, 2020 and submitted for MS analysis.

QAPP Worksheet #19 & 30-1: Sample Containers, Preservation, and Hold Times
(UFP QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory:
Eurofins Lancaster Laboratories Environmental, LLC - 2425 New Holland Pike, Lancaster, PA 17601 - Megan Moeller - 717-656-2300
Accreditation and Expiration Date: NELAC Certification- New York Certification # 10670, Expiration Date 4/1/2020
Sample Delivery Method: Federal Express
Sample Type- Definitive

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
Groundwater/ Wastewater	VOCs - GC/MS	Low	USEPA Methods 5030B/8000C/ 8260C Lab SOP-001A	Three 40 milliliter vials	Three 40-milliliter glass vials with Teflon® lined septum caps	≤6°C HCL to pH<2. If free chlorine is present in samples, it must be removed by the appropriate addition of Na2S2O3 or ascorbic acid	14 days from collection to analysis for preserved sample; 7 days from collection for unpreserved sample.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
Shallow Soil Borings/ Deep Soil Borings/Sludge/ Sediment/ IDM	VOCs - GC/MS Note: For each VOC soil sample a separate aliquot will be provided for moisture analysis using Lab SOP 17 SM2540G	Low	USEPA Methods 5035A/8000C/ 8260C Lab SOP-001B, 001D	2-Encore sampler used to collect and transport sample in accordance with USEPA Method 5035A.	2-Encore sampler used to collect and transport sample in accordance with USEPA Method 5035A.	<6°C Sealed and Headspace Free	At the laboratory: For Encore sampler: extrude sample to a sealed vial and freeze to -7°C within 48 hours from collection. Analysis must be performed within 14 days from collection. Otherwise, 48 hours from collection to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
Shallow Soil Borings/ Deep Soil Borings/Sludge/ Sediment/ IDM	VOCs- GC/MS Note: For each VOC soil sample a separate aliquot will be provided for moisture analysis using Lab SOP 17 SM2540G	Medium	USEPA Methods 5035A/8000C/ 8260C Lab SOP-001B, 001D	Encore sampler used to collect and transport sample in accordance with USEPA Method 5035A.	Encore sampler used to collect and transport sample in accordance with USEPA Method 5035A.	<6°C Sealed and Headspace Free	At the laboratory within 48 hours of collection: Add methanol solution to 5 grams of sample in accordance with USEPA Method 5035A. 14 days from collection to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
Shallow Soil Borings/ Deep Soil Borings/Sludge/ Sediment/ IDM	VOCs - GC/MS Note: For each VOC soil sample a separate aliquot will be provided for moisture analysis using Lab SOP 17 SM2540G	Low/Medium/ Wet Solids	USEPA Methods 5035A/8000C/ 8260C Lab SOP-001B, 001D	1-40 or 60 milliliter wide-mouth glass vials with Teflon® lined septum caps, for air-tight and headspace free seal (as a last option).	1-40 or 60 milliliter wide-mouth glass vials with Teflon® lined septum caps, for air-tight and headspace free seal (as a last option).	<6°C Sealed and Headspace Free	Within 48 hours of collection: Either de-ionized water is added (for low level preparation), or methanol is added (for medium level); the sample is preserved at 4®C until analysis. Or the vial containing the sample is frozen to -7°C Analysis within 14 days from collection. If not preserved as described above, then 48 hours from collection to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
IDM - TCLP Preparation	VOCs - GC/MS Note: For each VOC soil sample a separate aliquot will be provided for moisture analysis using Lab SOP 17 SM2540G	Low	USEPA Methods 1311/5035A/ 8000C/8260C Lab SOP-001A, 001C	1-25 gram Encore sampler used to collect and transport sample in accordance with USEPA Method 5035A.	1-25 gram Encore sampler used to collect and transport sample in accordance with USEPA Method 5035A.	<6°C Sealed and Headspace Free	At the laboratory: For Encore sampler: extrude sample to a sealed vial and freeze to -7°C within 48 hours from collection. For TCLP -VOCs, 14 days from collection to extract generation. 14 days from extract generation to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
Groundwater/ Wastewater	SVOCs & 1,4-Dioxane - GC/MS	Low	USEPA Methods 3510C/8000C /8270D/8270D SIM Lab SOP-002A,002B, 002C, 002D	500 milliliters	2- 250 milliliter Amber Glass container with Teflon® lined screw cap	<6°C	7 days from collection to extraction; 40 days from extraction to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory
Shallow Soil Borings/ Deep Soil Borings/Sludge/ Sediment/ IDM	SVOCs & 1,4-Dioxane - GC/MS	Low	USEPA Methods 3546/8000C/8 270D/SIM Lab SOPs-002A, 002B, 002E	100 grams	250 milliliter wide mouth glass container with Teflon® lined lid.	<6°C	14 days from collection to extraction; 40 days from extraction to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
IDM – TCLP Preparation	SVOCs - GC/MS	Low	USEPA Methods 1311/3546/ 8000C/8270D Lab SOPs- 002B, 002F	100 grams	250 milliliter wide mouth glass container with Teflon® lined lid.	<6°C	For TCLP - 14 days from collection to extract generation. 7 days from extract generation to extraction. 40 days from extraction to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory
Groundwater/ Wastewater	Pesticides – GC	Low	USEPA Methods 3510C/8081B Lab SOP- 003A	500 milliliters	2- 250 milliliter Amber Glass container with Teflon® lined screw cap	<6°C	7 days from collection to extraction; 40 days from extraction to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory
Shallow Soil Borings/ Deep Soil Borings/Sludge/ Sediment/ IDM	Pesticides – GC	Low	USEPA Methods 3546/8081B Lab SOPs- 003B, 003C, 003D	100 grams	250 milliliter wide mouth glass container with Teflon® lined lid.	<6°C	14 days from collection to extraction; 40 days from extraction to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
IDM – TCLP Preparation	Pesticides – GC	Low	USEPA Methods 1311/3546/ 8081B Lab SOPs-003A, 014	100 grams	250 milliliter wide mouth glass container with Teflon® lined lid.	<6°C	For TCLP - 14 days from collection to extract generation. 7 days from extract generation to extraction. 40 days from extraction to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory
Groundwater/ Wastewater	PCBs - GC	Low	USEPA Methods 3510C/8082A Lab SOP- 004A	500 milliliters	2- 250 milliliter Amber Glass container with Teflon® lined screw cap	<6°C	1 year from collection to extraction; 40 days from extraction to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory
Shallow Soil Borings/ Deep Soil Borings/Sludge/ Sediment/ IDM	PCBs - GC	Low	USEPA Methods 3546/8082A Lab SOPs- 004B, 004C, 004D	100 grams	250 milliliter wide mouth glass container with Teflon® lined lid.	<6°C	1 year from collection to extraction; 40 days from extraction to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
IDM - TCLP Preparation	Herbicides – GC	Low	USEPA Methods 1311/3546/ 8151A Lab SOPs-005, 0014	100 grams	250 milliliter wide mouth glass container with Teflon® lined lid.	<6°C	For TCLP - 14 days from collection to extract generation. 7 days from extract generation to extraction. 40 days from extraction to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory
Groundwater/ Wastewater	Metals - ICP-AES/ ICP-MS	Low	USEPA Methods 3005A/6010C/ 6020A Lab SOPs-006A, 006B, 006C	50 milliliters	One 250-milliliter polyethylene or fluorocarbon (TFE or PFA) container	≤6°C HNO3 to pH<2	180 days from collection to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
Shallow Soil Borings/ Deep Soil Borings/Sludge/ Sediment/ IDM	Metals - ICP-AES/ ICP-MS	Low	USEPA Methods 3010A/6010C/ 6020A Lab SOPs-006A, 006B, 006D	50 grams	4-ounce wide glass container	≤6°C	180 days from collection to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
IDM	Metals - ICP-AES/ ICP-MS	Low	USEPA Methods 3010A/6010C/ 6020A Lab SOPs- 006A, 006B, 006D, 006E, 006F	50 grams	4-ounce wide glass container	≤6°C	180 days from collection to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
IDM- TCLP Preparation	Metals - ICP-AES/ ICP-MS	Low	USEPA Methods 1311/3010A/ 6010D/6020B Lab SOPs- 006A, 006B, 014	50 grams	4-ounce wide glass container	≤6°C	For TCLP - 180 days from collection to extract generation, 180 days from extraction to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
Groundwater/ Wastewater	Mercury - CVAA	Low	USEPA Method 7470A Lab SOPs- 006G, 006H	200 milliliters	One 250-milliliter polyethylene or fluorocarbon (TFE or PFA) container	≤6°C HNO3 to pH<2	28 days from collection to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
Shallow Soil Borings/ Deep Soil Borings/Sludge/ Sediment/ IDM	Mercury – CVAA	Low	USEPA Method 7471B Lab SOPs- 006G, 006H, 006I	50 grams	4-ounce wide glass container	≤6°C	28 days from collection to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
IDM – TCLP Preparation	Mercury – CVAA	Low	USEPA Method 1311/7470A Lab SOPs- 006i, 014	50 grams	4-ounce wide glass container	≤6°C	For TCLP - 28 days from collection to extract generation, 280 days from extraction to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
Groundwater/ Wastewater	Total Cyanide - Colorimeter	Low	USEPA Method 9012B Lab SOPs 007A, 007B	50 milliliters	One 1000-milliliter polyethylene or fluorocarbon (TFE or PFA) container	≤6°C NaOH to pH≥12 OA (if oxidizing agents are present, add ascorbic acid)	14 days from collection to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
Shallow Soil Borings/ Deep Soil Borings/Sludge/ Sediment/ IDM	Total Cyanide - Colorimeter	Low	USEPA Method 9012B Lab SOPs-007A, 007B	50 grams	4-ounce wide glass container	≤6°C	14 days from collection to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
Shallow Soil Borings/ Deep Soil Borings/Sediment/ IDM	TOC - Colorimeter	Low	Lloyd Kahn Method Lab SOP-008	50 grams	4-ounce wide glass container	≤6°C	14 days from collection to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
IDM	Corrosivity / pH – Electrode	Low	USEPA Method 9045D Lab SOP 009	50 grams	8-ounce wide mouth glass container with Teflon® lined lid.	≤6°C	28 days from collection to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
IDM	Ignitability /Pensky-Martin Closed Cup Tester	Low	USEPA Method 40 CFR Part 261.21 Lab SOP 010	50 grams	8-ounce wide mouth glass container with Teflon® lined lid.	≤6°C	28 days from collection to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
IDM	Flashpoint /Pensky-Martin Closed Cup Tester	Low	USEPA Method 1010A Lab SOP 011	50 grams	8-ounce wide mouth glass container with Teflon® lined lid.	≤6°C	28 days from collection to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
IDM	Reactive Cyanide – Colorimeter	Low	USEPA Chapter 7 9012B Lab SOP-012, 007A	100 grams	300 milliliter wide mouth glass container with Teflon® lined lid. .	≤6°C	14 days from collection to analysis	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
IDM	Reactive Sulfide – Titration	Low	USEPA Chapter 7 9034 Lab SOP-013	100 grams	300 milliliter wide mouth glass container with Teflon® lined lid. .	≤6°C	28 days from collection to analysis.	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
Shallow Soil Borings/ Deep Soil Borings/Sludge/ Sediment/ IDM	Percent Solids – Gravimetric Analysis	Low	SM20 2540G – Lab SOP-017	50 grams	8-ounce wide mouth glass container with Teflon® lined lid.	≤6°C	NA	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.
Shallow Soil Borings/ Deep Soil Borings/Sediment	Grain size/ Physical Test	Low	ASTM D422- Lab SOP-015	100 grams	8-ounce wide mouth glass container with Teflon® lined lid.	≤6°C	NA	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)	Data Results and Data Package Turnaround
Shallow Soil Borings/ Deep Soil Borings/Sediment	Bulk Density/ Physical Test	Low	ASTM E-868-82 Lab SOP-016	100 grams	8-ounce wide mouth glass container with Teflon® lined lid.	≤6°C	NA	Data will be provided by the laboratory 10 business days from the date of sample receipt at the laboratory. Data packages will be provided by the laboratory 20 business days from the date of sample receipt at the laboratory.

QAPP Worksheet #20: Field QC Summary
(UFP QAPP Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.5)

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
Groundwater	Groundwater Sampling – Overburden Monitoring Wells	VOCs - Gas Chromatography/ Mass Spectrometry (GC/MS)	USEPA Methods 5030B/8000C/ 8260C	5	1	1 Set	1	3	12
Groundwater	Groundwater Sampling – Bedrock Groundwater/Supply Well	VOCs - (GC/MS)	USEPA Methods 5030B/8000C/ 8260C	1	1	1 Set	NA	1	5
Surface and Near-Surface Soil	Shallow Soil Borings	VOCs - GC/MS	USEPA Methods 5035A/8000C/ 8260C	10	1	1 Set	NA	2	15
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway	VOCs - GC/MS	USEPA Methods 5035A/8000C/ 8260C	1	1	1 Set	NA	1	5
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway – Route 203 Right-of-Way	VOCs - GC/MS	USEPA Methods 5035A/8000C/ 8260C	1	1	1 Set	NA	1	5
Surface and Near-Surface Soil	Shallow Soil Borings – National Grid Property	VOCs - GC/MS	USEPA Methods 5035A/8000C/ 8260C	1	1	1 Set	NA	1	5

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
Deep Soil Borings	Deep Soil Borings to 30 Feet Below Ground Surface	VOCs - GC/MS	USEPA Methods 5035A/8000C/ 8260C	1	1	1 Set	NA	1	5
Deep Soil Borings	Deep Soil Borings to 15 Feet Below Ground Surface	VOCs - GC/MS	USEPA Methods 5035A/8000C/ 8260C	1	1	1 Set	NA	1	5
Deep Soil Borings	Deep Soil Borings to 10 Feet Below Ground Surface	VOCs - GC/MS	USEPA Methods 5035A/8000C/ 8260C	3	1	1 Set	NA	1	7
Pond Sediment	Pond Sediment	VOCs - GC/MS	USEPA Methods 5035A/8000C/ 8260C	5	1	1 Set	1	1	10
UST Contents	Liquid Tank Content	VOCs - GC/MS	USEPA Methods 5035A/8000C/ 8260C	1	NA	NA	NA	1	2
IDM – Soil Disposal Characterization	Soil, Tank Content	VOCs – TCLP Preparation - GC/MS	USEPA Methods 1311/5035A/8000C/ 8260C	TBD	NA	NA	NA	NA	TBD
IDM – Liquid Disposal Characterization	Liquid, Tank Content	VOCs – TCLP Preparation - GC/MS	USEPA Methods 1311/5035A/8000C/ 8260C	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM – Solid	VOCs – TCLP Preparation - GC/MS	USEPA Methods 1311/5035A/8000C/ 8260C	TBD	NA	NA	NA	NA	TBD

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
IDM Characterization	IDM – Liquid	VOCs – TCLP Preparation - GC/MS	USEPA Methods 1311/5035A/8000C/ 8260C	TBD	NA	NA	NA	NA	TBD
Groundwater	Groundwater Sampling – Overburden Monitoring Wells	SVOCs - GC/MS	USEPA Methods 3510C/8000C /8270D and 1,4-Dioxane 8270D SIM	5	1	1 Set	1	NA	9
Groundwater	Groundwater Sampling – Bedrock Groundwater/Supply Well	SVOCs - GC/MS	USEPA Methods 3510C/8000C /8270D and 1,4-Dioxane 8270D SIM	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings	SVOCs - GC/MS	USEPA Methods 3546/8000C/ 8270D	10	1	1 Set	NA	NA	13
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway	SVOCs - GC/MS	USEPA Methods 3546/8000C/ 8270D	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway – Route 203 Right-of-Way	SVOCs - GC/MS	USEPA Methods 3546/8000C/ 8270D	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings – National Grid Property	SVOCs - GC/MS	USEPA Methods 3546/8000C/ 8270D	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 30 Feet Below Ground Surface	SVOCs - GC/MS	USEPA Methods 3546/8000C/ 8270D	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 15 Feet Below Ground Surface	SVOCs - GC/MS	USEPA Methods 3546/8000C/ 8270D	1	1	1 Set	NA	NA	4

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
Deep Soil Borings	Deep Soil Borings to 10 Feet Below Ground Surface	SVOCs - GC/MS	USEPA Methods 3546/8000C/ 8270D	3	1	1 Set	NA	NA	6
Pond Sediment	Pond Sediment	SVOCs - GC/MS	USEPA Methods 3546/8000C/ 8270D	5	1	1 Set	1	NA	9
UST Contents	Liquid Tank Content	SVOCs - GC/MS	USEPA Methods 3510C/8000C /8270D	1	NA	NA	NA	NA	1
IDM – Soil Disposal Characterization	Soil, Tank Content	SVOCs – TCLP Preparation - GC/MS	USEPA Methods 1311/3546/ 8000C/8270D	TBD	NA	NA	NA	NA	TBD
IDM – Liquid Disposal Characterization	Liquid, Tank Content	SVOCs – TCLP Preparation - GC/MS	USEPA Methods 1311/3546/ 8000C/8270D	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM – Solid	SVOCs – TCLP Preparation - GC/MS	USEPA Methods 1311/3546/ 8000C/8270D	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM – Liquid	SVOCs – TCLP Preparation - GC/MS	USEPA Methods 1311/3546/ 8000C/8270D	TBD	NA	NA	NA	NA	TBD
Groundwater	Groundwater Sampling – Overburden Monitoring Wells	Pesticides - GC	USEPA Methods 3510C/8081B	5	1	1 Set	1	NA	9
Groundwater	Groundwater Sampling – Bedrock Groundwater/Supply Well	Pesticides - GC	USEPA Methods 3510C/8081B	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings	Pesticides - GC	USEPA Methods 3546/8081B	10	1	1 Set	NA	NA	13
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway	Pesticides - GC	USEPA Methods 3546/8081B	1	1	1 Set	NA	NA	4

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway – Route 203 Right-of-Way	Pesticides - GC	USEPA Methods 3546/8081B	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings – National Grid Property	Pesticides - GC	USEPA Methods 3546/8081B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 30 Feet Below Ground Surface	Pesticides - GC	USEPA Methods 3546/8081B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 15 Feet Below Ground Surface	Pesticides - GC	USEPA Methods 3546/8081B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 10 Feet Below Ground Surface	Pesticides - GC	USEPA Methods 3546/8081B	3	1	1 Set	NA	NA	6
Pond Sediment	Pond Sediment	Pesticides - GC	USEPA Methods 3546/8081B	5	1	1 Set	1	NA	9
UST Contents	Liquid Tank Content	Pesticides - GC	USEPA Methods 3510C/8081B	1	NA	NA	NA	NA	1
IDM – Soil Disposal Characterization	Soil, Tank Content	Pesticides – TCLP Preparation - GC	USEPA Methods 1311/3546/8081B	TBD	NA	NA	NA	NA	TBD
IDM – Liquid Disposal Characterization	Liquid, Tank Content	Pesticides – TCLP Preparation - GC	USEPA Methods 1311/3546/8081B	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM – Solid	Pesticides – TCLP Preparation - GC	USEPA Methods 1311/3546/8081B	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM – Liquid	Pesticides – TCLP Preparation - GC	USEPA Methods 1311/3546/8081B	TBD	NA	NA	NA	NA	TBD
Groundwater	Groundwater Sampling – Overburden Monitoring Wells	PCBs - GC	USEPA Methods 3510C/8082A	5	1	1 Set	1	NA	9

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
Groundwater	Groundwater Sampling – Bedrock Groundwater/Supply Well	PCBs - GC	USEPA Methods 3510C/8082A	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings	PCBs - GC	USEPA Methods 3546/8082A	195	10	10 Sets	NA	NA	225
Surface and Near-Surface Soil	Archived - Shallow Soil Borings	PCBs - GC	USEPA Methods 3546/8082A	TBD	TBD	TBD	NA	NA	TBD
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway	PCBs - GC	USEPA Methods 3546/8082A	27	3	3 Sets	NA	NA	36
Surface and Near-Surface Soil	Archived - Shallow Soil Borings – Eastern Drainageway	PCBs - GC	USEPA Methods 3546/8082A	TBD	TBD	TBD	NA	NA	TBD
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway – Route 203 Right-of-Way	PCBs - GC	USEPA Methods 3546/8082A	2	1	1 Set	NA	NA	5
Surface and Near-Surface Soil	Archived - Shallow Soil Borings – Eastern Drainageway – Route 203 Right-of-Way	PCBs - GC	USEPA Methods 3546/8082A	TBD	TBD	TBD	NA	NA	TBD
Surface and Near-Surface Soil	Shallow Soil Borings – Residential Property to 3 Feet Below Ground Surface	PCBs - GC	USEPA Methods 3546/8082A	48	3	3 Sets	NA	NA	57
Surface and Near-Surface Soil	Archived - Shallow Soil Borings – Residential Property	PCBs - GC	USEPA Methods 3546/8082A	TBD	TBD	TBD	NA	NA	TBD
Surface and Near-Surface Soil	Shallow Soil Borings – Residential Property to 1 Foot Below Ground Surface	PCBs - GC	USEPA Methods 3546/8082A	6	1	1 Set	NA	NA	9
Surface and Near-Surface Soil	Shallow Soil Borings – National Grid Property	PCBs - GC	USEPA Methods 3546/8082A	27	2	2 Sets	NA	NA	33

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
Deep Soil Borings	Deep Soil Borings to 30 Feet Below Ground Surface	PCBs - GC	USEPA Methods 3546/8082A	20	1	1 Set	NA	NA	23
Deep Soil Borings	Archived - Deep Soil Borings to 30 Feet Below Ground Surface	PCBs - GC	USEPA Methods 3546/8082A	TBD	TBD	TBD	NA	NA	TBD
Deep Soil Borings	Deep Soil Borings to 15 Feet Below Ground Surface	PCBs - GC	USEPA Methods 3546/8082A	8	1	1 Set	NA	NA	11
Deep Soil Borings	Archived - Deep Soil Borings to 15 Feet Below Ground Surface	PCBs - GC	USEPA Methods 3546/8082A	TBD	TBD	TBD	NA	NA	TBD
Deep Soil Borings	Deep Soil Borings to 10 Feet Below Ground Surface	PCBs - GC	USEPA Methods 3546/8082A	52	3	3 Sets	NA	NA	61
Deep Soil Borings	Archived - Deep Soil Borings to 10 Feet Below Ground Surface	PCBs - GC	USEPA Methods 3546/8082A	TBD	TBD	TBD	NA	NA	TBD
Pond Sediment	Pond Sediment	PCBs - GC	USEPA Methods 3546/8082A	93	5	5 Sets	5	NA	113
Pond Sediment	Archived - Pond Sediment	PCBs - GC	USEPA Methods 3546/8082A	TBD	TBD	TBD Set	TBD	NA	TBD
UST Contents	Liquid Tank Content	PCBs - GC	USEPA Methods 3510C/8082A	1	NA	NA	NA	NA	1
IDM – Soil Disposal Characterization	Soil, Tank Content	PCBs - GC	USEPA Methods 3546/8082A	TBD	NA	NA	NA	NA	TBD
IDM – Liquid Disposal Characterization	Liquid, Tank Content	PCBs - GC	USEPA Methods 3510C/8082A	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM – Solid	PCBs - GC	USEPA Methods 3546/8082A	TBD	NA	NA	NA	NA	TBD

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
IDM Characterization	IDM – Liquid	PCBs - GC	USEPA Methods 3510C/8082A	TBD	NA	NA	NA	NA	TBD
IDM – Soil Disposal Characterization	Soil, Tank Content	Herbicides – TCLP Preparation - GC	USEPA Methods 1311/3546/ 8151A	TBD	NA	NA	NA	NA	TBD
IDM – Liquid Disposal Characterization	Liquid, Tank Content	Herbicides – TCLP Preparation - GC	USEPA Methods 1311/3546/ 8151A	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM – Solid	Herbicides – TCLP Preparation - GC	USEPA Methods 1311/3546/ 8151A	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM – Liquid	Herbicides – TCLP Preparation - GC	USEPA Methods 1311/3546/ 8151A	TBD	NA	NA	NA	NA	TBD
Groundwater	Groundwater Sampling – Overburden Monitoring Wells	Total and Dissolved Metals - ICP-AES/ ICP-MS	USEPA Methods 3005A/6010D/ 6020B	5	1	1 Set	1	NA	9
Groundwater	Groundwater Sampling – Bedrock Groundwater/Supply Well	Total and Dissolved Metals - ICP-AES/ ICP-MS	USEPA Methods 3005A/6010D/ 6020B	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings	Metals - ICP-AES/ ICP-MS	USEPA Methods 3010A/6010D/ 6020B	10	1	1 Set	NA	NA	13
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway	Metals - ICP-AES/ ICP-MS	USEPA Methods 3010A/6010D/ 6020B	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway – Route 203 Right-of-Way	Metals - ICP-AES/ ICP-MS	USEPA Methods 3010A/6010D/ 6020B	1	1	1 Set	NA	NA	4

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Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
Surface and Near-Surface Soil	Shallow Soil Borings – National Grid Property	Metals - ICP-AES/ ICP-MS	USEPA Methods 3010A/6010D/ 6020B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 30 Feet Below Ground Surface	Metals - ICP-AES/ ICP-MS	USEPA Methods 3010A/6010D/ 6020B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 15 Feet Below Ground Surface	Metals - ICP-AES/ ICP-MS	USEPA Methods 3010A/6010D/ 6020B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 10 Feet Below Ground Surface	Metals - ICP-AES/ ICP-MS	USEPA Methods 3010A/6010D/ 6020B	3	1	1 Set	NA	NA	6
Pond Sediment	Pond Sediment	Metals - ICP-AES/ ICP-MS	USEPA Methods 3010A/6010D/ 6020B	5	1	1 Set	1	NA	9
UST Contents	Liquid Tank Content	Total and Dissolved Metals - ICP-AES/ ICP-MS	USEPA Methods 3005A/6010D/ 6020B	1	NA	NA	NA	NA	1
IDM – Soil Disposal Characterization	Soil, Tank Content	Metals – TCLP Preparation - ICP-AES/ ICP-MS	USEPA Methods 1311/3010A/6010D/ 6020B	TBD	NA	NA	NA	NA	TBD
IDM – Liquid Disposal Characterization	Liquid, Tank Content	Metals – TCLP Preparation - ICP-AES/ ICP-MS	USEPA Methods 1311/3010A/6010D/ 6020B	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM – Solid	Metals – TCLP Preparation - ICP-AES/ ICP-MS	USEPA Methods 1311/3010A/6010D/ 6020B	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM – Liquid	Metals – TCLP Preparation - ICP-AES/ ICP-MS	USEPA Methods 1311/3010A/6010D/ 6020B	TBD	NA	NA	NA	NA	TBD

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
Groundwater	Groundwater Sampling – Overburden Monitoring Wells	Mercury - CVAA	USEPA Method 7470A	5	1	1 Set	1	NA	9
Groundwater	Groundwater Sampling – Bedrock Groundwater/Supply Well	Mercury - CVAA	USEPA Method 7470A	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings	Mercury - CVAA	USEPA Method 7471B	10	1	1 Set	NA	NA	13
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway	Mercury - CVAA	USEPA Method 7471B	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway – Route 203 Right-of-Way	Mercury - CVAA	USEPA Method 7471B	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings – National Grid Property	Mercury - CVAA	USEPA Method 7471B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 30 Feet Below Ground Surface	Mercury - CVAA	USEPA Method 7471B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 15 Feet Below Ground Surface	Mercury - CVAA	USEPA Method 7471B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 10 Feet Below Ground Surface	Mercury - CVAA	USEPA Method 7471B	3	1	1 Set	NA	NA	6
Pond Sediment	Pond Sediment	Mercury - CVAA	USEPA Method 7471B	5	1	1 Set	1	NA	9
UST Contents	Liquid Tank Content	Mercury - CVAA	USEPA Method 7470A	1	NA	NA	NA	NA	1
IDM – Soil Disposal Characterization	Soil, Tank Content	Mercury - TCLP Preparation - CVAA	USEPA Methods 1311/7470A	TBD	NA	NA	NA	NA	TBD

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
IDM – Liquid Disposal Characterization	Liquid, Tank Content	Mercury - TCLP Preparation - CVAA	USEPA Methods 1311/7470A	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM - Solid	Mercury - TCLP Preparation - CVAA	USEPA Methods 1311/7470A	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM - Liquid	Mercury - TCLP Preparation - CVAA	USEPA Methods 1311/ 7470A	TBD	NA	NA	NA	NA	TBD
Groundwater	Groundwater Sampling – Overburden Monitoring Wells	Total Cyanide - Colorimeter	USEPA Method 9012B	5	1	1 Set	1	NA	9
Groundwater	Groundwater Sampling – Bedrock Groundwater/Supply Well	Total Cyanide - Colorimeter	USEPA Method 9012B	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings	Total Cyanide – Colorimeter	USEPA Method 9012B	10	1	1 Set	NA	NA	13
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway	Total Cyanide – Colorimeter	USEPA Method 9012B	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings – Eastern Drainageway – Route 203 Right-of-Way	Total Cyanide – Colorimeter	USEPA Method 9012B	1	1	1 Set	NA	NA	4
Surface and Near-Surface Soil	Shallow Soil Borings – National Grid Property	Total Cyanide – Colorimeter	USEPA Method 9012B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 30 Feet Below Ground Surface	Total Cyanide – Colorimeter	USEPA Method 9012B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 15 Feet Below Ground Surface	Total Cyanide – Colorimeter	USEPA Method 9012B	1	1	1 Set	NA	NA	4
Deep Soil Borings	Deep Soil Borings to 10 Feet Below Ground Surface	Total Cyanide – Colorimeter	USEPA Method 9012B	3	1	1 Set	NA	NA	6

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
Pond Sediment	Pond Sediment	Total Cyanide – Colorimeter	USEPA Method 9012B	5	1	1 Set	1	NA	9
UST Contents	Liquid Tank Content	Total Cyanide – Colorimeter	USEPA Method 9012B	1	NA	NA	NA	NA	1
Surface and Near-Surface Soil	Shallow Soil Borings	TOC – Colorimeter	Lloyd Kahn Method	5	NA	NA	NA	NA	5
Deep Soil Borings	Deep Soil Borings to 30 Feet Below Ground Surface	TOC – Colorimeter	Lloyd Kahn Method	5	NA	NA	NA	NA	5
Pond Sediment	Pond Sediment	TOC – Colorimeter	Lloyd Kahn Method	31	NA	NA	NA	NA	31
IDM – Soil Disposal Characterization	Soil, Tank Content	Ignitability /Pensky-Martin Closed Cup Tester	USEPA Method 40 CFR Part 261.21	TBD	NA	NA	NA	NA	TBD
IDM – Liquid Disposal Characterization	Liquid, Tank Content	Ignitability /Pensky-Martin Closed Cup Tester	USEPA Method 40 CFR Part 261.21	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM - Solid	Ignitability /Pensky-Martin Closed Cup Tester	USEPA Method 40 CFR Part 261.21	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM - Liquid	Ignitability /Pensky-Martin Closed Cup Tester	USEPA Method 40 CFR Part 261.21	TBD	NA	NA	NA	NA	TBD
IDM – Liquid Disposal Characterization	Liquid, Tank Content	Corrosivity / pH – Electrode	USEPA Method 9045D	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM - Liquid	Corrosivity / pH – Electrode	USEPA Method 9045D	TBD	NA	NA	NA	NA	TBD
IDM – Liquid Disposal Characterization	Liquid, Tank Content	Flashpoint /Pensky-Martin Closed Cup Tester	USEPA Method 1010A	TBD	NA	NA	NA	NA	TBD

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
IDM Characterization	IDM - Liquid	Flashpoint /Pensky-Martin Closed Cup Tester	USEPA Method 1010A	TBD	NA	NA	NA	NA	TBD
IDM – Soil Disposal Characterization	Soil, Tank Content	Reactive Cyanide – Colorimeter	USEPA Chapter 7 9012B	TBD	NA	NA	NA	NA	TBD
IDM – Liquid Disposal Characterization	Liquid, Tank Content	Reactive Cyanide – Colorimeter	USEPA Chapter 7 9012B	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM - Solid	Reactive Cyanide – Colorimeter	USEPA Chapter 7 9012B	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM - Liquid	Reactive Cyanide – Colorimeter	USEPA Chapter 7 9012B	TBD	NA	NA	NA	NA	TBD
IDM – Soil Disposal Characterization	Soil, Tank Content	Reactive Sulfide – Titration	USEPA Chapter 7 9034	TBD	NA	NA	NA	NA	TBD
IDM – Liquid Disposal Characterization	Liquid, Tank Content	Reactive Sulfide – Titration	USEPA Chapter 7 9034	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM - Solid	Reactive Sulfide – Titration	USEPA Chapter 7 9034	TBD	NA	NA	NA	NA	TBD
IDM Characterization	IDM - Liquid	Reactive Sulfide – Titration	USEPA Chapter 7 9034	TBD	NA	NA	NA	NA	TBD
Surface and Near-Surface Soil	Shallow Soil Borings	Grainsize/ Physical Test	ASTM D422	5	NA	NA	NA	NA	5
Deep Soil Borings	Deep Soil Borings to 30 Feet Below Ground Surface	Grainsize/ Physical Test	ASTM D422	5	NA	NA	NA	NA	5
Pond Sediment	Pond Sediment	Grainsize/ Physical Test	ASTM D422	5	NA	NA	NA	NA	5
Surface and Near-Surface Soil	Shallow Soil Borings	Bulk Density/ Physical Test	ASTM E-868-82	5	NA	NA	NA	NA	5

Matrix	Sample Type and Project Task	Analyte/ Analytical Group	Analytical Method	Estimated # of Field Samples	Estimated # of Field Duplicates	Estimated # of MS/MSD Sets	Estimated # of Equipment Blanks[1]	Estimated # of Trip Blanks	Estimated # of Total Analyses
Deep Soil Borings	Deep Soil Borings to 30 Feet Below Ground Surface	Bulk Density/ Physical Test	ASTM E-868-82	5	NA	NA	NA	NA	5
Pond Sediment	Pond Sediment	Bulk Density/ Physical Test	ASTM E-868-82	5	NA	NA	NA	NA	5

QC Sample Frequency:
Field Duplicates, MS/MSD Sets: One for every 20 samples per each sampling event for each matrix.
Equipment Blanks: One for every 20 samples per each sampling event for each matrix; not required for dedicated equipment.
Trip Blanks: One for every cooler containing VOCs.
Equipment blanks are not required when samples are collected using dedicated sampling equipment.

QAPP Worksheet #21: Field SOPs
(UFP QAPP Manual Section3.1.2)
(EPA 2106-G-05 Section 2.3.2)

Project Sampling SOP References Table (SOPs are included as Appendix B in this UFP-QAPP)					
SOP Number	**Title, Revision and Date**	**Originating Organization**	**SOP option or Equipment Type (if SOP provides different options)**	**Modified for Project? Y/N**	**Comments**
SOP 001	Field Logbook Entries	OBG	N/A	N	The purpose of this SOP is to describe protocols for recording field survey and sampling information in a field logbook.
SOP 002	Soil Sampling Procedure	OBG	N/A	N	The purpose of this SOP is to define protocols for soil sampling.
SOP 003	NAPL Field Screening Procedure	OBG	N/A	N	The purpose of this SOP is to define protocols for NAPL screening procedures.
SOP 003A	Attachment Field Screening Log	OBG	N/A	N	The purpose of this log is to document field screening activities.
SOP 004	Chain of Custody, Handling, Packing and Shipping	OBG	N/A	N	The purpose of this SOP is to describe protocols for Chain-of-Custody (COC), sample handling, sample packing and shipping.
SOP 005	Field Equipment Decontamination	OBG	N/A	N	This SOP describes the procedures to be followed for decontaminating sampling equipment used during field activities.
SOP 006	Water Level Measurement	OBG	N/A	N	The purpose of this SOP is to define protocols for obtaining water level measurements during well installation, development and sampling.
SOP 007	Monitoring Well Development	OBG	N/A	N	The purpose of this SOP is to describe protocols for monitoring well development.
SOP 008	Low Flow Procedure	OBG	N/A	N	The purpose of this SOP is to describe protocols for low flow procedures.
SOP 009	Photoionization Detector (PID)	OBG	N/A	N	The purpose of this SOP is to describe protocols for PID procedures.

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Project Sampling SOP References Table (SOPs are included as Appendix B in this UFP-QAPP)					
SOP Number	**Title, Revision and Date**	**Originating Organization**	**SOP option or Equipment Type (if SOP provides different options)**	**Modified for Project? Y/N**	**Comments**
SOP 010	UST Sampling	OBG	N/A	N	The purpose of this SOP is to define protocols for UST sampling.
SOP 011	Sediment Sampling and Soft Sediment Probing	OBG	N/A	N	The purpose of this SOP is to define protocols for sediment and soft sediment sampling.
SOP 012	Supply Well Sampling	OBG	N/A	N	The purpose of this SOP is to define protocols for supply well sampling.
SOP 013	EM 31 Geophysics Surveying	OBG	N/A	N	The purpose of this SOP is to define protocols for EM 31 surveying.
SOP 014	GPR Geophysics Surveying	OBG	N/A	N	The purpose of this SOP is to define protocols for GPR surveying.
SOP 015	MAG Geophysics Surveying	OBG	N/A	N	The purpose of this SOP is to define protocols for MAG surveying.

QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection (UFP QAPP Manual Section 3.1.2.4) (EPA 2106-G-05 Section 2.3.6)

Field Equipment	Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
PID	Calibrate for organic vapors using compressed gas cylinders. Calibrate per manufacturer's instructions. Perform end of day calibration check.	Charge batteries. Allow the batteries to totally discharge before recharging to prevent battery memory from occurring. Perform maintenance per manufacturer's instructions.	Evaluation for potential volatile compound concentrations, screening level data use per manufacturer's instructions.	Per manufacturer's instructions.	Daily before use.	Check operations manual for acceptable range of calibrated probe for the specific lamp model.	Check operations manual for corrective action(s). If meter fails to calibrate, do not use this meter.	Field Team Leader	SOP 009
In-Line Water Quality Meter (pH, temperature, specific conductivity, dissolved oxygen, oxidation-reduction potentiality)	Calibrate per manufacturer's instructions.	Perform maintenance per manufacturer's instructions.	Evaluation per manufacturer's instructions.	Per manufacturer's instructions.	Daily before use.	Check operations manual for acceptable criteria.	Check operations manual for corrective action(s). If analyzer fails to calibrate, do not use.	Field Team Leader	SOP 007, SOP 008
Turbidity Meter	Calibrate per manufacturer's instructions.	Perform maintenance per manufacturer's instructions.	Evaluation per manufacturer's instructions.	Per manufacturer's instructions.	Daily before use.	Check operations manual for acceptable criteria.	Check operations manual for corrective action(s). If analyzer fails to calibrate, do not use.	Field Team Leader	SOP 007, SOP 008

QAPP Worksheet #23: Analytical SOPs
(UFP QAPP Manual Section3.2.1)
(EPA 2106-G-05 Section 2.3.4)

SOP Reference Number	Analytical Method and Matrix	Reference Number/ Method/ Analysis Type	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument or Technique	Organization Performing Analysis	Modified for Project Work?
SOP-001A	VOCs / 8260C/ Aqueous	T-VOA-WI8194, Version 8/ SW-846 8260C/ VOCs	VOCs and GRO by GC/MS in Waters and Wastewaters by EPA 8260C/D, 8-JUL-2019	Definitive	Organics – VOCs	GC/MS	ELLE	N
SOP-001B	VOCs / 8260C / Solids	T-VOA-WI8236 Version 8/SW-846 8260C/VOCs	VOCs and GRO by GC/MS in Soils and Solids by EPA 8260C/D, 12-APR-2019	Definitive	Organics – VOCs	GC/MS	ELLE	N
SOP-001C	VOCs Prep /1311/ Solids	T-TL-WI7258/ SW-846 1311 Version 13/VOCs	Volatiles by Zero Headspace Extractor (ZHE) Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312, 17-JUL-2019	Definitive	Organics – VOCs	TCLP Preparation	ELLE	N
SOP-001D	VOCs Prep /5035/ Solids	S-SS-WI11170 Version 19/ SW 846 5035, 5035A/ VOCs	Preparation of Soils for Volatile Analysis by EPA SW846 Method 5035 and Method 5035A, 31-JUL-2018	Definitive	Organics – VOCs	Preparation	ELLE	N
SOP-002A	SVOCs / 8720DSIM/ Aqueous and Solids	T-SVOA-WI9995 Version 15/ SW 846 8270D/SVOCs	Semi-volatiles in Waters and Soils by Methods 8270C/D SIM by GC/MS, 29-JUL-2019	Definitive	Organics – SVOCs	GC/MS	ELLE	N
SOP-002B	SVOCs / 8270D/ Aqueous and Solids	T-SVOA-WI9617 Version 10/ SW 846 8270D/SVOCs	Semi-volatile Organic Compounds by Method 8270D/E in Aqueous and Non Aqueous Matrices using GCMS, 26-APR-2019	Definitive	Organics – SVOCs	GC/MS	ELLE	N
SOP-002C	1,4-Dioxane/ SVOC / 3546 / Solids	T-SVOA-WI13634 Version 2/ SW 876 8270D/SVOCs	The Determination of 1,4Dioxane by GC/MS using Isotope Dilution and Selective Ion Monitoring (SIM) by Method 8270C/D, 26-JUL-2019	Definitive	Organics – SVOCs	GC/MS	ELLE	N

SOP Reference Number	Analytical Method and Matrix	Reference Number/ Method/ Analysis Type	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument or Technique	Organization Performing Analysis	Modified for Project Work?
SOP-002D	SVOC Extraction / 3510C / Aqueous	T-OE-SVOA-WI11432 Version 15/SW 846 3510/SVOCs	Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater,30-APR-2018	Definitive	Organics – SVOCs	Preparation	ELLE	N
SOP-002E	SVOC Extraction / 3546 /Solids	T-OE-SVOAWI10928, Version 13/SW 846 3546/SVOCs	Microwave Extraction by Method 3546 for Semi-volatiles, 20-MAR-2019	Definitive	Organics – SVOCs	Preparation	ELLE	N
SOP-002F	TCLP SVOC Extraction / 1311 / Aqueous	TTLWI7151 Version 13/SW 846 1311/SVOCs	Nonvolatiles Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 13, 17-JUL-2019	Definitive	Organics – SVOCs	TCLP Preparation	ELLE	N
SOP-003A	Pesticides/8081B/ Aqueous	T-PEST-WI9999 Version 7/ SW 846 8081B/ Pesticides	Pesticides in Water by Method 8081B using GC-ECD, 29-MAR-2018l	Definitive	Organics - Pesticides	GC	ELLE	N
SOP-003B	Pesticides/8081B/ Solids	T-PEST-WI9232 Version 6/ SW 846 8081B/ Pesticides	Analysis of Pesticides by 8081B in Solid Samples using GC-ECD/ 29-MAR-2018	Definitive	Organics - Pesticides	GC	ELLE	N
SOP-003C	Pesticides/PCBs/ Cleanup/ Solids	T-OE-PESTWI10281 Version 14/ Cleanup/ Pesticides/PCBs	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs), 08-APR-2019	Definitive	Organics – Pesticides/PCBs	Preparation	ELLE	N
SOP-003D	Pesticides/3546/ Solids	T-OE-PESTWI10926 Version 14/ SW 846 3546/ Pesticides	Microwave Extraction Method 3546 for Pesticides in a Solid Matrix, 01-MAY-2018	Definitive	Organics – Pesticides	Preparation	ELLE	N
SOP-004A	PCBs/8082A/ Aqueous	T-PEST-WI9238 Version 6/ SW 846 8082A/PCBs	Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD, 29-MAR-2018	Definitive	Organics - PCBs	GC	ELLE	N

SOP Reference Number	Analytical Method and Matrix	Reference Number/ Method/ Analysis Type	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument or Technique	Organization Performing Analysis	Modified for Project Work?
SOP-004B	PCBs/8082A/ Solids	T-PEST-WI10004 Version 9/ SW 846 8082A/PCBs	Polychlorinated Biphenyls (PCBs) in Solid Samples by 8082A Using GC-ECD, 29-MAR-2018	Definitive	Organics - PCBs	GC	ELLE	N
SOP-004C	PCBs/Low Level 8082A/ Solids	T-PEST-WI9961/ Version 9/ SW 846 8082A/PCBs	Low Level PCBs in Water by Method 8082/8082A using GC-ECD, 24-MAY-2019	Definitive	Organics - PCBs	GC	ELLE	N
SOP-004D	PCBs/3546/ Solids	T-OE-PESTWI10927/ Version 8/ SW 846 3546/PCBs	Microwave Extraction Method 3546 for PCBs in a Solid Matrix, 01-MAY-2018	Definitive	Organics - PCBs	Preparation	ELLE	N
SOP-005	Herbicides/8151A/ Aqueous	T-PEST-WI9202 Version 17/SW 846/Herbicides	Analysis of Chlorinated Herbicides by 8151A in Water, 28-JUN-2019	Definitive	Organics - Herbicides	GC	ELLE	N
SOP-006A	Metals / 6010C / Aqueous and Solids	T-MET-WI11931 Version 13 / SW-846 6010C / Metals	Metals by ICP for Methods SW846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous), 17-JUL-2019	Definitive	Metals	ICP	ELLE	N
SOP-006B	Metals / 6020A / Aqueous and Solids	T-MET-WI11933 Version 10/ SW 846 6020a/ Metals	Metals by Inductively Coupled Plasma Mass Spectrometry for SW846 Methods 6020/6020A/6020B (aqueous, solid, tissue) and EPA 200.8 (aqueous), 12-JUL-2019	Definitive	Metals	ICP/MS	ELLE	N
SOP-006C	Metals / Preparation / Aqueous	T-MET-WI8639 Version 16/ Preparation/ Metals	Sample Preparation of Waters for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Optical Emission Spectrometry, 03-DEC-2014	Definitive	Metals	Preparation	ELLE	N
SOP-006D	Metals / Preparation / Solids	T-MET-WI8636/ Version 25/ Preparation/ Metals	Sample Prep of Sediments, Sludges, Soils, and Tissues by SW846 3050B for ICP and ICPMS, 08-MAR-2019	Definitive	Metals	Preparation	ELLE	N

SOP Reference Number	Analytical Method and Matrix	Reference Number/ Method/ Analysis Type	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument or Technique	Organization Performing Analysis	Modified for Project Work?
SOP-006E	Metals / Preparation / Leachates, Wastewater	T-MET-WI11937/ Version 12/ Preparation/ Metals	Sample Preparation of Leachates and Other Wastewater for Analysis of Total Metals by Inductively Coupled Plasma Mass Spectrometer (ICPMS), 19-JAN-2015	Definitive	Metals	Preparation	ELLE	N
SOP-006F	Metals / Preparation / Oils	T-MET-WI11926, Version 12/ Preparation/ Metals	Digestion of Oils by EPA 3050B for ICP Analysis, 15-MAR-2019	Definitive	Metals	Preparation	ELLE	N
SOP-006G	Mercury / 7470A/7471B / Aqueous and Solids	T-MET-WI7965 Version 18/ SW 846 7470A, 7471B/Mercury	Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA, 12-AUG-2019	Definitive	Metals	CVAA	ELLE	N
SOP-006H	Mercury / 7470A/7471B / Aqueous and Solids	T-MET-WI11924 Version 21/ SW 846 7470A/Mercury	Digestion of Aqueous Samples by SW846 Method 7470A, 12-AUG-2019	Definitive	Metals	Preparation	ELLE	N
SOP-006I	Mercury/ 7471A/7471B/ Solids	T-MET-WI11948 Version 20, SW 846 7471A/ Mercury	Preparation of Solids by EPA 7471A or B for Mercury Analysis, 069-MAR-2019	Definitive	Metals	Preparation	ELLE	N
SOP-007A	Total Cyanide/ 9012A/ Aqueous and Solids	T-WC-WI11629/ Version 19/ SW 846 9012B/ Total Cyanide	Total, Amenable and Weak Acid Dissociable Cyanide in Waters and Soils, Free Cyanide in Water, Reactive Cyanide of Solids, by SW846 Method 9012A/B, EPA 335.4/3, and SM 4500CN G/E1999/ 201, 27-NOV-2018	Definitive	Total Cyanide	Colorimeter	ELLE	N
SOP-007B	Total Cyanide/ 9012A Distillation/ Aqueous and Solids	T-WC-WI10085/ Version 19/ SW 846 9012B/ Total Cyanide	Total and Amenable Cyanide Distillation in Waters and Solids by SW846 9012A/B, EPA 335.1/3/4, and SM 4500CN G1999/ 2011, 15-OCT-2018	Definitive	Total Cyanide	Preparation	ELLE	N

SOP Reference Number	Analytical Method and Matrix	Reference Number/ Method/ Analysis Type	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument or Technique	Organization Performing Analysis	Modified for Project Work?
SOP-008	Total Organic Carbon (TOC)/ Lloyd Kahn/ Solids	T-WC-WI11627/ Version 17/ Lloyd Kahn/TOC	TOC and TC in Solids and Sludges by Combustion by SM 5310B, EPA 415.1, SW846 9060/9060A, Lloyd Kahn, 09-JUL-2019	Definitive	TOC	Nondispersive Infrared (NDIR) Detector	ELLE	N
SOP-009	Corrosivity/pH/ 9045D/ Solids	T-WC-WI11518/ Version 13/ 9045D/Corrosivity, pH	pH by EPA 9045C, 9045D and Corrosivity by SW846 Chapter 7 of Solids, Soils, and Solvents using Electrometric Methods, 08-JUL-2019	Definitive	Corrosivity/ pH	pH Electrode	ELLE	N
SOP-010	Ignitability/40 CFR Part 261.21/ Solids	T-WC-WI10627/ Version 8/ 40 CFR Part 261.21/ Ignitability	Ignitability of Solids by 40 CFR, Part 261.21, 09-NOV-2015	Definitive	Ignitability	Pensky-Martens Closed Cup Tester	ELLE	N
SOP-011	Flash Point/SW 846 1010A/ Solids	T-WC-WI10612/ Version 2/ SW 846 1010A/Flash Point	Flash Point for Liquids and Solids by ASTM Method D9307, ASTM D9390 or SW846 1010A, 30-JUL-2018	Definitive	Flash Point	Pensky-Martens Closed Cup Tester	ELLE	N
SOP-012	Reactivity/SW 846 Chapter 7.3 Preparation/ Solids	T-WC-WI11574/ Version 14/ SW 846 Chapter 7.3/ Reactivity Preparation	Reactivity of Waste	Definitive	Reactivity Preparation	Preparation	ELLE	N
SOP-013	Reactive Sulfide/SW 846 Chapter 7.3, 9034/ Solids	T-WC-WI11572/ Version 10/ SW 846 Chapter 7.3, 9034/ Reactive Sulfide	Reactive Sulfide (titration) by SW846 9034 (1996) or Chapter 7.3 (1996) in Solid or Liquid Waste, 08-MAR-2019	Definitive	Reactive Sulfide	Titration	ELLE	N
SOP-014	Toxicity Characteristic Leaching Procedure (TCLP)/SW 846 1311/ Solids	T-TL-WI7151/ Version 13/ SW 846 1311/ TCLP Preparation	Nonvolatiles Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312, 17-JUL-2019	Definitive	Reactive Sulfide	TCLP Preparation	ELLE	N

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SOP Reference Number	Analytical Method and Matrix	Reference Number/ Method/ Analysis Type	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument or Technique	Organization Performing Analysis	Modified for Project Work?
SOP-015	Grain Size/ASTM D422-63/ Solids	T-WC-WI11514/ Version 10/ ASTM D422-63/ Grain Size	Particle Size Distribution of Soils and Solids/Grain Size Classification by ASTM D42263 (reapproved 2007), 24-JAN-2019	Screening	Grain Size	Sieving	ELLE	N
SOP-016	Bulk Density/ASTM E868-82/ Solids	T-WC-WI10421/ Version 10/ ASTM E868-82/ Bulk Density	#1443 Specific Gravity by SM 2710F1997, #6569 Bulk Density by ASTM E86882 Sec 9.9, 11-DEC-2018	Screening	Bulk Density	Gravimetric	ELLE	N
SOP-017	Percent Moisture/ SM2540/ASTM 2540/ Percent Moisture	S-SS-WI10697/ Version 17/ SM 2540/ Percent Moisture	% Moisture Calculation and % Solids Calculation (Gravimetric) by SM 2540 G1997 and SM 2540 G2011	Definitive	Percent Moisture	Gravimetric	ELLE	N

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Analytical Instrument Calibration Table - Definitive Data (See associated Tables for additional information)						
Instrument or Method	**Calibration Procedure**	**Frequency of Calibration**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**Laboratory References**
Gas Chromatograph/Mass Spectrometer (GC/MS) (VOCs)	Instrument Performance Check	Once every 12 hours prior to initial calibration and calibration verifications. Analytical sequence must be completed within 12 hours of the GC/MS Instrument Performance Check.	Key ions and abundance criteria listed in the method must be met and analyses must be performed within 12 hours of injection of the BFB.	Tune the mass spectrometer and repeat. Samples cannot be analyzed until method criteria have been met.	Lab analyst	Table 1/ Lab SOPs-001A, 001B
	Initial calibration - Five concentrations bracketing expected concentration range for all target analytes. One standard must be at the quantitation level (QL) concentration.	Prior to sample analysis and when calibration verifications criteria are not met.	Minimum average response factor (RF) as listed in Method 8260C. Linear calibration using RF with relative standard deviation (RSD) less than or equal to 20%. Otherwise use linear calibration with least squares regression (r for un-weighted least squares regression or non-linear calibration using no more than third order with seven standards. Coefficient of Determination (COD) or r^2 must be greater than 0.990.	Correct problem and repeat initial calibration.	Lab analyst	
	Second-source calibration verification - Initial Calibration Verification (ICV)	ICV immediately following each initial calibration.	Within 30% recovery.	Correct problem and repeat initial calibration.	Lab analyst	
	Continuing calibration verification (CCV)	Every 12 hours, following Instrument Performance Check.	Within percent drift or percent difference (%D) of $\leq$ 20 for target analytes. RF requirements are the same as listed in the initial calibration.	Recalibrate and reanalyze all samples since the last acceptable continuing calibration verification.	Lab analyst	

Analytical Instrument Calibration Table - Definitive Data (See associated Tables for additional information)						
Instrument or Method	**Calibration Procedure**	**Frequency of Calibration**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**Laboratory References**
GC/MS (SVOCs)	Instrument Performance Check	Once every 12 hours prior to initial calibration and calibration verifications. Analytical sequence must be completed within 12 hours of the GC/MS Instrument Performance Check	Key ions and abundance criteria listed in the method must be met and analyses must be performed within 12 hours of injection of the performance check.	Tune the mass spectrometer and repeat. Samples cannot be analyzed until method criteria have been met.	Lab analyst	Table 2/ Lab SOPs-002A, 002B, 002C
	Initial calibration - Five concentrations bracketing expected concentration range for all target analytes. One standard must be at the QL concentration.	Prior to sample analysis and when calibration verifications criteria are not met.	Minimum average RF as listed in Method 8270D. Linear calibration using RF with RSD less than or equal to 20%. Otherwise use linear calibration with least squares regression (r for un-weighted least squares regression or non-linear calibration using no more than third order with seven standards. COD or r^2 must be greater than 0.990.	Correct problem and repeat initial calibration	Lab analyst	
	Second-source calibration verification (ICV)	Immediately following each initial calibration	Within 30% recovery.	Correct problem and repeat initial calibration	Lab analyst	
	CCV	Every 12 hours, following Instrument Performance Check.	Within percent drift or percent difference (%D) of $\leq$ 20 for target analytes. RF requirements are the same as listed in the initial calibration.	Recalibrate and reanalyze all samples since the last acceptable continuing calibration verification	Lab analyst	

Analytical Instrument Calibration Table - Definitive Data (See associated Tables for additional information)						
Instrument or Method	**Calibration Procedure**	**Frequency of Calibration**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**Laboratory References**
Gas Chromatograph (GC) (Pesticides, PCBs, Herbicides)	Initial calibration - Minimally five concentrations for single component analytes and for Aroclor 1016/1260. One-point calibration for the remaining Aroclors. One calibration standard must be at concentration less than or equal to the QL.	Prior to sample analysis and when calibration verifications criteria are not met.	If RSD ≤20% the average relative response factor (internal calibration) or average calibration factor (external calibration) is used for quantitation. Otherwise a linear regression calibration with correlation coefficient (r) ≥0.990 is used for quantitation; or a nonlinear first or second order calibration curve with a coefficient of determination (COD) of ≥0.990 is used for quantitation.	Correct problem and repeat initial calibration	Lab analyst	Tables 3, 4, 5 Lab SOPs-003A, 003B, 004A, 004B, 004C, 005
	Second-source calibration verification (ICV) is recommended	ICV immediately following each initial calibration	Percent difference ≤ 30%.	Correct problem and repeat initial calibration	Lab analyst	
	CCV	Every 12 hours or daily, after every 10 samples and at the end of the sequence.	Percent difference ≤ 20%.	Recalibrate and reanalyze all samples since the last acceptable continuing calibration verification	Lab analyst	
	Second-source calibration verification (ICV)	ICV immediately following each initial calibration.	Within 15% percent difference.	Correct problem and repeat initial calibration.	Lab analyst	

Analytical Instrument Calibration Table - Definitive Data (See associated Tables for additional information)						
Instrument or Method	**Calibration Procedure**	**Frequency of Calibration**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**Laboratory References**
Inductively Coupled Plasma (ICP- AES) (ICP/MS) (Metals)	Initial calibration (a blank and at least one standard).	Prior to sample analysis, whenever modifications are made to the system, or when CCV fails.	If more than two standards are used, correlation coefficient must be greater than or equal to 0.998 using first order curve.	Correct problem and repeat initial calibration.	Lab analyst	Table 6/ Lab SOPs- 006A, 006B
	Second-source calibration verification (ICV)	Immediately following each initial calibration.	All analytes must be within 10% of expected value.	Correct problem and repeat initial calibration.	Lab analyst	
	Calibration blanks: Initial Calibration Blank (ICB Continuing Calibration Blank (CCB)	ICB- After ICV CCB- After the CCV; every 10 samples and at the end of a sequence.	Should be less than QL for target analytes.	Reanalyze samples impacted by ICB/CCB.	Lab analyst	
	CCV	After every 10 samples and at the end of the analysis sequence.	All analytes must be within 10% of expected value.	Reanalyze samples impacted by CCV.	Lab analyst	
Cold Vapor Atomic Absorption (CVAA) (Mercury)	Initial calibration includes a blank and 5 standards	Daily, once every 24 hours, whenever modifications are made to the system, or when continuing calibration verification fails	Correlation coefficient must be greater than or equal to 0.995	Correct problem and repeat initial calibration	Lab analyst	Table 7/ Lab SOP-006G
	CCB	After the CCV; after every 10 samples and at the end of a sequence	No analytes detected at or above the QL	Correct the problem, then reanalyze previous 10 samples	Lab analyst	
	CCV	After every 10 samples and at the end of the analysis sequence	All analytes within 20% of true value	Reanalyze samples impacted by CCV	Lab Analyst	

Analytical Instrument Calibration Table - Definitive Data (See associated Tables for additional information)						
Instrument or Method	**Calibration Procedure**	**Frequency of Calibration**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**Laboratory References**
Colorimeter (Total Cyanide), Nondispersive Infrared (NDIR) Detector (TOC)	Initial calibration	Prior to sample analysis or when calibration criteria are not met, using a minimum of 5 standards.	Correlation coefficient must be greater than or equal to 0.995.	Correct problem and repeat initial calibration.	Lab analyst	Tables 7/ Lab SOPs- 007A, 008
	Calibration blank	After the CCV, every 10 samples and at the beginning and end of the analysis sequence.	No analytes detected at or above the QL.	Correct the problem. Re-analyze associated samples.	Lab analyst	
	CCV	After every 10 samples and at the beginning and end of the analysis sequence.	All analytes must be within 10% of the true value.	Re-analyze all associated samples.	Lab analyst	

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection (UFP QAPP Manual Section 3.2.3) (EPA 2106-G-05 Section 2.3.6)

Instrument/ Equipment-Definitive Data	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Gas Chromatograph/Mass Spectrometer (GC/MS) (VOCs, SVOCs)	Check for leaks, replace gas line filters, recondition or replace trap, replace column, clean injection port/liner, replace EM	Monitor instrument performance via CCV	Monitor instrument performance via CCV	Daily, after every 12 hours of operation	Per Laboratory SOP	Replace connections, replace gas line filters, replace trap, replace GC column, clip column, replace injection port liner, clean injection port, replace EM	Laboratory analyst	Lab SOPs-001A, 001B, 002A, 002B, 002C
Gas Chromatograph (GC) (Pesticides, PCBs, Herbicides)	Check for leaks, replace column, clean injection port/liner	Monitor instrument performance via CCV	Monitor instrument performance via CCV	Daily, after every 12 hours of operation	Per Laboratory SOP	Replace connections, replace GC column, clip column, replace injection port liner, clean injection port	Laboratory analyst	Lab SOPs-003A, 003B, 004A, 004B, 004C, 005
Inductively Coupled Plasma (ICP- AES) (ICP/MS) (Metals)	Perform leak test, change pump tubing, change torch and window, clean filters	Monitor instrument performance via CCV and CCB	Monitor instrument performance via CCV and CCB	Daily, after every 10 samples	Per Laboratory SOP	Replace pump tubing, replace torch and window, clean all filters	Laboratory analyst	Lab SOPs-006A, 006B
Cold Vapor Atomic Absorption (CVAA) (Mercury)	Check instrument parameters	Monitor instrument performance via CCV and CCB	Monitor instrument performance via CCV and CCB	Daily, after every 10 samples	Per Laboratory SOP	Change instrument equipment	Laboratory analyst	Lab SOP-006G
Colorimeter (Total Cyanide), Nondispersive Infrared (NDIR) Detector (TOC)	Check instrument parameters	Monitor instrument performance via CCV and CCB	Monitor instrument performance via CCV and CCB	As required.	Per Laboratory SOP	Change analytical column, replace tubing	Laboratory analyst	Lab SOPs-007A, 008

QAPP Worksheet #26 & 27-1: Sample Handling, Custody, and Disposal (UFP QAPP Manual Section 3.3) (EPA 2106-G-05 Section 2.3.3)

SAMPLING ORGANIZATION: OBG
LABORATORIES: Eurofins Lancaster Laboratories Environmental, LLC (ELLE) of Lancaster, Pennsylvania will perform the definitive and screening analytical services.

Method of Sample Delivery (shipper/carrier): Federal Express (or equivalent courier)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT

Sample Collection (Personnel/Organization): Field Team Leader or designee/OBG (SOPs 002, 003, 003A, 004, 010, 011, 012)

Sample Packaging (Personnel/Organization): Field Team Leader or designee/OBG (SOP 004)

Coordination of Shipment (Personnel/Organization): Field Team Leader or designee/ OBG (SOP 004)

Type of Shipment/Carrier: Federal Express (or equivalent courier)

SAMPLE RECEIPT AND ANALYSIS

Sample Receipt (Personnel/Organization): Laboratory sample pick-up staff and Laboratory sample custodian/ELLE

Sample Custody and Storage (Personnel/Organization): Laboratory sample custodian/ELLE

Sample Preparation (Personnel/Organization): Laboratory specific analytical technicians/ELLE

Sample Determinative Analysis (Personnel/Organization): Laboratory specific analytical technicians/ELLE

Samples will be shipped the same day as sample collection by overnight courier to ELLE

SAMPLE ARCHIVING

Field Sample Storage (number of days from sample collection): Laboratory sample custodian will store samples at the laboratory for 30 days after final report has been submitted to OBG. Field samples archived for contingent analysis will be properly store in the laboratory (in sample jars filled in the field) until a determination is made by OBG.

Sample Extract/Digestate Storage (number of days from extraction/digestion): Laboratory specific analytical technicians will store all extracts/digestates for 30 days after final report has been submitted to OBG.

Biological Sample Storage (number of days from sample collection): Not applicable.

SAMPLE DISPOSAL

Personnel/Organization: Laboratory hazardous waste manager/ELLE

Number of Days from Analysis: Samples may not be disposed of prior to 30 days after final report has been submitted to OBG.

QAPP Worksheet #26 & 27-2: Sample Handling, Custody, and Disposal (UFP QAPP Manual Section 3.3) (EPA 2106-G-05 Section 2.3.3)

Sample Custody and Procedures

Chain-of-custody procedures will be instituted and followed throughout the project. These procedures include field custody, laboratory custody, and evidence files. Samples are physical evidence and will be handled according to strict chain-of-custody protocols. The OBG QAO must be prepared to produce documentation that traces the samples from the field to the laboratory and through analysis.

Sample Preparation

The laboratory will supply appropriate sample containers for samples in coolers, as well as preservatives. QA measures for this project will begin with the sample containers; pre-cleaned containers will be purchased by the laboratory from a USEPA-certified manufacturer (I-Chem 200 or equivalent).

Immediately after collection, samples will be transferred to properly labeled sample containers, and properly preserved where appropriate. This UFP-QAPP lists the proper sample container, sample volumes, preservation, and holding times. Samples requiring refrigeration for preservation will be promptly transferred to coolers packed with wet ice and/or ice packs. If field storage is required, the samples will be stored in a secured storage facility and a cooler temperature of ≤6 °C will be maintained.

Field Custody Procedures

The field sampler is personally responsible for the care and custody of the sample until transferred. The field logbook will be used to note information regarding collection of samples and any observations. All entries will be signed and dated. Field logbooks will be waterproof and bound. The logbook will be dedicated to the project and pages will not be removed. Corrections will be made by drawing a single line through the incorrect data and initialing and dating the correction that was made to the side of the error. An initialed diagonal line will be used to indicate the end of an entry or the end of the day's activities.

The following information will be recorded in the field logbook by the field sampling team:

- Name and title of author, date, and time of site entry, and physical/environmental conditions during the field activity;
- Meteorological data;
- Project number, client name, and Site name;
- Name and title of field crew members;
- Sample media;
- Sample collection method, including equipment utilized;
- Number and volume of samples collected;
- Description of sample locations;
- Date and time of sample collection;
- Diagrams of sampling process;
- Sample and QA/QC identification numbers;
- Sample distribution;
- Field observations;
- Field measurements made and equipment used;

- Calculations, results, and calibration data for field sampling and measurements;
- References for maps and photographs of the sample location;
- Bottle lot numbers; and
- Dates and method of sample shipments.

A completed sample identification label or tag that will be sequentially numbered, will be attached to each investigative or QC sample and the sample placed in a shipping container. The identification on the label/tag must be sufficient to enable cross-reference with the logbook. The sample label/tag will be recorded using waterproof, non-erasable ink and will be attached to the sample container using adhesive.

The sample labels/tags will contain the following information:

- Sample location/number identification;
- Site/project name;
- Date and time of sample collection;
- Designation of the sample as a grab or composite;
- Type of sample matrix;
- Name/initials of the sampler;
- Whether the sample is preserved or unpreserved;
- Space for laboratory sample number (only on the sample tag); and
- General types of analysis to be performed.

Chain-of-Custody Procedures

For samples, chain-of-custody records will be kept starting at the time that sample containers are placed in the coolers for transportation to the laboratory. One completed chain-of-custody record must be kept with each sample cooler at all times. Example chain-of-custody forms are provided in the laboratory's Quality Assurance Manual (QAM).

The following measures will be taken when completing a chain-of-custody record:

- Chain-of-custody forms will be completed in waterproof, non-erasable ink;
- Chain-of-custody forms will be completed neatly using printed text. If a simple mistake is made, the error will be lined out with a single line and initialed and dated;
- Each separate sample entry will be sequentially numbered;
- The use of "Ditto" or quotation marks to indicate repetitive information in columnar entries should be avoided. If numerous repetitive entries must be made in the same column, a continuous vertical arrow will be used between the first entry and the next different entry;
- When more than one chain-of-custody form is used for a single shipment, each form will be consecutively numbered using the "Page ___ of ___" format;
- If necessary, additional instructions will be placed directly onto the chain-of-custody form; and
- Acronyms used on a chain-of-custody form will be defined.

The chain-of-custody record will contain the following information:

- Laboratory name and address;

- Project identification and number;
- Sample description/location;
- Required analysis;
- Date and time of sample collection;
- Type and matrix of sample;
- Number of sample containers;
- Analysis requested/comments;
- Sampler signature/date/time;
- Date and signature of the field representative;
- Date and signature of the laboratory representative;
- Carrier used to ship coolers; and
- Air bill number (if shipped by a commercial carrier).

In the case that high concentrations are suspected to be present in the samples, a note to that effect will be included on the chain-of-custody form.

In the field logbook, samplers will note the information previously presented.

Environmental samples will be packed prior to shipment using the following procedures:

- Select a sturdy cooler in good repair and clean. Secure and tape the drain plug in the cooler with fiber or duct tape;
- Be sure the lids on all bottles are tight (will not leak) and baggies are sealed;
- Where applicable, put ice that has been placed in heavy-duty polyethylene bags and properly sealed on top of or between the samples. Pack samples securely to eliminate breakage during shipment with ice packs to maintain the inside temperature at approximately ≤6 °C.
- Sampling containers will be packed with packing materials. When possible, sample container preparation and packing for shipment will be completed in a well-organized and clean area. Sample containers will be prepared for shipment by wiping containers clean of debris/water using paper towels. Paper towels will be disposed with the PPE;
- Place chain-of-custody record into a Ziploc plastic bag, tape the bag to the inner side of the cooler lid, and close the cooler and securely tape (preferably with fiber tape) the top of the cooler shut. Two custody seals will be affixed to the latch and lid of the cooler. The number of the security seal will be recorded on the chain-of-custody form. The custody seals will consist of adhesive-backed tape that easily rips if it is disturbed. The field sampler will initial and date the seal. The seals must be broken to open the cooler and will indicate tampering if the seal is broken before receipt at the laboratory; and
- A label containing the name and address of the shipper will be placed on the outside of the container

The field sampling team will either hand deliver or ship the cooler or box via an overnight delivery service or contact the laboratory to send a courier for pick up. Prior to shipment of sample coolers, the field sampling team will contact the laboratory to notify the laboratory of the shipment. Samples will not be sent to another laboratory without the permission of OBG. Sample shipments will not be left at an unsecured or questionable drop-off location.

Samples will remain in the custody of the sampler until transfer of custody is completed. Transfer consists of:

- Delivery of samples to the Laboratory Sample Custodian; and/or
- Signature of the Laboratory Sample Custodian on the chain-of-custody form as receiving the samples and signature of sampler as relinquishing the samples.

The chain-of-custody document will be completed by the field sampler and provided for each sample cooler. When transferring the possession of samples, individuals relinquishing and receiving will sign, date, and note the time on the chain-of-custody. Custody of samples must be continuous between parties and time gaps must not be present. Each shipment of samples to the laboratory must have its own chain-of-custody record with the contents of the shipment, method of shipment, name of courier, and other pertinent information written on the record. The original record accompanies the shipment and the copies are kept with the field logbook and distributed to the OBG Project Manager. The laboratory will be notified daily of each sample shipment. Freight bills, postal service receipts, and bills of lading will be retained as permanent documentation.

If a carrier is used to take samples between the sampler and the laboratory, the air bill number must be written on the chain-of-custody.

Groundwater, wastewater, sludge, sediment and soil samples will be shipped or transported within 24 hours of being collected.

Laboratory Chain-of-Custody Procedures

Laboratory custody procedures continue when the samples are received by the laboratory. When the samples arrive at the laboratory, the Laboratory Sample Custodian will sign the courier's air bill or bill of lading (unless hand-delivered), will notify the OBG Project Manager or designee of the sample receipt, and will note the cooler temperature on the chain-of-custody form, if temperature preservation is required. If the cooler temperature is greater than 6°C, the OBG Project Manager will be notified. If the samples were shipped, the courier's air bill number will be attached to the chain-of-custody and the air bill number will be written on the chain-of-custody form. If the cooler arrives at the laboratory after hours, an external chain-of-custody will be properly filled out and will accompany the cooler until the laboratory receives the cooler.

The Laboratory Sample Custodian's duties and responsibilities upon sample receipt will be to:

- Document receipt of samples by signing the record with the date and time of sample receipt;
- Note the cooler temperature on the chain-of-custody form;
- Inspect sample shipping containers for the presence or absence of custody seals (only if shipped via overnight courier) and for container integrity;
- Sign the appropriate forms or documents, verify, and record the agreement or disagreement of information on sample documents and, if there are discrepancies, record the problem and notify the OBG Project Manager;
- Assign a number for each sample upon receipt. That sample number will be placed on the sample label which will remain attached to the sample container;
- Log sample information into the laboratory sample tracking system;
- Label sample with a unique, sequential laboratory sample number; and
- Place samples in the walk-in cooler or sample storage area that is a secure, limited-access storage.

If QC samples have not been properly identified during sample collection, the Laboratory Project Manager will contact the OBG Project Manager to assign QC samples prior to the start of sample analysis.

The laboratory will immediately contact the OBG Project Manager if issues pertaining to sample condition or documentation are detected (e.g., broken security seal; broken, open, or otherwise compromised sample containers; chain-of-custody information in disagreement with sample labels; vapor intrusion samples without a residual vacuum).

Final Evidence Files

The final evidence file will be the central repository for documents that constitute evidence relevant to sampling and

analysis activities as described in this UFP-QAPP. OBG is the custodian of the evidence file and maintains the contents of evidence files for the Site, including relevant records, reported, logs, field notebooks, pictures, subcontractor reports, and data reviews.

Copies of the laboratory data packages will be stored by the laboratory for incorporation into the sample file. The Laboratory Project Manager will be responsible for laboratory data packages.

Upon completion of the analyses, the OBG Project Manager will begin assimilating the field and laboratory data. In this way, the file for the samples will be generated.

The final file for the sample will be stored at OBG and will consist of the following, where applicable:

- Laboratory data packages, including summary and raw data from the analysis of environmental and QC samples, chromatograms, mass spectra, calibration data, work sheets, and sample preparation log;
- Chain-of-custody records;
- Data validation reports;
- Field notebooks and data;
- Field collection report;
- Pictures and drawings, if applicable;
- Progress and QA reports;
- Contractor and subcontractor reports; and
- Correspondence.

The evidence file must be maintained in a secured, limited access area until submittals for the project have been reviewed and approved, and for a minimum of 10 years past the submittal date of the final report.

Sample Storage and Handling

At the laboratory, the analysts will be required to log samples and extracts in and out of storage as the analysis proceeds. There must not be a lapse in the custody for the sample containers and exchanges of custody must be documented on the form. Samples will be returned to secure storage at the close of business. Care must be exercised to properly complete, date, and sign records needed to generate the data package.

Procedures to be followed by the laboratory include:

- Samples will be handled by the minimum number of people possible;
- The laboratory will set aside a secured sample storage area consisting of a clean, dry, refrigerated, isolated room;
- A specific person will be designated sample custodian. Incoming samples will be received by the custodian who will indicate receipt by signing the chain-of-custody form;
- The custodian will ensure that samples which are heat-sensitive, light-sensitive, radioactive, or which require special handling in other ways, are properly stored and maintained prior to analysis;
- The analytical area will be restricted to authorized personnel only; and
- After sample analyses are complete, the analytical data will be kept secured and released to authorized personnel only.

QAPP Worksheet #28-1: Analytical Quality Control and Corrective Action
(UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	VOCs - Definitive Data
Analytical Method/ SOP Reference	VOCs/USEPA Methods 1311/5030B/5035A/8260C Lab SOPs 001A, 001B, 001C, 001D

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	Reference WS #18	See Table 1	See Table 1	Field Team Leader/ Lab analyst	Representativeness	See Table 1
Field Duplicate	Reference WS #18	See Table 1	See Table 1	Data Verification Leader	Precision	See Table 1
Matrix Spike	Reference WS #18	See Table 1	See Table 1	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
MS Duplicate	Reference WS #18	See Table 1	See Table 1	Lab analyst	Precision	Reference WS#15-1, -2, -3
Method Blank	See Table 1	See Table 1	See Table 1	Lab analyst	Representativeness	See Table 1
Surrogate Response	See Table 1	See Table 1	See Table 1	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
Internal Standard Response	See Table 1	See Table 1	See Table 1	Lab analyst	Accuracy/ bias	See Table 1
LCS	See Table 1	See Table 1	See Table 1	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3

QAPP Worksheet #28-2: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	SVOCs - Definitive Data
Analytical Method/ SOP Reference	SVOCs/USEPA Methods 1311/3510C/3546/8270D, 8270D SIM Lab SOPs 002A, 002B, 002C, 002D, 002E, 002F

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	Reference WS #18	See Table 2	See Table 2	Field Team Leader/ Lab analyst	Representativeness	See Table 2
Field Duplicate	Reference WS #18	See Table 2	See Table 2	Data Verification Leader	Precision	See Table 2
Matrix Spike	Reference WS #18	See Table 2	See Table 2	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
MS Duplicate	Reference WS #18	See Table 2	See Table 2	Lab analyst	Precision	Reference WS#15-1, -2, -3
Method Blank	See Table 2	See Table 2	See Table 2	Lab analyst	Representativeness	See Table 2
Surrogate Response	See Table 2	See Table 2	See Table 2	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
Internal Standard Response	See Table 2	See Table 2	See Table 2	Lab analyst	Accuracy/ bias	See Table 2
LCS	See Table 2	See Table 2	See Table 2	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3

QAPP Worksheet #28-3: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	Pesticides - Definitive Data
Analytical Method/ SOP Reference	Pesticides/USEPA Methods 1311/3510C/3546/8081B Lab SOPs 003A, 003B, 003C, 003D

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	Reference WS #18	See Table 4	See Table 4	Field Team Leader/ Lab analyst	Representativeness	See Table 4
Field Duplicate	Reference WS #18	See Table 4	See Table 4	Data Verification Leader	Precision	See Table 4
Matrix Spike	Reference WS #18	See Table 4	See Table 4	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
MS Duplicate	Reference WS #18	See Table 4	See Table 4	Lab analyst	Precision	Reference WS#15-1, -2, -3
Method Blank	See Table 4	See Table 4	See Table 4	Lab analyst	Representativeness	See Table 4
Surrogate Response	See Table 4	See Table 4	See Table 4	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
LCS	See Table 4	See Table 4	See Table 4	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3

QAPP Worksheet #28-4: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	PCBs - Definitive Data
Analytical Method/ SOP Reference	PCBs/USEPA Methods 3510C/3546/8082A Lab SOPs 004A, 004B, 004C, 004D

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	Reference WS #18	See Table 3	See Table 3	Field Team Leader/ Lab analyst	Representativeness	See Table 3
Field Duplicate	Reference WS #18	See Table 3	See Table 3	Data Verification Leader	Precision	See Table 3
Matrix Spike	Reference WS #18	See Table 3	See Table 3	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
MS Duplicate	Reference WS #18	See Table 3	See Table 3	Lab analyst	Precision	Reference WS#15-1, -2, -3
Method Blank	See Table 3	See Table 3	See Table 3	Lab analyst	Representativeness	See Table 3
Surrogate Response	See Table 3	See Table 3	See Table 3	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
LCS	See Table 3	See Table 3	See Table 3	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3

QAPP Worksheet #28-5: Analytical Quality Control and Corrective Action
(UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix	IDM
Analytical Group	Herbicides - Definitive Data
Analytical Method/ SOP Reference	USEPA Methods 1311/3510C/8151A Lab SOP 005

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	Reference WS #18	See Table 5	See Table 5	Field Team Leader/ Lab analyst	Representativeness	See Table 5
Calibration Blank	See Table 5	See Table 5	See Table 5	Field Team Leader/ Lab analyst	Representativeness	See Table 5
Field Duplicate	Reference WS #18	See Table 5	See Table 5	Data Verification Leader	Precision	See Table 5
Matrix Spike	Reference WS #18	See Table 5	See Table 5	Lab analyst	Accuracy/ bias	Reference WS#15-3
MS Duplicate	Reference WS #18	See Table 5	See Table 5	Lab analyst	Precision	Reference WS#15-3
Method Blank	See Table 5	See Table 5	See Table 5	Lab analyst	Representativeness	See Table 5
LCS	See Table 5	See Table 5	See Table 5	Lab analyst	Accuracy/ bias	Reference WS#15-3

QAPP Worksheet #28-6: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	Metals - Definitive Data
Analytical Method/ SOP Reference	Metals/USEPA Methods 1311/3005A/3010A/3050B/6010C/6020A Lab SOPs 006A, 006B, 006C, 006D, 006E, 006F

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	Reference WS #18	See Table 6	See Table 6	Field Team Leader/ Lab analyst	Representativeness	See Table 6
Field Duplicate	Reference WS #18	See Table 6	See Table 6	Data Verification Leader	Precision	See Table 6
Calibration Blank	See Table 6	See Table 6	See Table 6	Field Team Leader/ Lab analyst	Representativeness	See Table 6
Matrix Spike	Reference WS #18	See Table 6	See Table 6	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
MS Duplicate	Reference WS #18	See Table 6	See Table 6	Lab analyst	Precision	Reference WS#15-1, -2, -3
Method blank	See Table 6	See Table 6	See Table 6	Lab analyst	Representativeness	See Table 6
LCS	See Table 6	See Table 6	See Table 6	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
Interference Check Sample	See Table 6	See Table 6	See Table 6	Lab analyst	Accuracy/ bias	See Table 6
Serial Dilution	See Table 6	See Table 6	See Table 6	Lab analyst	Accuracy	See Table 6

QAPP Worksheet #28-7: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	Mercury - Definitive Data
Analytical Method/ SOP Reference	Mercury/USEPA Methods 1311/7470A/7471B Lab SOPs 006G, 006H, 006I

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	Reference WS #18	See Table 7	See Table 7	Field Team Leader/ Lab analyst	Representativeness	See Table 7
Field Duplicate	Reference WS #18	See Table 7	See Table 7	Data Verification Leader	Precision	See Table 7
Calibration Blank	See Table 7	See Table 7	See Table 7	Field Team Leader/ Lab analyst	Representativeness	See Table 7
Matrix Spike	Reference WS #18	See Table 7	See Table 7	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
MS Duplicate	Reference WS #18	See Table 7	See Table 7	Lab analyst	Precision	Reference WS#15-1, -2, -3
Method blank	See Table 7	See Table 7	See Table 7	Lab analyst	Representativeness	See Table 7
LCS	See Table 7	See Table 7	See Table 7	Lab analyst	Accuracy/ bias	Reference WS#15-1, -2, -3
Interference Check Sample	See Table 7	See Table 7	See Table 7	Lab analyst	Accuracy/ bias	See Table 7
Serial Dilution	See Table 7	See Table 7	See Table 7	Lab analyst	Accuracy	See Table 7

QAPP Worksheet #28-8: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	Groundwater/Wastewater/Sludge/Shallow Soil Borings/Deep Soil Borings/Sediment/IDM
Analytical Group	Total Cyanide - Definitive Data
Analytical Method/ SOP Reference	Total Cyanide/USEPA Method 9012A Lab SOPs 007A, 007B

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	Reference WS #18	See Table 7	See Table 7	Field Team Leader/ Lab analyst	Representativeness	See Table 7
Field Duplicate	Reference WS #18	See Table 7	See Table 7	Data Verification Leader	Precision	See Table 7
Calibration Blank	See Table 7	See Table 7	See Table 7	Field Team Leader/ Lab analyst	Representativeness	See Table 7
Matrix Spike	Reference WS #18	See Table 7	See Table 7	Lab analyst	Accuracy/ bias	Reference WS#15-1, 15-2
MS Duplicate	Reference WS #18	See Table 7	See Table 7	Lab analyst	Precision	Reference WS#15-1, 15-2
Method blank	See Table 7	See Table 7	See Table 7	Lab analyst	Representativeness	See Table 7
LCS	See Table 7	See Table 7	See Table 7	Lab analyst	Accuracy/ bias	Reference WS#15-1, 15-2
Interference Check Sample	See Table 7	See Table 7	See Table 7	Lab analyst	Accuracy/ bias	See Table 7
Serial Dilution	See Table 7	See Table 7	See Table 7	Lab analyst	Accuracy	See Table 7

Mercury/USEPA Methods 7470A/7471B

QAPP Worksheet #28-9: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	Shallow Soil Borings/Deep Soil Borings/Sediment
Analytical Group	Total Organic Carbon (TOC) - Definitive Data
Analytical Method/ SOP Reference	TOC/Lloyd Kahn Method Lab SOP 008

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	See Table 8	See Table 8	See Table 8	Lab analyst	Representativeness	See Table 8
LCS	See Table 8	See Table 8	See Table 8	Lab analyst	Accuracy/ bias	Reference WS#15-2

QAPP Worksheet #28-10: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	IDM
Analytical Group	Corrosivity/ pH - Definitive Data
Analytical Method/ SOP Reference	Corrosivity USEPA SW846 Chapter 7/ pH/USEPA Method 9045D Lab SOP 009

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	See Table 8	See Table 8	See Table 8	Lab analyst	Representativeness	See Table 8
LCS	See Table 8	See Table 8	See Table 8	Lab analyst	Accuracy/ bias	Reference WS#15-3

QAPP Worksheet #28-11: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	IDM
Analytical Group	Ignitability - Definitive Data
Analytical Method/ SOP Reference	Ignitability/ USEPA 40 CFR 261.21 Lab SOP 010

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	See Table 8	See Table 8	See Table 8	Lab analyst	Representativeness	See Table 8
LCS	See Table 8	See Table 8	See Table 8	Lab analyst	Accuracy/ bias	Reference WS#15-3

QAPP Worksheet #28-12: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	IDM
Analytical Group	Flashpoint - Definitive Data
Analytical Method/ SOP Reference	Flashpoint/ USEPA Method 1010A Lab SOP-011

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	See Table 8	See Table 8	See Table 8	Lab analyst	Representativeness	See Table 8
LCS	See Table 8	See Table 8	See Table 8	Lab analyst	Accuracy/ bias	Reference WS#15-3

QAPP Worksheet #28-13: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	IDM
Analytical Group	Reactive Cyanide - Definitive Data
Analytical Method/ SOP Reference	Reactive Cyanide/ USEPA Method SW846 Chapter 7.3, Method 9012B Lab SOPs -012, 007A, 007B

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Calibration Blank	See Table 8	See Table 8	See Table 8	Field Team Leader/ Lab analyst	Representativeness	See Table 8
Method blank	See Table 8	See Table 8	See Table 8	Lab analyst	Representativeness	See Table 8
LCS	See Table 8	See Table 8	See Table 8	Lab analyst	Accuracy/ bias	Reference WS#15-3

QAPP Worksheet #28-14: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	IDM
Analytical Group	Reactive Sulfide - Definitive Data
Analytical Method/ SOP Reference	Reactive Sulfide/ USEPA Method SW846 Chapter 7.3, Method 9034 Lab SOP-013

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Calibration Blank	See Table 8	See Table 8	See Table 8	Field Team Leader/ Lab analyst	Representativeness	See Table 8
Method blank	See Table 8	See Table 8	See Table 8	Lab analyst	Representativeness	See Table 8
LCS	See Table 8	See Table 8	See Table 8	Lab analyst	Accuracy/ bias	Reference WS#15-3

QAPP Worksheet #28-15: Analytical Quality Control and Corrective Action (UFP QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix	Shallow Soil Borings/Deep Soil Borings/Sediment
Analytical Group	Physical Properties – Grain Size, Bulk Density - Screening Data
Analytical Method/ SOP Reference	Physical Properties – Grain Size – ASTM D422, Bulk Density- ASTM E-868-82 Lab SOPs- 015, 016

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Duplicate	See Lab SOPs-015, 016	See Lab SOPs-015, 016	See Lab SOPs-015, 016	Lab analyst	Precision	See Lab SOPs-015, 016
Blank	See Lab SOPs-015, 016	See Lab SOPs-015, 016	See Lab SOPs-015, 016	Lab analyst	Representativeness	See Lab SOPs-015, 016

QAPP Worksheet #29: Project Documents and Records
(UFP QAPP Manual Section 3.5.1)
(EPA 2106-G-05 Section 2.2.8)

Sample Collection and Field Records			
Record	**Generation**	**Verification**	**Storage location/archival**
Chain-of-custody records	Field Manager	Project Manager	Project File
UFP-QAPP	QAO	Project Manager	Project File
Field logs and notes, field equipment calibration logs, sampling decontamination notes, well diagrams, inspection and maintenance records, photographs	Field Manager	Project Manager	Project File
Shipping air bills	Field Manager	Project Manager	Project File
Project Deviations	Field Manager, QAO or Project Manager	Project Manager	Project File
Corrective Action Reports	Field Manager or QAO	Project Manager	Project File
Training Records	Field Manager	Project Manager	Project File
Laboratory SOPs	Laboratory	QAO	Project File
Laboratory Accreditations	Laboratory	QAO	Project File
Sample Acceptance Checklist/ laboratory information management system (LIMS) Sample Receipts	Laboratory	Project Manager	Project File
Laboratory EDDs	Laboratory	Data Management	Project File
Electronic and hardcopy laboratory data packages (including supportive raw data and QC summary forms for analytical evaluation parameters)	Laboratory	Data Validator	Project File
Data Validation Reports	Data Validator	Project Manager	Project File
Field Audit Results	Field Manager	Project Manager	Project File

Sample Collection and Field Records			
Record	**Generation**	**Verification**	**Storage location/archival**
Corrective Action Reports	Field Manager/ Data Validator	Project Manager	Project File
Project database	Data Management	Project Manager	Project File
Correspondence/Telephone Logs	Field Manager, QAO, Project Manager	Project Manager	Project File

Data Management

The electronic environmental data will be submitted to USEPA in accordance with Region 2's Electronic Data Deliverable (EDD) requirements, including the application of the following:

- Standardized EDD format, in accordance with the Comprehensive EDD Specification Manual, which provides detailed instructions on data preparation as well as identification of data fields that Region 2 requires for data submittals
- Valid Values Tables Reference Manual Spreadsheet for the valid values required for a number of the fields that make up the EDD format
- Basic Manual For Historic Electronic Data which provides reporting requirements for a subset of the comprehensive EDD specification for preparing historic sampling results and project data collected prior to implementation of the EDD.
- Electronic Data Processor which allows for third-party checking of data sets prior to submittal to EPA Region 2.

Project Deliverables

Laboratory Data Package Deliverables

Legally defensible definitive analytical data packages will be provided by the laboratory in both hardcopy and electronic (pdf) format sufficient for data validation as defined in this UFP-QAPP.

Data packages for definitive data will include all materials required for data verification and data review/validation including the following:

Cover Sheet. The cover sheet includes the following information:
- Name, location and certification numbers of laboratory
- Sample delivery group (SDG)
- Contract number
- Client name and address
- Project name and site location
- Statement of data authenticity and official signature of person authorizing report release
- Amendments to previous reports identify the SDG number for the previous report and state the reason(s) for re-issuance of the report.

UFP QAPP: Loeffel Route 203 Property: Worksheets

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Case Narrative that outlines:
- Problems with analysis
- Lists of methods, including preparation methods used
- Cross reference table correlating field sample numbers, laboratory sample numbers, and methods performed
- Define all laboratory data flags
- Deviations of QC sample results from laboratory acceptance limits
- Corrective actions taken by the laboratory
- Other factors that could affect the sample results

Analytical Results that contains:
- Project name and unique ID number
- Field sample ID number as written on custody form
- Laboratory name and location (city and state)
- Laboratory sample ID number
- Preparation and analysis batch numbers
- Date sample collected
- Date sample received
- Date sample extracted or prepared
- Date sample analyzed
- Methods for analysis, preparation and cleanup procedures
- Analyte or parameter
- Method detection limits (MDL) - Adjusted for aliquot size, dilution factors, moisture content
- QL
- Analytical results with correct number of significant figures (results for solid matrices reported on a dry weight basis)
- Concentration units
- Dilution factor: All reported data shall reflect any dilutions and/or concentrations; data from both runs should be reported
- Matrix (soil, aqueous, IDM, etc.)
- Percent moisture or percent solids
- Chromatograms, mass spectra and other raw data
- Sample aliquot analyzed
- Final extract volume
- Sample preservation

Sample Documentation including:
- Chain of custody records, shipping documents, internal receipt forms

QC/QA Information including:
- Internal laboratory QC data with their respective acceptance criteria
- MDLs

- Correlation of QC data with corresponding environmental samples per batch
- Surrogate spike recoveries
- Internal standard responses and recoveries
- LCS spike recoveries
- MS/MSD spike recoveries
- MS/MSD and LCS/LCSD RPD
- Method blanks
- Laboratory and field duplicate RPDs
- Serial dilutions
- ICSA/ICSAB results
- Post-digestion spikes
- Initial calibration and calibration verification summary forms and associated raw data
- GC/MS instrument performance results
- Information to allow complete reconstruction of the analyses that were performed

Laboratory Electronic Data Deliverables for definitive data including:

- CD-ROM containing Adobe Portable Document Format (pdf file) of the complete data package including all raw data reported in hardcopy form
- Hard copy data package (analytical results, case narrative, COC, cross reference table, associated with raw data)
- EDD including sample results and associated QC results: EQuIS 4-file EDD (or equivalent) and USEPA-compliant Region 2 EDD format (USEPA Region II 2013 EDD Comprehensive Electronic Data Deliverable Specification Manual)

Data packages for screening data will include the following:

Cover Sheet. The cover sheet includes the following information:
- Name, location and certification numbers of laboratory
- Sample delivery group (SDG)
- Contract number
- Client name and address
- Project name and site location
- Statement of data authenticity and official signature of person authorizing report release
- Amendments to previous reports identify the SDG number for the previous report and state the reason(s) for re-issuance of the report.

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Case Narrative that outlines:
- Problems with analysis
- Lists of methods, including preparation methods used
- Cross reference table correlating field sample numbers, laboratory sample numbers, and methods performed
- Define all laboratory data flags
- Deviations of QC sample results from laboratory acceptance limits
- Corrective actions taken by the laboratory

- Other factors that could affect the sample results

Analytical Results that contains:
- Project name and unique ID number
- Field sample ID number as written on custody form
- Laboratory name and location (city and state)
- Laboratory sample ID number
- Date sample collected
- Date sample received
- Date sample prepared
- Date sample analyzed
- Methods for analysis and preparation procedures
- Analyte or parameter
- MDL - where applicable, adjusted for aliquot size, dilution factors, moisture content
- QL
- Analytical results with correct number of significant figures
- Concentration units
- Dilution factor: All reported data shall reflect any dilutions and/or concentrations; data from both runs should be reported
- Matrix (soil, water, IDM, etc.)
- Percent moisture or percent solids

Sample Documentation including:
- COC records, shipping documents, internal receipt forms

OBG Data Validation Report

The Data Validation Report will contain separate QA sections in which data quality information collected during the investigation is summarized. The validation report will include the following:

- Guidelines used to evaluate the data;
- Data qualifiers applied to sample results;
- Summary of samples collected and analyses performed;
- Narrative that identifies major and minor analysis excursions detected for each parameter evaluated for each analysis;
- Additional issues and information that may be beneficial to the data user;
- Data summary forms.

The Data Validation Report will be prepared under the direction of the QAO and will include the report on the usability of the data.

OBG Project Reports

The data collected in association with the investigation will be presented in the Final Investigation Report. The report will describe the analytical results from the sample analyses and the sampling and analysis methodologies used and will present the analytical results and data in tabular form.

Additional Reports include:

- Summary of Weekly Conference Calls with USEPA
    - During the investigation field activities, Respondent will schedule and hold weekly conference calls with USEPA to provide updates on progress, upcoming tasks, and any potential issues to be resolved. Subsequent to each conference call, a summary of each conference call will be emailed to USEPA unless otherwise agreed upon by USEPA.
- Monthly Progress Reports submitted to USEPA by the 15th day of each month.
- Interim Deliverable submitted to USEPA within 45 days after the receipt of the final set of laboratory analytical results, or such longer time as specified or agreed to by USEPA.
- Final Investigation Report submitted to USEPA within (a) 60 days after determination by USEPA and Respondent based on the Interim Deliverable that additional field investigation activities are not needed or, in the alternative, (b) 75 days after receipt of the final set of laboratory analytical results from the additional field investigation activities, or such longer time as specified or agreed to by USEPA.

QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action (UFP QAPP Manual Sections 4.1.1 and 4.1.2) (EPA 2106-G-05 Section 2.4 and 2.5.5)

Assessment Type	Frequency (where applicable)	Responsible Party/ Organization Performing Assessment	Estimated Dates/Timeframes	Assessment Deliverable	Deliverable due date
Field Procedure Assessment and UFP-QAPP Compliance	As required	OBG Field Manager	Report due within 14 days of field assessment completion	Field Notes	Report due within 14 days of field assessment completion
Field Audit	As required at the discretion of the Project Team	OBG QAO or Designee	Report due within 14 days of audit completion	Field Notes	Report due within 14 days of audit completion
Field documentation reviews	As required at the discretion of the Project Team	OBG Field Manager	Report due within 14 days of review completion	Field Notes	Report due within 14 days of review completion
Management Reviews	As required at the discretion of the Project Team	OBG Project Manager or designee	Report due within 14 days of review completion	Final Investigation Report	Report due within 14 days of review completion
Correction Action Identification	As required at the discretion of the Project Team	OBG Field Manager/OBG QAO or designee	Report due within 14 days of review completion	Final Investigation Report	Report due within 14 days of review completion
Correction Action Implementation	As required at the discretion of the Project Team	OBG Project Manager or designee	Report due within 14 days of review completion	Final Investigation Report	Report due within 14 days of review completion
Data Validation	If warranted based on TCL/TAL analytical results in soil, sediment, wastewater, sludge and/or groundwater	OBG QAO	Report due within 45 days of determination that data validation is warranted	Validation Report in the Final Investigation Report	Report due within 45 days of determination that data validation is warranted
Internal Project Report Reviews	Once per report and/or report version generated	OBG Project Manager or designee	Report due within 14 days of review completion	Final Investigation Report	Report due within 14 days of review completion
Health and Safety Audit	As required at the discretion of the Project Team	OBG Health & Safety Manager	Report due within 14 days of audit completion	Field Notes	Report due within 14 days of audit completion
Laboratory Technical Systems/Performance Audits	As required at the discretion of the Project Team	OBG QAO or Designee	Report due within 14 days of audit completion	Audit Report	Report due within 14 days of audit completion

QAPP Worksheet #34-1: Data Verification and Validation Inputs
(UFP QAPP Manual Section 5.2.1 and Table 9)
(EPA 2106-G-05 Section 2.5.1)

Verification Input	Description
Project UFP-QAPP, Lab SOPs, Field SOPs	Available for data evaluation and project requirements.
Chain-of-Custody Record and Shipping Forms	Review for completeness when compared to field logs, laboratory data package and UFP-QAPP.
Field Records	Review for completeness based on field activities.
Field Change Notices	Review for accuracy and implementation.
Laboratory Data and Data Package	Review for completeness.
Laboratory Electronic Deliverable(s)	Laboratory run Electronic Data Processor (EDP) and fix errors before submitting EDDs; laboratory review EDDs for completeness
Project Communications	Review for accuracy, implementation and project revisions.

QAPP Worksheet #34-2: Data Verification and Validation Inputs
(UFP QAPP Manual Section 5.2.1 and Table 9)
(EPA 2106-G-05 Section 2.5.1)

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved UFP-QAPP	**X**	
2	Field SOPs	**X**	
3	Laboratory SOPs	**X**	
Field Records			
4	Field Logbooks/ Sampling Logs	**X**	**X**
5	Equipment Calibration Records	**X**	**X**
6	Chain-of-Custody Record	**X**	**X**
7	Sampling Trip Reports	**X**	**X**
8	Sampling diagrams/surveys	**X**	**X**
9	Drilling logs	**X**	**X**
10	Geophysics reports	**X**	**X**
11	Relevant correspondence	**X**	**X**
12	Change orders/deviations	**X**	**X**
13	Field audit reports	**X**	**X**
14	Field corrective action reports	**X**	**X**
Laboratory Analytical Data Package - Definitive Data			
15	Cover sheet (laboratory identifying information)/Case narrative	**X**	**X**
16	Internal laboratory chain-of-custody/Sample receipt records	**X**	**X**
17	Sample chronology (i.e., dates and times of receipt, preparation, & analysis)	**X**	**X**
18	Communication records	**X**	**X**
19	Performance Evaluation results	**X**	**X**
22	Instrument calibration records	**X**	**X**
23	Definition of laboratory qualifiers	**X**	**X**
24	Results reporting forms	**X**	**X**
25	QC sample results	**X**	**X**
26	Corrective action reports	**X**	**X**
27	Supportive raw data	**X**	**X**
28	EDD	**X**	**X**
Final Report			
29	Final Sample Report/Data Evaluation Report	**X**	**X**

Data Review

Field Data Review:

Field measurements and field log information will be reviewed by the Field Manager or designee. Procedures to evaluate field data include reviewing the data entered into the log books to ensure that errors have not been made. The field data documented includes data generated during measurement of field parameters, observations, results of any quality control sample analyses, and field instrument calibrations.

Laboratory Data Review:

Analytical data will be reviewed by the laboratory before submittal to OBG, including all aspects of data generation, reduction, and quality control assessment. Each laboratory analytical section will review 100 percent of the definitive data and the Laboratory QC Manager will perform 100 percent review of 10 percent of the data packages generated for the project. Each laboratory analytical section will review 100 percent of the screening data and the Laboratory QC Manager will perform 100 percent review of 10 percent of the data packages generated for the project. When the required analyses of the samples in a project are complete, entered, and reviewed, a report will be generated. The report will be forwarded to the assigned Laboratory Project Manager or designee for review.

The review or verification at each level by the laboratory will include the following at a minimum:

- Sample receipt procedures and conditions;
- Sample preparation;
- Appropriate SOPs and analytical methodologies;
- Accuracy and completeness of analytical results;
- Correct interpretation of all raw data, including all manual integrations;
- Appropriate application of QC samples and compliance with established control limits;
- Verification of data transfers;
- Documentation completeness (for example, all anomalies in the preparation and analysis have been identified, appropriate corrective actions have been taken and documented in the case narrative(s), associated data have been appropriately qualified, and anomaly forms are complete); and
- Accuracy and completeness of data deliverables (hard copy and electronic).

For excursions identified, the laboratory may apply data qualifiers or address excursions in the case narrative. The definitions of any data qualifiers applied by the laboratory must be defined in the case narrative.

QAPP Worksheet #35: Data Verification Procedures
(UFP QAPP Manual Section5.2.2)
(EPA 2106-G-05 Section 2.5.1)

Verification Input	Description	Responsible for Verification
Field methods	Verify that the field data meets UFP-QAPP requirements for completeness based on the field calibration records. Verify that field QC samples were collected and that sample collection locations are documented. Verify that changes/exceptions are documented and were reported in accordance with requirements.	OBG Field Team Leader
Field documentation	Verify completenss of field notes and documentation.	OBG Field Team Leader
Sampling SOPs	Verify that the sampling SOPs were followed.	OBG Field Team Leader
Analytical Methods	Verify that the analytical methods were followed.	OBG QAO/Data Validator
Method QC Results	Verify that the required QC samples were run and met required limits (where applicable).	OBG QAO/Data Validator
Field QC Results	Verify that the required UFP-QAPP field QC samples were run and met required limits (where applicable) .	OBG QAO
Quantitation Limits	Verify that the sample results met the project QLs specified in the UFP-QAPP.	OBG Project Manager and Data Management Team
Data Validation	Data evaluation using method criteria and UFP-QAPP requirements. Applying current Region II validation guidelines and professional judgement.	OBG QAO
Data usability evaluation	Evaluate data to precision, accuracy, representativeness, comparability and completeness project objectives.	OBG QAO and OBG Project Manager

QAPP Worksheet #36: Data Validation Procedures
(UFP QAPP Manual Section5.2.2)
(EPA 2106-G-05 Section 2.5.1)

Soil, sediment, groundwater, wastewater, sludge and IDM samples will be collected and submitted for laboratory analysis during the investigation. Third-party, fully-validatable, Full Contract Laboratory Program (CLP) equivalent data packages will be obtained from ELLE for the following analyses:

- PCBs for soil and sediment samples;
- Non-PCB TCL/TAL constituents and CN for select soil and sediment samples;
- TCL/TAL constituents and CN for groundwater samples; and
- 1,4-dioxane for groundwater samples.

Data packages will be obtained from ELLE for the soil and sediment samples submitted for analysis of TOC, grain size, and bulk density, and for the aqueous sample(s) collected from the UST for analysis of TCL/TAL constituents and CN. These data packages will consist of a case narrative, analytical results, data qualifications, and field chain-of-custody forms, and the results will not be validated.

Data packages will be obtained from ELLE for the waste characterization samples collected from the IDM (see Section 2.16). These results will not be validated.

Data validation will be performed for the soil, sediment and groundwater sample results for TCL/TAL constituents (including PCBs) and CN, and for the groundwater sample results for 1,4-dioxane. Sufficient QA/QC samples will be collected for the analyses listed above in order to perform the data validation.

Percentage of the Data Validated, Data Validation Level and Turnaround Time[1]	Tasks and Sample Matrix	Analytical Groups*	Validation Criteria**	Data Validator Organization

Full Data Validation for 10 percent of the data generated by ELLE Definitive Data for each analysis and each matrix during field investigation activities specified in Appendix C; Partial validation for the remaining data 45 days from determination that the data validation is warranted	Shallow soil borings, deep soil boring, sediment, and groundwater	VOCs using USEPA Method 8260C, SVOCs using USEPA Method 8270D, 1,4-dioxane using USEPA Method 8270D SIM, pesticides using USEPA Method 8081B, PCBs using USEPA Method 8082A, metals using USEPA Method 6010D/6020B, mercury using USEPA Method 7470A/7471B, and total cyanide using USEPA Method 9012A	See Appendix C	OBG
* The laboratory will analyze samples for this project utilizing guidance from this UFP-QAPP, the analytical methods, and the laboratory SOPs. ** Data will be evaluated using UFP-QAPP requirements; validation qualifiers will be applied using current USEPA Region II validation guidelines and professional judgment. [1] USEPA. 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, USEPA 540-R-08-005.				

QAPP Worksheet #37: Data Usability Assessment (UFP QAPP Manual Section5.2.3 including Table 12) (EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

Data Usability

Data usability will be determined by the OBG project team. Data gaps will be present if a sample is not collected, a sample is not analyzed for the requested parameters, or the data are determined to be unusable (rejected; flagged "R") based on the data validation report.

The specific data quality requirements including precision, accuracy, representativeness, comparability, sensitivity, and completeness will be assessed. Data usability with respect to the DQOs and data uses will be compared to the project requirements. In the event that the completeness objective of 95 percent is not achieved, samples may be recollected at the discretion of the OBG Project Manager.

Based on the QA/QC information review and the qualifiers assigned to the analytical data, an overall evaluation of the data's usability will be performed. Data usability is defined as the percentage of data that remains unqualified or is qualified as approximate or non-detected due to blank contamination, divided by the data reported by the laboratory times 100. The percent usability excludes the data qualified as rejected due to major QA/QC excursions. The non-usable data is defined as the percentage of the data qualified as rejected divided by the data reported by the laboratory times 100. The data usability will be provided for each type of analysis performed.

The data usability evaluation considers the data parameters of precision, sensitivity, accuracy, representativeness, comparability, and completeness which are described as follows:

- Precision is evaluated through the review of field duplicate samples, laboratory duplicates, and MS/MSD samples;
- Sensitivity is evaluated through the review of reported detection limits;
- Accuracy is evaluated through the review of MS/MSD samples, internal standards, surrogate recoveries, LCS recoveries, calibration, and instrument performance checks;
- Representativeness is evaluated through the review of holding times, sample preparation, blank analysis, and target compound identification and quantification;
- Comparability is evaluated through the review of the analytical methods and reporting procedures for consistency; and
- Completeness is defined as the overall percentage of sample results that are determined to be usable.

The need for further QA/QC investigation will be determined on a case-by-case basis, depending on whether data can be extrapolated from adjacent sampling locations, and whether or not the results are necessary based on the results from adjacent locations. Data qualified as approximate (flagged "J" or "UJ") are usable. Although approximated data may be less accurate than unqualified data, approximated results may still be used to evaluate and interpret Site conditions provided that consideration of the data does not compromise the project objectives.

Rejected data (flagged "R") is not usable for quantitative or qualitative purposes. Outliers, if present, are addressed on a case-by-case basis.

If data that are above the regulatory guidance levels are associated with unacceptable data review, the impact on the project objectives will be identified and a corrective action, which may include re-sampling of the data point, will be developed.

If data that are below the guidance levels are associated with unacceptable data review, the impact on the project objectives will be identified and a corrective action, which may include use of the data as approximated or re-sampling of the data point, will be developed.

The Final Investigation Report will describe the effect of any rejected results on the usability of the data in making the project decisions.

TABLES

Table 1
VOCs using USEPA Methods 8000C/8260C
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Sample preservation	Samples must be preserved based on method and QAPP requirements	For aqueous samples: cooler temperature ≤6°C, preserve with HCL to pH≤2, Sealed and Headspace Free. For solid samples: cooler temperature ≤6°C, See QAPP for sample preservation information.	Notify Project Manager since re-sampling may be required. Document corrective action in the case narrative.
Holding times (Sensitivity)	Samples must be analyzed within holding time.	For aqueous and solid samples: Analyze within 14 days from collection for preserved samples. Analysis within 7 days from collection to analysis for aqueous samples not acid preserved. For TCLP - 14 days from collection to extract generation. 14 days from extract generation to analysis. See QAPP for sample collection information.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify QAO since re-sampling may be required. Document corrective action in the case narrative.
MS Tuning (Accuracy)	Once every 12 hours prior to initial calibration and calibration verifications. Analytical sequence must be completed within 12 hours of the GC/MS Instrument Performance Check	Bromofluorobenzene (BFB) key ions and abundance criteria listed in the method Table 3 or Lab SOP must be met for all 9 ions and analyses must be performed within 12 hours of injection of the BFB. Part of the BFB peak will not be background subtracted to meet tune criteria. Documentation of all bromofluorobenzene analyses and evaluation must be included in the data packages.	Tune the mass spectrometer. Document corrective action in the case narrative. Samples cannot be analyzed until control limit criteria have been met.

Table 1
VOCs using USEPA Methods 8000C/8260C
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Initial Calibration Initial Calibration Verification (ICV) (Accuracy)	Prior to sample analysis and when calibration verifications criteria are not met. Initial calibration will contain all target analytes in each standard. Quantitation of analyses will utilize the initial calibration results.	A minimum of five concentrations bracketing expected concentration range for all compounds of interest. One standard must be analyzed at or below the QL concentration. One second-source standard (ICV) must be analyzed immediately following the initial calibration at the mid-calibration concentration. This standard must be within 30% recovery or within laboratory control limits. It is also recommended that a separate standard at the MDL level be analyzed after calibration is complete to check sensitivity. Response factor (RF) as listed in Table 4, Method 8260C. The following exceptions are allowed: RFs ≥ 0.010 for poor purging target analytes such as ketones, acetonitrile, acrolein, propionitrile, vinyl acetate, 1,4-dioxane, alcohols, tetrahydrofuran, and cyclohexanone. For other target analytes not listed on Table 4, RFs ≥ 0.050. For Ketones listed in Table 4 with RFs ≥ 0.010 and less than 0.100 results, data will be qualified as approximate (UJ, J). For compound with %RSD >20, quantitation must be performed using a separate calibration curve and the Coefficient of Determination (COD) must be ≥ 0.99. If linear regression is used for the calibration curve, the low initial calibration standard should be evaluated for accuracy using criteria of %D <30% from true value. Relative retention time (RRT) for each target analyte in each calibration standard must agree within ± 0.06 RRT units	Identify and correct problem. If criteria are still not met, recalibrate. Document corrective action in the case narrative. Samples should not be analyzed until calibration control limit criteria are met. Response factor excursions may result in rejected data during data validation. Contact QAO to discuss problem target analytes before proceeding with analysis.
Calibration Verification (Accuracy)	Every 12 hours, following BFB. The calibration verification will contain all target analytes in each standard at a concentration that is representative of the midpoint of the initial calibration.	Within percent drift or percent difference (%D) ≤ 20 for compound. RFs must meet the criteria listed for initial calibration. The internal standards areas and retention times must meet the method criteria.	Reanalyze. If criteria are still not met, identify and correct problem, recalibrate. Document corrective action in the case narrative; samples should not be analyzed until calibration control limit criteria are met.

Table 1
VOCs using USEPA Methods 8000C/8260C
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Preparation Blank Analysis (Sensitivity)	Every 12 hours, following calibration verification	Methylene chloride less than 3 times QL and 2-butanone and acetone less than 5 times QL remaining analytes less than QL will be provided along with the preparation blank results.	Reanalyze blank. If limits are still exceeded, clean instrument, recalibrate analytical system, and reanalyze all samples if detected for same compounds as in blank. Document corrective action in the case narrative - samples cannot be analyzed until blank criteria have been met.
Field Blank Analysis (Sensitivity)	Collected per QAPP requirements.	Methylene chloride less than 3 times QL and 2-butanone and acetone less than 5 times QL. Remaining analytes less than QL.	Investigate problem. Document in the case narrative.
Trip Blank (Sensitivity)	1 per cooler containing VOC samples.	Methylene chloride less than 3 times QL and 2-butanone and acetone less than 5 times QL. Remaining analytes less than QL.	Investigate problem. Document in the case narrative.
Laboratory Control Sample Analysis (Accuracy)	Each analytical batch (every 12 hours). Prepared independently from calibration standards. Spike must contain all target analytes and should be at a concentration, which is in the lower 1/2 of the calibration curve.	Recovery within laboratory control limits. For compounds without established laboratory control limits, 70-130% recovery will be used. The lowest acceptable control limits for recovery will be 10%.	If recovery failures are above control limits and these compounds are not detected in the associated samples, corrective action is not required. If recovery failures are below control limits, reanalyze LCS and examine results of other QC analyses. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. Document corrective action in the case narrative.
Internal Standards (Accuracy)	All samples and blanks(including MS/MSD)	Response -50% - +200% of internal standards from continuing calibration of the day. RT must be ± 30 sec. from associated calibration verification standard of that sequence.	Reanalyze. If still outside of the limits, report both analyses. Document corrective action in the case narrative.
Surrogate Spike (Accuracy)	All samples and blanks (including MS/MSD)	Recovery within laboratory control limits. The lowest acceptable control limits for recovery will be 10%.	Reanalyze any environmental or QC sample with surrogates that exceed control limits. If still outside of the limits, report both analyses. Document corrective action in the case narrative.

Table 1
VOCs using USEPA Methods 8000C/8260C
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Matrix Spike/ Matrix Spike Dup. (MS/MSD) Analysis (Accuracy/Precision)	Collected per QAPP requirements. Samples from the investigation must be used for MS/MSD analysis. Spike must contain complete list of target analytes.	Recovery and RPD within laboratory control limits. For compounds without established laboratory control limits, 70-130% recovery will be used. The lowest acceptable control limits for recovery will be 10%.	Reanalyze if <10%. It is recommended that if reanalysis is still <10%, report both analyses and document in the case narrative. If >10% and LCS criteria are met, document in case narrative; no additional corrective action required. If LCS criteria are exceeded also, examine other QC data for source of problem; i.e., surrogate recoveries for extraction efficiency and calibration data for instrument performance issues. Reanalyze samples and associated MS/MSD and LCSs as required. Document corrective action in the case narrative
Field Duplicate Analysis (Precision)	Collected per QAPP requirements. Field duplicate will not be identified to the laboratory.	Validation criteria: 30% RPD for waters, 50% RPD for solids. For sample results that are less than or equal to five times the QL, the criterion of plus or minus two times the QL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.

Table 1
VOCs using USEPA Methods 8000C/8260C
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Target Analyte Identification (Accuracy)	As required for identification of target analytes	The intensities of the characteristic ions of a compound maximize in the same scan or within one scan of each other. Selection of a peak by a data system target compound search routine where the search is based on the presence of a target chromatographic peak containing ions specific for the target compound at a compound-specific retention time will be accepted as meeting this criterion. The relative RRT of the sample component is within ± 0.06 RRT units of the RRT of the standard component. The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%.) Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When gas chromatographic peaks obviously represent more than one sample component (i.e., a broadened peak with shoulder(s) or a valley between two or more maxima), appropriate selection of analyte spectra and background spectra is important.	Not applicable
Target Analyte Identification (Accuracy)	As required for identification of target analytes	Examination of extracted ion current profiles of appropriate ions can aid in the selection of spectra, and in qualitative identification of compounds. When analytes co-elute (i.e., only one chromatographic peak is apparent), the identification criteria may be met, but each analyte spectrum will contain extraneous ions contributed by the co-eluting compound.	Not applicable
Target Analyte Quantitation (Accuracy)	Apply USEPA Method 8000C for medium level extraction technique	Moisture correction in accordance with USEPA Method 8000C will be applied to the complete set of solid samples, regardless of the percent moisture content.	Not applicable
Tentatively Identified Compound (Accuracy)	If required, perform for each sample and blank analysis. Non-target compounds will be reported using a Mass Spectral Library search.	Not applicable	Not applicable

Table 1
VOCs using USEPA Methods 8000C/8260C
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Dilutions	When target analyte concentration exceeds upper limit of calibration curve. When matrix interference is demonstrated by the lab and documented in the case narrative (highly viscous samples or a large number of nontarget peaks on the chromatogram). It is recommended that a reagent blank be analyzed if an analyte saturates the detector or if highly concentrated analytes are detected. Otherwise data impacted from carryover cannot be used. Laboratory will note in the data deliverables which analytical runs were reported.	The reagent blank will meet the method blank criteria.	Reanalyze reagent blank until method blank criteria are met. Document corrective action in the case narrative.
pH Determination	Once sample aliquot is taken from the VOC vial, the pH of water samples must be determined.	Record pH and report in the case narrative. pH logs may be requested during data validation.	Not applicable
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable	Not applicable
Percent solids	For solid samples, the percent solids will be determined and sample results will be corrected for percent solids.	Not applicable	Not applicable
Laboratory control limits	Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable	Not applicable

Table 1
VOCs using USEPA Methods 8000C/8260C
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Deliverables as required	Full CLP-like deliverables must be provided to document each audit item for easy reference and inspection. It is recommended that an example calculation be provided for each analysis, for each type of matrix in the data package using samples from the project. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. Final spiking concentrations will be presented in summary form. Standard tracing information will be provided. Cooler temperatures and any observations of bubbles in sample containers will be provided in the data packages. Run logs will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes.
Method and QAPP requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable	Not applicable
Notes: Data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP. Communications with OBG will be documented and included in the data packages.			

Table 2
SVOCs Using USEPA Methods 8000C/8270D/SIM
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Sample preservation	Samples must be preserved based on method and QAPP requirements	For aqueous and soil samples: cooler temperature ≤6°C. See QAPP for sample preservation information.	1. Notify Project Manager since re-sampling may be required. 2. Document corrective action in the case narrative.
Holding times (Sensitivity)	Samples must be extracted and analyzed within holding time.	Extract within 7 days from collection for aqueous samples; 14 days from collection for soil samples. Analyze extracts within 40 days of extraction. For TCLP - 14 days from collection to extract generation. 40 days from extraction to analysis See QAPP for sample collection information.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the QAO since re-sampling may be required.
MS Tuning (Accuracy)	Once every 12 hours prior to initial calibration and calibration verification. Must contain 50ng/uL of 4,4-DDT, pentachlorophenol, and benzidine.	1. DFTPP key ions and abundance criteria listed in the method or Laboratory SOP must be met for all 13 ions and analyses must be performed within 12 hours of injection of the DFTPP. 2. Part of the DFTPP peak will not be background subtracted to meet tune criteria. 3. Documentation of all DFTPP analyses and evaluations must be included in the data packages. 4. Degradation of 4,4-DDT <20%. 5. Tailing factor of ≤2 for benzidine and pentachlorophenol.	1. Tune the mass spectrometer. 2. Document any observations and corrective action in the case narrative - samples cannot be analyzed until control limit criteria have been met.

Table 2
SVOCs Using USEPA Methods 8000C/8270D/SIM
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Initial Calibration Verification (ICV) (Accuracy)	Prior to sample analysis and when calibration verification criteria are not met. Initial calibration will contain all target analytes in each standard. Quantitation of analyses will utilize the initial calibration results.	1. A minimum of five concentrations bracketing expected concentration range for all compounds of interest with one standard at or less than the QL 2. One second-source standard should be analyzed immediately following the initial calibration at the mid-calibration concentration. This standard must be within 30% recovery or within laboratory control limits. 3. It is also recommended that a separate standard at the MDL level be analyzed after calibration is complete to check sensitivity. 4. RFs must meet criteria listed in Method 8270D; remaining RFs must be 0.05. 6. For compounds with %RSD >20, quantification must be performed using a separate calibration curve and the COD must be ≥ 0.99. If linear regression is used for the calibration curve, the low level initial calibration standard should be evaluated for accuracy using criteria of %D < 30% from the true value. 8. Relative retention for each target analyte in each calibration standard must agree within ± 0.06 units.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document any observations and corrective action in the case narrative - samples should not be analyzed until calibration control limit criteria are met.
Calibration Verification (Accuracy)	Every 12 hours, following DFTPP. Calibration verification will contain all target analytes in each standard at a concentration that is representative of the midpoint of the initial calibration.	1. Within method specified criteria, percent drift or percent difference (%D) ≤ 20 for target analytes. Response factor requirements as listed in initial calibration. *2.* The internal standards areas and retention times must meet the method criteria.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document any observations and corrective action in the case narrative - samples should not be analyzed until calibration control limit criteria are met.
Preparation Blank Analysis (Sensitivity)	Prepared with each extraction batch of no more than 20 analytical samples.	1. Common laboratory contaminants (phthalate) less than 5 x QL. Remaining analytes less than QL. 2. QLs and MDLS will be provided along with the preparation blank results.	1. Reanalyze blank. 2. If limits are still exceeded, clean instrument, recalibrate analytical system and re-extract and reanalyze all samples if detected for same compounds as in the blank. 3. Document any observations and corrective action in the case narrative - samples should not be analyzed until blank criteria have been met.
Field Blank Analysis (Sensitivity)	Collected per QAPP requirements.	1. Common laboratory contaminants (phthalate) less than 5 x QL. Remaining analytes less than QL.	1. Investigate problem. 2. Document any observations and corrective actions in the case narrative.

Table 2
SVOCs Using USEPA Methods 8000C/8270D/SIM
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Laboratory Control Sample Analysis (Accuracy)	Prepared with each extraction batch, of no more than 20 analytical samples. Prepared independently from calibration standards. Spike must contain all target compounds and should be at a concentration that is approximately in the lower 1/2 of the calibration curve.	Recovery within laboratory control limits. For compounds without established laboratory control limits, 70 to 130% recovery will be used. The lowest acceptable control limits for recovery will be 10%.	1. If recovery failures are above control limits and these compounds are not detected in the associated samples, no corrective action is required. 2. If recovery failures are below the control limits, reanalyze LCS and examine results of other QC analyses. 3. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. 4. Document any observations and corrective action in the case narrative.
Internal Standards (Accuracy)	All samples and blanks (including MS/MSD).	Response -50% - +200% of the internal standards from the continuing calibration of the day. RT must be ± 30 sec. from calibration verification of that sequence.	Reanalyze. If the re-analysis meets criteria or demonstrates fewer excursions, report the re-analysis result. If the re-analysis does not meet criteria or demonstrates fewer excursions, report the initial analysis and include raw data for both analyses in the data package. Document corrective action in the case narrative.
Surrogate Spike (Accuracy)	All samples, and blanks (including MS/MSD).	Recovery within laboratory control limits. The lowest acceptable control limits for recovery will be 10%.	1. Reanalyze if more than 1 AE or 1 BN fails or if any one surrogate recovery is < 10%. 2. If re-analysis meets criteria, report re-analysis result. 3. If reanalysis recovery fails criteria but recovery is >10%: a. Report the analysis that demonstrates fewer excursions and include raw data for both analyses in the data package. 4. If re-analysis recovery is < 10%, re-extract and re-analyze sample. 5. For re-extracted sample, report the analysis that meets criteria or demonstrates fewer excursions and include raw data for both analyses in the data package. 6. Document corrective action in the case narrative.

Table 2
SVOCs Using USEPA Methods 8000C/8270D/SIM
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Matrix Spike/ Matrix Spike Dup. (MS/MSD) Analysis (Accuracy/Precision)	Collected per QAPP requirements. Samples from the investigation must be used for MS/MSD analysis. Spike must contain complete list of target analytes.	Recovery and RPD within laboratory control limits. For compounds without established laboratory control limits, 70-130% recovery will be used. The lowest acceptable control limits for recovery will be 10%.	1. Reanalyze if <10%. 2. It is recommended that if reanalysis is < 10%, report both analyses and document in the case narrative. 3. If reanalysis is >10%, and LCS criteria are met, document in the case narrative. 4. If LCS criteria are exceeded also, examine other QC data for source of problem; i.e. surrogate recoveries for extraction efficiency and calibration data for instrument performance issues; re-extract or reanalyze samples and associated MS/MSD and LCSs as required.
Field Duplicate Analysis (Precision)	Collected per QAPP requirements. Field duplicate will not be identified to the laboratory.	Validation criteria: 30% RPD for waters, 50% RPD for solids. For sample results that are less than or equal to five times the QL, the criterion of plus or minus two times the QL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.

Table 2
SVOCs Using USEPA Methods 8000C/8270D/SIM
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Target Analyte Identification (Accuracy)	As required for identification of target analytes	1. The intensities of the characteristic ions of a compound maximize in the same scan or within one scan of each other. Selection of a peak by a data system target compound search routine where the search is based on the presence of a target chromatographic peak containing ions specific for the target compound at a compound-specific retention time will be accepted as meeting this criterion. 2. The RRT of the sample component is within ± 0.06 RRT units of the RRT of the standard component. 3. The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%.) 4. Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. 5. Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When gas chromatographic peaks obviously represent more than one sample component (i.e., a broadened peak with shoulder(s) or a valley between two or more maxima), appropriate selection of analyte spectra and background spectra is important. 6. Examination of extracted ion current profiles of appropriate ions can aid in the selection of spectra, and in qualitative identification of compounds. When analytes co-elute (i.e., only one chromatographic peak is apparent), the identification criteria may be met, but each analyte spectrum will contain extraneous ions contributed by the co-eluting compound.	Not applicable
Screening samples	As required for samples suspected to contain high concentrations or matrix interferences	It is highly recommended that samples be screened prior to analysis. Screening data (performed prior to the initial analysis) does not need to be included in the data package. Data for samples analyzed at dilutions for initial or subsequent analyses is required to be included in the data package.	Not applicable

Table 2
SVOCs Using USEPA Methods 8000C/8270D/SIM
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Cleanup	Gel permeation chromatography (GPC) should be performed for water extracts with high molecular weight contaminants.	Calibrate according to method. Criteria must be met as listed in method for calibration and blank analysis.	Clean GPC column or replace.
Tentatively Identified Compound **(Accuracy)**	If required, for each sample and blank analysis. Non-target compounds will be reported using a Mass Spectral Library search.	Not applicable	Not applicable
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable	Not applicable
Percent solids	For solid samples, the percent solids will be determined and sample results will be corrected for percent solids.	Not applicable	Not applicable
Dilutions	1. When target analyte concentration exceed upper limit of calibration curve. 2. When matrix interference demonstrated by lab and documented in the case narrative (highly viscous samples or a large number of non-target peaks on the chromatogram). 3. Samples should be cleaned up during sample preparation/extraction procedure using appropriate methods when matrix interference is present. 4. Laboratory will note in the data deliverables which analytical runs were reported.	The laboratory will not dilute samples unless elevated concentrations of target analytes or matrix interference is demonstrated in the samples.	Not applicable
Laboratory control limits	1. Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated biannually.	Not applicable	Not applicable

Table 2
SVOCs Using USEPA Methods 8000C/8270D/SIM
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency	Laboratory Control Limits	Laboratory Corrective Action
Deliverables as required	1. Full CLP-like deliverables must be provided to document each audit item for easy reference and inspection. 2. It is recommended that an example calculation be provided for each analysis, for each type of matrix in the data package using samples from the project. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. For the initial data package, standard tracing information will be provided. 6. Cooler temperatures will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes.
Method and QAPP requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable	Not applicable
Notes: Data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods that are currently used by the laboratory. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP. Communications with the QAO will be documented and included in the data packages.			

Table 3
PCBs using USEPA Methods 8000C/8082A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Sample preservation	Samples must be preserved based on method and QAPP requirements	For aqueous and soil samples: cooler temperature ≤6°C. See QAPP for sample preservation information.	1. Notify Project Manager since re-sampling may be required. 2. Document corrective action in the case narrative.
Holding Times **(Sensitivity)**	Samples must be extracted and analyzed within holding time.	Extract within 1 year from collection for aqueous samples and 1 year from collection for solid samples. Analyze extracts within 40 days of extraction. 7 days from extract generation to extraction. 40 days from extraction to analysis See QAPP for sample collection information.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the QAO since re-sampling may be required.
Initial Calibration **Initial Calibration Verification (ICV)** **(Accuracy)**	Prior to start up and when criteria are exceeded for continuing calibration. Calibrations must contain all target analytes. Quantitation of analyses will utilize the initial calibration results.	1. Minimally five concentrations for Aroclor 1016/1260 (one point calibration for the remaining Aroclors), one calibration standard must be at concentration less than or equal to the QL. 2. One second-source standard (ICV) should be analyzed immediately following the initial calibration at the mid-calibration concentration. This standard must be within 30% recovery. 3. It is recommended that if results are reported below the QL, a separate standard at the MDL level analyzed after calibration is complete to check sensitivity. 4 It is recommended that if results are reported below the QL, a second-source standard (initial validation verification) at the MDL level analyzed after calibration is complete to check sensitivity with %D <30. at the mid-calibration concentration. 4. If RSD ≤20%, the average relative response factor (internal calibration) or average calibration factor (external calibration) is used for quantitation. If RSD >20%, a linear regression calibration that does not pass through the origin with a correlation coefficient (r) ≥0.990 is used for quantitation; or a nonlinear first or second order calibration curve with a coefficient of determination (COD) of ≥0.990 is used for quantitation.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document any observations and corrective action in the case narrative - samples should not be analyzed until calibration control limit criteria are met.

Table 3
PCBs using USEPA Methods 8000C/8082A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Calibration Verification (Accuracy)	Calibration standards must contain Aroclor 1016/1260 at the mid-range concentration. Calibration verification standards must be analyzed every 20 samples and must bracket each end of the sample sequence. In the case that Aroclors are detected above the MDL concentration in the associated samples, the identified Aroclor must be analyzed within the same 48-hour period as the sample in a valid analytical sequence.	Calibration verification response %D ≤ 20%. RT for each target analyte must be within established RT windows.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. Samples must be bracketed by compliant calibration standards. 3. Document corrective action in the case narrative.
Retention Time Windows (Accuracy)	Retention time windows (absolute retention time) must be established in accordance with USEPA Method 8000B/8000C or relative retention times must be used if internal standards are employed.	Compounds must be within established retention time windows or within laboratory established relative retention time criteria for the succeeding calibration standards. It is recommended that retention time windows be provided for each calibration verification. Retention times for each surrogate analyzed for samples and QC samples should be provided on a summary form.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. 3. Document corrective action in the case narrative.
Method Blank Analysis (Sensitivity)	Prepared with each extraction batch of no more than 20 analytical samples.	1. Less than QL. 2. QLs and MDLS will be provided along with the preparation blank results.	1. Reanalyze blank. 2. If limits are still exceeded, clean instrument, recalibrate analytical system and re-extract and reanalyze all samples if detected for same compounds as in the blank. 3. Document any observations and corrective action in the case narrative - samples should not be analyzed until blank criteria have been met.
Field Blank Analysis (Sensitivity)	Collected per QAPP requirements.	Less than QL.	1. Investigate problem. 2. Document any observation or in the case narrative.
Instrument Blank Analysis (Sensitivity)	Must be analyzed at the beginning of 12-hour sequence, following the initial calibration verification standard.	Less than QL.	1. Reanalyze. 2. If limits are still exceeded, re-extract and reanalyze method blank and associated samples. Samples must not be analyzed until method blank criteria are met. 3. Document corrective action in the case narrative.

Table 3
PCBs using USEPA Methods 8000C/8082A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Laboratory Control Sample Analysis (Accuracy)	Prepared with each extraction batch, of no more than 20 analytical samples. Prepared independently from calibration standards LCS will be spiked with the Aroclor 1016/1260 at concentrations near the midpoint of the calibration curve. Other Aroclors may be used in the LCS analysis if requested.	Recovery within laboratory control limits. For compounds without established laboratory control limits, 70 to 130% recovery will be used. The lowest acceptable control limits for recovery will be 10%.	1. If recovery failures are above control limits and these compounds are not detected in the associated samples, no corrective action is required. 2. If recovery failures are below the control limits, reanalyze LCS and examine results of other QC analyses. 3. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. 4. Document any observations and corrective action in the case narrative.
MS/MSD Analysis (Accuracy/Precision)	Field collected at a frequency listed in the QAPP MS/MSDs will be spiked with the Aroclor 1016/1260 at concentrations near the midpoint of the calibration curve. Other Aroclors maybe be used in the MS/MSD analysis if requested. Samples from the investigation must be used for MS/MSD analysis.	Recovery and RPD within laboratory control limits. For compounds without established laboratory control limits, 70-130% recovery will be used. The lowest acceptable control limits for recovery will be 10%.	1. Reanalyze if <10%. 2. It is recommended that if reanalysis is < 10%, report both analyses and document in the case narrative. 3. If reanalysis is >10%, and LCS criteria are met, document in the case narrative. 4. If LCS criteria are exceeded also, examine other QC data for source of problem; i.e. surrogate recoveries for extraction efficiency and calibration data for instrument performance issues; re-extract or reanalyze samples and associated MS/MSD and LCSs as required.

Table 3
PCBs using USEPA Methods 8000C/8082A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Surrogate Spike (Accuracy)	Samples, blanks, MS/MSDs, and LCSs must be spiked with method specified surrogate compounds on each column used in the analysis.	Recovery within laboratory control limits. Corrective action is not required if one of the four surrogates (for two columns) has recovery outside of control limits if the recovery is >10% and the remaining three surrogates are within control limits. Surrogate recoveries for each surrogate on each column must be provided in a summary form. The lowest acceptable control limits for recovery will be 10%.	1. Reanalyze. 2. If re-analysis meets criteria, report re-analysis result. 3. If reanalysis recovery fails criteria but recovery is >10%: a. Report the analysis that demonstrates fewer excursions and include raw data for both analyses in the data package. 4. If re-analysis recovery is < 10%, re-extract and re-analyze sample. 5. For re-extracted sample, report the analysis that meets criteria or demonstrates fewer excursions and include raw data for both analyses in the data package. 6. Document corrective action in the case narrative.
Field Duplicate Analysis (Precision)	Collected per QAPP requirements. Field duplicate will not be identified to the laboratory.	Validation criteria: 30% RPD for waters, 50% RPD for solids. For sample results that are less than or equal to five times the QL, the criterion of plus or minus two times the QL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.
Target Analyte Identification (Accuracy)	As required for identification of target analytes	Retention times must be within established retention time windows or must meet relative retention time criteria. Confirmation analysis is required. It is recommended that retention time windows must be provided for each calibration verification. USEPA CLP Form 10 Summary form, providing the %D and retention times for all detected analytes in samples and QC samples, will be provided.	1. Investigate problem; reanalyze calibration standards to check for retention time shift. 2. Document corrective action in the case narrative.

Table 3
PCBs using USEPA Methods 8000C/8082A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Quantitation (Accuracy)	Samples, blanks, and QC data.	Confirmation analysis is required. Internal or external standard method may be used. Verify concentration is within linear calibration range of standards. %D must be less than 40% (method requirement): %D - Difference between Primary column concentration and the Confirmation column divided by the Primary column times 100. If result for lower concentration is reported, %D - Difference between lower concentration and higher concentration divided by lower concentration times 100. Aroclor concentration is determined using response factor for each of the characteristic peaks and then averaging the five concentrations. Peak areas from a minimum of three Aroclor peaks unique to the target Aroclor will be used to quantitate the Aroclor concentration. Every effort must be made to meet specified QL requirements. Lab must state the technique used for quantitation of results for the samples.	1. If concentration is above linear calibration range, dilute sample and reanalyze. Dilution should result in concentration in the upper calibration range of the instrument. 2. Document corrective action in the case narrative.
Chromatography Presentation	For each standard, sample and QC sample analysis.	Copies of chromatograms provided in the data package must be large enough to view during validation; detail of each peak involved in the Aroclor identification, including peak shape and associated baseline. In the case that matrix interference is detected or manual integration is performed, enlarged copies of those manipulations will be included in the data package for review.	1. Provide requested information.
Cleanup	Acid wash clean-up is required for PCB extracts.	Not applicable	Not applicable
Screening samples	As required for samples suspected to contain high concentrations or matrix interferences	It is highly recommended that samples be screened prior to analysis. Screening data (performed prior to the initial analysis) does not need to be included in the data package. Data for samples analyzed at dilutions for initial or subsequent analyses is required to be included in the data package.	Not applicable

Table 3
PCBs using USEPA Methods 8000C/8082A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages. USEPA Form 8 Summary form, providing the date, time of analysis of samples and QC samples, surrogate retention times and surrogate retention time window, should be provided.	Not applicable	Not applicable
Confirmation Analysis	Dual column quantitation and qualitative confirmation is required. The information presented in CLP Form 10 will be provided in the data package for evaluation.	Not Applicable	Not Applicable
Laboratory control limits	Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable	Not applicable
Percent solids	For solids samples, the percent solids will be determined and sample results will be corrected for percent solids.	Not applicable	Not applicable
Dilutions	1. When target analyte concentration exceed upper limit of calibration curve. 2. When matrix interference demonstrated by lab and documented in the case narrative (highly viscous samples or a large number of non-target peaks on the chromatogram). 3. Samples should be cleaned up during sample preparation/extraction procedure using appropriate methods when matrix interference is present. 4. Laboratory will note in the data deliverables which analytical runs were reported.	The laboratory will not dilute samples unless elevated concentrations of target analytes or matrix interference is demonstrated in the samples.	Not applicable

Table 3
PCBs using USEPA Methods 8000C/8082A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Deliverables as required	1. Full CLP-like deliverables must be provided to document each audit item for easy reference and inspection. 2. It is recommended that an example calculation be provided for each analysis, for each type of matrix in the data package using samples from the project. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. For the initial data package, standard tracing information will be provided. 6. Cooler temperatures will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes.
Method and QAPP requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable	Not applicable

Notes:

Data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods that are currently used by the laboratory. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP.
Communications with the QAO will be documented and included in the data packages.

Table 4
Pesticides using USEPA Methods 8000C/8081B
Quality Control Requirements and Corrective Actions.

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Sample preservation	Samples must be preserved based on method and QAPP requirements	For aqueous and soil samples: cooler temperature ≤6°C. See QAPP for sample preservation information.	1. Notify Project Manager since re-sampling may be required. 2. Document corrective action in the case narrative.
Holding Times (Sensitivity)	Samples must be extracted and analyzed within holding time.	Extract within 7 days from collection for aqueous samples and 14 days from collection for solid samples. Analyze extracts within 40 days of extraction. For TCLP - 14 days from collection to extract generation. 7 days from extract generation to extraction. 40 days from extraction to analysis See QAPP for sample collection information.	1. If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the Project Manager immediately since re-sampling may be required. 2. Document any observations and corrective action in the case narrative.
Initial Calibration Initial Calibration Verification (ICV) (Accuracy)	Prior to start up and when criteria are exceeded for continuing calibration. Calibrations must contain all target analytes. Quantitation of analyses will utilize the initial calibration results.	1. Minimally five concentrations for each single component analyte. One calibration standard must be at concentration less than or equal to the QL. 2. It is recommended that one second-source ICV standard be analyzed immediately following the initial calibration at the mid-calibration concentration. This standard must be within 30% recovery. 3. It is recommended that if results are reported below the QL, a separate standard at the MDL level analyzed after calibration is complete to check sensitivity. 4. Toxaphene requires a single point calibration. If detected in samples, the samples are re-analyzed behind a five-point calibration for each detected analyte. 5. If RSD ≤20% the average relative response factor (internal calibration) or average calibration factor (external calibration) is used for quantitation. If RSD >20% a linear regression calibration that does not pass through the origin with a correlation coefficient (r) ≥0.990 is used for quantitation; or a nonlinear first or second order calibration curve with a coefficient of determination (COD) of ≥0.990 is used for quantitation. 6. 8081B- Degradation of 4,4'-DDT/ endrin to 4,4'-DDE, 4,4'-DDD/ endrin ketone, endrin breakdown must be less than 15%.	1. Identify and correct problem. 2. Recalibrate instrument; samples should not be analyzed until initial calibration criteria are met. 3. Document any observations and corrective action in the case narrative.

Table 4
Pesticides using USEPA Methods 8000C/8081B
Quality Control Requirements and Corrective Actions.

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Calibration Verification (Accuracy)	Single component analyte calibration standards must contain each target analyte at mid-range concentration. Calibration verification standards must be analyzed at the beginning of 12-hour sequence and every 20 samples (every 10 samples is recommended), and at the close of the sequence. Pesticides- A standard containing 4,4-DDT and endrin must be analyzed at the beginning of each 12-hour sequence.	Calibration verification response (% difference) or concentration (% drift) ≤ 20%. Pesticides- Degradation for 4,4-DDT and endrin must be <15%. Method 8081B- Degradation of 4,4'-DDT/ endrin to 4,4'-DDE, 4,4'-DDD/ endrin ketone, endrin breakdown must be less than 15%.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. Samples must be bracketed by compliant calibration standards. 3. Document any observations and corrective action in the case narrative.
Retention Time Windows (Accuracy)	Retention time windows (absolute retention time) must be established in accordance with USEPA Method 8000B/8000C or relative retention times must be used if internal standards are employed.	Compounds must be within established retention time windows or within laboratory established relative retention time criteria for the succeeding calibration standards. It is recommended that retention time windows be provided for each calibration verification. Retention times for each surrogate analyzed for samples and QC samples should be provided on a summary form.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. 3. Document any observations and corrective action in the case narrative.
Method Blank Analysis (Sensitivity)	Method Blank: 1 per 20 samples of similar matrix extracted at the same time and undergo same cleanup procedures as samples or a separate cleanup blank must be prepared and analyzed. Instrument blank: Must be analyzed at the beginning of 12-hour sequence, following the initial calibration verification standard.	Target analyte concentrations must be less than QL.	1. Reanalyze. 2. If limits are still exceeded, re-extract and reanalyze method blank and associated samples. Samples must not be analyzed until method blank criteria are met. 3. Document any observations and corrective action in the case narrative.
Field Blank Analysis (Sensitivity)	Collected per QAPP requirements.	1. Common laboratory contaminants (phthalate) less than 5 x QL. Remaining analytes less than QL. 2. QLs and MDLS will be provided along with the blank results.	1. Investigate problem. 2. Document any observations and corrective actions in the case narrative.

Table 4
Pesticides using USEPA Methods 8000C/8081B
Quality Control Requirements and Corrective Actions.

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Laboratory Control Sample (Accuracy)	Prepared with each extraction batch, of no more than 20 analytical samples. Prepared independently from calibration standards. LCSs must be spiked with each of the single component analyte at concentrations near the mid point of the calibration curve.	Percent recoveries must be within laboratory control limits. For compounds without established laboratory control limits, 70-130% recovery will be used. The lowest acceptable control limits for recovery will be 10%.	1. If recovery failures are above control limits and these compounds are not detected in the associated samples, no corrective action is required. 2. If recovery failures are below the control limits, reanalyze LCS and examine results of other QC analyses. 3. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. 4. Document any observations and corrective action in the case narrative.
Matrix Spike/ Matrix Spike Dup. (MS/MSD) Analysis (Accuracy/Precision)	Collected per QAPP requirements. MS/MSDs must be spiked with each of the single component analyte at concentrations near the midpoint of the calibration curve. Samples from the investigation must be used for MS/MSD analysis. If samples were not designated as MS/MSD samples, contact QAO upon receipt of samples at the laboratory.	Recovery and RPD within laboratory control limits. For compounds without established laboratory control limits, 70-130% recovery will be used. The lowest acceptable control limits for recovery will be 10%.	1. Reanalyze if <10%. 2. It is recommended that, if reanalysis is < 10%, report both analyses and document in the case narrative. 3. If reanalysis is >10%, and LCS criteria are met, document in the case narrative. 4. If LCS criteria are exceeded also, examine other QC data for source of problem; i.e. surrogate recoveries for extraction efficiency and calibration data for instrument performance issues; re-extract or reanalyze samples and associated MS/MSD and LCSs as required.

Table 4
Pesticides using USEPA Methods 8000C/8081B
Quality Control Requirements and Corrective Actions.

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Surrogate Spike (Accuracy)	Samples, blanks, MS/MSDs, and LCSs must be spiked with method specified surrogate compounds on each column used in the analysis.	Recovery within laboratory control limits. Corrective action is not required if one of the four surrogates (for two columns) has recovery outside of control limits if the recovery is >10% and the remaining three surrogates are within control limits. Surrogate recoveries for each surrogate on each column must be provided in a summary form. The lowest acceptable control limits for recovery will be 10%.	1. Reanalyze. 2. If re-analysis meets criteria, report re-analysis result. 3. If reanalysis recovery fails criteria but recovery is >10%: a. Report the analysis that demonstrates fewer excursions and include raw data for both analyses in the data package. 4. If re-analysis recovery is < 10%, re-extract and re-analyze sample. 5. For re-extracted sample, report the analysis that meets criteria or demonstrates fewer excursions and include raw data for both analyses in the data package. 6. Document corrective action in the case narrative.
Field Duplicate Analysis (Precision)	Collected per QAPP requirements. Field duplicate will not be identified to the laboratory.	Validation criteria: 30% RPD for waters, 50% RPD for solids. For sample results that are less than or equal to five times the QL, the criterion of plus or minus two times the QL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.
Target Analyte Identification (Accuracy)	As required for identification of target analytes	Retention times must be within established retention time windows or must meet relative retention time criteria. Dual column confirmation (quantitative and qualitative) analysis is required. Retention time windows must be provided for each calibration verification. USEPA CLP Form 10 Summary form, providing the percent difference and retention times for all detected analytes in samples and QC samples, will be provided. Percent difference must be less than 40 %D. %D calculation: Difference between Higher concentration of sample and Lower concentration of sample divided by the Lower concentration of sample times 100.	1. Investigate problem; reanalyze calibration standards to check for retention time shift. 2. Document any observations and corrective action in the case narrative.

Table 4
Pesticides using USEPA Methods 8000C/8081B
Quality Control Requirements and Corrective Actions.

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Screening samples	As required for samples suspected to contain high concentrations or matrix interferences	It is highly recommended that samples be screened prior to analysis. Screening data (performed prior to the initial analysis) does not need to be included in the data package. Data for samples analyzed at dilutions for initial or subsequent analyses is required to be included in the data package.	Not applicable
Quantitation	Samples, blanks, and QC data.	Confirmation analysis is required. Internal or external standard method may be used. Verify concentration is within linear calibration range of standards. Every effort must be made to meet specified QL requirements. Lab must state the technique used for quantitation of results for the samples.	1. If concentration is above linear calibration range, dilute sample and reanalyze. Dilution should result in concentration in the upper calibration range of the instrument. 2. Document any observations and corrective action in the case narrative.
Chromatography Presentation	For each standard, sample and QC sample analysis.	Copies of chromatograms provided in the data package must be large enough to view during validation. In the case that matrix interference is detected or manual integration is performed, enlarged copies of those manipulations will be included in the data package for review.	1. Provide requested information.
Cleanup (Where applicable)	GPC must be performed for all pesticide solids or water extracts with high molecular weight contaminants. Sulfur cleanup must be performed for all sample extracts contaminated with sulfur. Florisil cartridge cleanups should be performed for all pesticide extracts.	Calibrate according to method. Criteria must be met as listed in method.	1. For GPC, perform column maintenance, recalibrate. 2. For florisil, obtain a new lot of cartridges.
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages. USEPA Form 8 Summary form, providing the date, time of analysis of samples and QC samples, surrogate retention times and surrogate retention time window, should be provided.	Not applicable	Not applicable
Confirmation Analysis	Dual column quantitation and qualitative confirmation will be performed. The information presented in CLP Form 10 will be provided in the data package for evaluation	Not applicable	Not applicable

Table 4
Pesticides using USEPA Methods 8000C/8081B
Quality Control Requirements and Corrective Actions.

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Laboratory control limits	Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable	Not applicable
Percent solids	For solids samples, the percent solids will be determined and sample results will be corrected for percent solids.	Not applicable	Not applicable
Dilutions	1. When target analyte concentration exceed upper limit of calibration curve. 2. When matrix interference demonstrated by lab and documented in the case narrative (highly viscous samples or a large number of non-target peaks on the chromatogram). 3. Samples should be cleaned up during sample preparation/extraction procedure using appropriate methods when matrix interference is present. 4. Laboratory will note in the data deliverables which analytical runs were reported.	1. The reagent blank will meet the method blank criteria.	1. Reanalyze reagent blank until method blank criteria are met.
Deliverables as required	1. Full CLP-like deliverables must be provided to document each audit item for easy reference and inspection. 2. It is recommended that an example calculation be provided for each analysis, for each type of matrix in the data package using samples from the project. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. Standard tracing information will be provided. 6. Cooler temperatures will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes.

Table 4
Pesticides using USEPA Methods 8000C/8081B
Quality Control Requirements and Corrective Actions.

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Method and QAPP requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable	Not applicable
Notes: Data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods that are currently used by the laboratory. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP. Communications with the QAO will be documented and included in the data packages.			

Table 5
Herbicides using USEPA Methods 8000C/8151A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Sample preservation	Samples must be preserved based on method and QAPP requirements	For aqueous and soil samples: cooler temperature ≤6°C. See QAPP for sample preservation information.	1. Notify Project Manager since re-sampling may be required. 2. Document corrective action in the case narrative.
Holding Times (Sensitivity)	Samples must be extracted and analyzed within holding time.	Extract within 7 days from collection for aqueous samples and 14 days from collection for solid samples. Analyze extracts within 40 days of extraction. For TCLP - 14 days from collection to extract generation. 7 days from extract generation to extraction. 40 days from extraction to analysis See QAPP for sample collection information.	1. If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the Project Manager immediately since re-sampling may be required. 2. Document any observations and corrective action in the case narrative.
Initial Calibration Initial Calibration Verification (ICV) (Accuracy)	Prior to start up and when criteria are exceeded for continuing calibration. Calibrations must contain all target analytes. Quantitation of analyses will utilize the initial calibration results.	1. Minimally five concentrations for each single component analyte. One calibration standard must be at concentration less than or equal to the QL. 2. It is recommended that one second-source ICV standard be analyzed immediately following the initial calibration at the mid-calibration concentration. This standard must be within 30% recovery. 3. It is recommended that if results are reported below the QL, a separate standard at the MDL level analyzed after calibration is complete to check sensitivity. 4. Toxaphene requires a single point calibration. If detected in samples, the samples are re-analyzed behind a five-point calibration for each detected analyte. 5. If RSD ≤20% the average relative response factor (internal calibration) or average calibration factor (external calibration) is used for quantitation. If RSD >20% a linear regression calibration that does not pass through the origin with a correlation coefficient (r) ≥0.990 is used for quantitation; or a nonlinear first or second order calibration curve with a coefficient of determination (COD) of ≥0.990 is used for quantitation. 6. 8081B- Degradation of 4,4'-DDT/ endrin to 4,4'-DDE, 4,4'-DDD/ endrin ketone, endrin breakdown must be less than 15%.	1. Identify and correct problem. 2. Recalibrate instrument; samples should not be analyzed until initial calibration criteria are met. 3. Document any observations and corrective action in the case narrative.

Table 5
Herbicides using USEPA Methods 8000C/8151A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Calibration Verification (Accuracy)	Single component analyte calibration standards must contain each target analyte at mid-range concentration. Calibration verification standards must be analyzed at the beginning of 12-hour sequence and every 20 samples (every 10 samples is recommended), and at the close of the sequence. Pesticides- A standard containing 4,4-DDT and endrin must be analyzed at the beginning of each 12-hour sequence.	Calibration verification response (% difference) or concentration (% drift) ≤ 20%. Pesticides- Degradation for 4,4-DDT and endrin must be <15%. Method 8081B- Degradation of 4,4'-DDT/ endrin to 4,4'-DDE, 4,4'-DDD/ endrin ketone, endrin breakdown must be less than 15%.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. Samples must be bracketed by compliant calibration standards. 3. Document any observations and corrective action in the case narrative.
Retention Time Windows (Accuracy)	Retention time windows (absolute retention time) must be established in accordance with USEPA Method 8000B/8000C or relative retention times must be used if internal standards are employed.	Compounds must be within established retention time windows or within laboratory established relative retention time criteria for the succeeding calibration standards. It is recommended that retention time windows be provided for each calibration verification. Retention times for each surrogate analyzed for samples and QC samples should also be provided on a summary form.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. 3. Document any observations and corrective action in the case narrative.
Method Blank Analysis (Sensitivity)	Method Blank: 1 per 20 samples of similar matrix extracted at the same time and undergo same cleanup procedures as samples or a separate cleanup blank must be prepared and analyzed. Instrument blank: Must be analyzed at the beginning of 12-hour sequence, following the initial calibration verification standard.	Target analyte concentrations must be less than QL.	1. Reanalyze. 2. If limits are still exceeded, re-extract and reanalyze method blank and associated samples. Samples must not be analyzed until method blank criteria are met. 3. Document any observations and corrective action in the case narrative.
Field Blank Analysis (Sensitivity)	Collected per QAPP requirements.	1. Common laboratory contaminants (phthalate) less than 5 x QL. Remaining analytes less than QL. 2. QLs and MDLS will be provided along with the blank results.	1. Investigate problem. 2. Document any observations and corrective actions in the case narrative.

Table 5
Herbicides using USEPA Methods 8000C/8151A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Laboratory Control Sample (Accuracy)	Prepared with each extraction batch, of no more than 20 analytical samples. Prepared independently from calibration standards. LCSs must be spiked with each of the single component analyte at concentrations near the low end of the calibration curve.	Percent recoveries must be within laboratory control limits. For compounds without established laboratory control limits, 70-130% recovery will be used. The lowest acceptable control limits for recovery will be 10%.	1. If recovery failures are above control limits and these compounds are not detected in the associated samples, no corrective action is required. 2. If recovery failures are below the control limits, reanalyze LCS and examine results of other QC analyses. 3. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. 4. Document any observations and corrective action in the case narrative.
Matrix Spike/ Matrix Spike Dup. (MS/MSD) Analysis (Accuracy/Precision)	Collected per QAPP requirements. MS/MSDs must be spiked with each of the single component analyte at concentrations near the low end of the calibration curve. Samples from the investigation must be used for MS/MSD analysis. If samples were not designated as MS/MSD samples, contact QAO upon receipt of samples at the laboratory.	Recovery and RPD within laboratory control limits. For compounds without established laboratory control limits, 70-130% recovery will be used. The lowest acceptable control limits for recovery will be 10%.	1. Reanalyze if <10%. 2. If reanalysis is < 10%, it is recommended that the lab report both analyses and document in the case narrative. 3. If reanalysis is >10%, and LCS criteria are met, document in the case narrative. 4. If LCS criteria are exceeded also, examine other QC data for source of problem; i.e. surrogate recoveries for extraction efficiency and calibration data for instrument performance issues; re-extract or reanalyze samples and associated MS/MSD and LCSs as required.

Table 5
Herbicides using USEPA Methods 8000C/8151A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Surrogate Spike (Accuracy)	Samples, blanks, MS/MSDs, and LCSs must be spiked with method specified surrogate compounds on each column used in the analysis.	Recovery within laboratory control limits. Corrective action is not required if one of the four surrogates (for two columns) has recovery outside of control limits if the recovery is >10% and the remaining three surrogates are within control limits. Surrogate recoveries for each surrogate on each column must be provided in a summary form. The lowest acceptable control limits for recovery will be 10%.	1. Reanalyze. 2. If re-analysis meets criteria, report re-analysis result. 3. If reanalysis recovery fails criteria but recovery is >10%: a. Report the analysis that demonstrates fewer excursions and include raw data for both analyses in the data package. 4. If re-analysis recovery is < 10%, re-extract and re-analyze sample. 5. For re-extracted sample, report the analysis that meets criteria or demonstrates fewer excursions and include raw data for both analyses in the data package. 6. Document corrective action in the case narrative.
Internal Standards (Accuracy) Where applicable	All samples and blanks (including MS/MSD).	Response -50% - +200% of the internal standards from the continuing cal of the day. RT must be ± 30 sec. from calibration verification of that sequence.	Reanalyze. If the re-analysis meets criteria or demonstrates fewer excursions, report the re-analysis result. If the re-analysis does not meet criteria or demonstrates fewer excursions, report the initial analysis and include raw data for both analyses in the data package. Document corrective action in the case narrative.
Field Duplicate Analysis (Precision)	Collected per QAPP requirements. Field duplicate will not be identified to the laboratory.	Validation criteria: 30% RPD for waters, 50% RPD for solids. For sample results that are less than or equal to five times the QL, the criterion of plus or minus two times the QL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.

Table 5
Herbicides using USEPA Methods 8000C/8151A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Target Analyte Identification **(Accuracy)**	As required for identification of target analytes	Retention times must be within established retention time windows or must meet relative retention time criteria. Dual column confirmation (quantitative and qualitative) analysis is required. Retention time windows must be provided for each calibration verification. USEPA CLP Form 10 Summary form, providing the percent difference and retention times for all detected analytes in samples and QC samples, will be provided. Percent difference must be less than 25 %D. %D calculation: Difference between Higher concentration of sample and Lower concentration of sample divided by the Lower concentration of sample times 100.	1. Investigate problem; reanalyze calibration standards to check for retention time shift. 2. Document any observations and corrective action in the case narrative.
Screening samples	As required for samples suspected to contain high concentrations or matrix interferences	It is highly recommended that samples be screened prior to analysis. Screening data (performed prior to the initial analysis) does not need to be included in the data package. Data for samples analyzed at dilutions for initial or subsequent analyses is required to be included in the data package.	Not applicable
Quantitation	Samples, blanks, and QC data.	Confirmation analysis is required. Internal or external standard method may be used. Verify concentration is within linear calibration range of standards. Every effort must be made to meet specified QL requirements. Lab must state the technique used for quantitation of results for the samples.	1. If concentration is above linear calibration range, dilute sample and reanalyze. Dilution should result in concentration in the upper calibration range of the instrument. 2. Document any observations and corrective action in the case narrative.
Chromatography Presentation	For each standard, sample and QC sample analysis.	Copies of chromatograms provided in the data package must be large enough to view during validation. In the case that matrix interference is detected or manual integration is performed, enlarged copies of those manipulations will be included in the data package for review.	1. Provide requested information.

Table 5
Herbicides using USEPA Methods 8000C/8151A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Cleanup	GPC must be performed for all pesticide solids or water extracts with high molecular weight contaminants. Sulfur cleanup must be performed for all sample extracts contaminated with sulfur. Florisil cartridge cleanups should be performed for all pesticide extracts.	Calibrate according to method. Criteria must be met as listed in method.	1. For GPC, perform column maintenance, recalibrate. 2. For florisil, obtain a new lot of cartridges.
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages. USEPA Form 8 Summary form, providing the date, time of analysis of samples and QC samples, surrogate retention times and surrogate retention time window, should be provided.	Not applicable	Not applicable
Confirmation Analysis	Dual column quantitation and qualitative confirmation will be performed. The information presented in CLP Form 10 will be provided in the data package for evaluation	Not Applicable	Not Applicable
Laboratory control limits	Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable	Not applicable
Percent solids	For solids samples, the percent solids will be determined and sample results will be corrected for percent solids.	Not applicable	Not applicable

Table 5
Herbicides using USEPA Methods 8000C/8151A
Quality Control Requirements and Corrective Actions

Audit Parameter (DQI)	Frequency (Applies to both primary and confirmation columns)	Laboratory Control Limits (Applies to both primary and confirmation columns)	Laboratory Corrective Action (Applies to both primary and confirmation columns)
Dilutions	1. When target analyte concentration exceed upper limit of calibration curve. 2. When matrix interference demonstrated by lab and documented in the case narrative (highly viscous samples or a large number of non-target peaks on the chromatogram). 3. Samples should be cleaned up during sample preparation/extraction procedure using appropriate methods when matrix interference is present. 4. Laboratory will note in the data deliverables which analytical runs were reported.	1. The reagent blank will meet the method blank criteria.	1. Reanalyze reagent blank until method blank criteria are met.
Deliverables	1. Full CLP-like deliverables must be provided to document each audit item for easy reference and inspection. 2. It is recommended that an example calculation be provided for each analysis, for each type of matrix in the data package using samples from the project. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. Standard tracing information will be provided. 6. Cooler temperatures will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes.
Method and QAPP requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable	Not applicable

Notes:

Data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods that are currently used by the laboratory. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP.

Communications with the QAO will be documented and included in the data packages.

Table 6
Metals using USEPA Methods 6010D/6020B
Quality Control Requirements and Corrective Actions

Audit (DQI) (where applicable)	Frequency	Control Limits	Corrective Action
Sample preservation	Samples must be preserved based on method and QAPP requirements	For aqueous and soil samples: cooler temperature ≤6°C. See QAPP for sample preservation information.	1. Notify Project Manager since re-sampling may be required. 2. Document corrective action in the case narrative.
Holding times (Sensitivity)	Samples must be digested and analyzed within holding time.	Metals: 180 days from collection to analysis. For TCLP - 180 days from collection to extract generation, 180 days from extraction to analysis	3. If holding times are exceeded for initial or any re-analyses required due to QC excursions. 4. Notify QAO since re-sampling may be required. 5. Document corrective action in the case narrative.
ICP/MS tuning, mass calibration and resolution checks **(Accuracy)**	Analyze tune solution at least 4 times after the instrument has equilibrated prior to sample analysis. Evaluate mass calibration and resolution checks in the mass regions of interest. Solution contains elements representing all the of mass regions of interest (such as Li, Co, In, Tl) to verify resolution and mass calibration within criteria.	1. RSD must be <15% for analytes in the tune solution, with 200 continuous scans. 2. If mass calibration is >0.1amu from the true value, mass calibration must be adjusted to correct values. 3. Resolution must be less than 0.9amu of full width at 10% of peak height. 4. Documentation of mass calibration and resolution evaluations may be requested.	1. Identify and correct problem and retune instrument - samples cannot be analyzed until tune criteria is met.
Initial Calibration Verification and Continuous Calibration Verification **(ICV, CCV)** **(Accuracy)**	ICP calibration curve is analyzed on a daily basis that employs a minimum of a calibration blank and three standards for each target analyte. After calibration, Initial calibration verification (ICV) is performed. The ICV is from a source independent of the calibration standards. A continuing calibration verification (CCV) is analyzed at the beginning of the run, at 10%. Also verify at the end of each run.	ICV, CCV - 90% to 110% of expected value for ICP, AA, colorimeter, and spectrophotometer. ICV for Mercury – 90% to 110% of expected true value. CCV for Mercury - 80% to 120% of expected true value. Correlation coefficient for first or second order curve must be ≥ 0.995.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action in the case narrative - samples should not be analyzed until calibration control limit criteria have been met.

Table 6
Metals using USEPA Methods 6010D/6020B
Quality Control Requirements and Corrective Actions

Audit (DQI) (where applicable)	Frequency	Control Limits	Corrective Action
ICP/MS **Initial and continuing calibration verification** **(ICV, CCV)** **(Accuracy)**	ICP/MS calibration curve is analyzed on a daily basis that employs a minimum of a calibration blank and three standards for each target analyte. Calibration standard solutions must contain appropriate internal standard for each target element. Calibration solution must be initially verified using a QC standard and monitored weekly for stability. The initial calibration verification (ICV) must be prepared in the same matrix as the calibration standards but as an independent standard near the midpoint of the linear range at a concentration other than the calibration standards. Verify calibration with ICV, ICB immediately after calibration. Verify with CCV, CCB at frequency of every 10 samples and at the end of the sequence. For ICP/MS, prior to preparing standards, each stock solution must be analyzed separately to determine any interferences.	ICV, CCV must be 90% to 110% of expected value for ICP/MS, and cyanide. If the ICP/MS is re-sloped or recalibrated after the ICV is analyzed, a new CCV, CCB must be analyzed prior to sample analysis. Provide documentation of calibration standard monitoring and evaluation.	1. Reanalyze. 2. If criteria are still not met, terminate analysis, identify and correct problem, recalibrate, and contact QAO. 3. Document corrective action in case narrative - samples cannot be analyzed until calibration control limit criteria have been met.
Lower Limit of Quantitation Check (LLQC) **(Accuracy)**	For ICP, LLQC is a standard at the QL concentration analyzed quarterly for all elements at the QL level.	The percent recovery of the LLQC must meet the laboratory established control limits.	The LLQC shall be re-analyzed immediately for those analytes; if the results of the re-analysis for those analytes fall within the control limits, no further corrective action is required. If the results of the re-analysis for those analytes do not fall within the control limits, the analysis shall be terminated, the problem corrected, the instrument recalibrated, the LLQC analyzed, and the samples associated with the LLQC re-analyzed. Document any observation or corrective action in the case narrative.
Internal Standard **(Accuracy)**	Monitored for all samples, blanks, standards, and QC samples analyzed.	Internal standard counts should be within 30% of Internal standard counts of the calibration standard for all samples and standards.	1. If internal standard area is not within 30%, review the internal areas of the closest calibration blanks for compliance. If the calibration blanks meet criteria; dilute the sample five-fold and reanalyze. 2. If the internal standard area of the calibration blank is also outside of 30%, stop sample analysis and recalibrate.

Table 6
Metals using USEPA Methods 6010D/6020B
Quality Control Requirements and Corrective Actions

Audit (DQI) (where applicable)	Frequency	Control Limits	Corrective Action
Internal Standard for ICP/MS **(Accuracy)**	Appropriate internal standard as listed in Method 6020 is required for each analyte. The internal standard should be no more than 50 amu from the target element. Recommended internal standards include 6Li, 45 Sc, 89Y, 103 Rh, 115In, 159Tb, 169Ho, 209Bi.	Intensity of all internal standards must be monitored for every analysis. The intensity of any internal standard must be >70% or <130% of the intensity of the internal standard in the initial calibration standard or blank. Document internal standard intensity and the evaluation for each analysis performed and include in the data package.	1. If sample analysis fails, dilute the sample fivefold (1+4), adjust internal standard and reanalyze. 2. Repeat until internal standard intensify meets criteria. 3. If the CCB or CCV intensity fails, terminate analysis, identify and correct problem, recalibrate, verify calibration and reanalyze samples, document in the case narrative, and contact QAO.
Low level Standard Analysis (Accuracy)	For ICP, Low-Level Standard is the QL concentration at the beginning of each run for all elements at the QL level	The percent recovery of the Low-Level Standard must meet the control limits of 80-120%.	1. The CRDL shall be re-analyzed immediately for those analytes; if the results of the re-analysis for those analytes fall within the control limits, no further corrective action is required. 2. If the results of the re-analysis for those analytes do not fall within the control limits, the analysis shall be terminated, the problem corrected, the instrument recalibrated, the CRDL analyzed, and the samples associated with the CRDL re-analyzed. 3. Document corrective action in case narrative.
Initial and Continuing Calibration Blank (ICB/CCB) **(Metals, mercury, cyanide)**	After ICV, CCV, at beginning and end of run and at a rate of 10^{th} sample.	The absolute value of the ICB and CCB must not exceed the QL.	Identify and correct problem. If criteria are still not met, recalibrate and reanalyze affected samples. Document corrective action in the case narrative - samples should not be analyzed until blank control limit criteria have been met.
Preparation Blank Analysis **(Sensitivity)**	1 per batch of samples digested, or 1 in 20, whichever is greater. PB shall be carried through the complete procedure and contain the same acid concentration in the final solution as the sample solution used for analysis.	The absolute value of the method blank must not exceed the QL.	Reanalyze blank. If limits are still exceeded, clean instrument and recalibrate analytical system and re-preparation and reanalyze affected samples if detected. Document corrective action in the case narrative - samples cannot be analyzed until blank criteria are met.
Field Blank Analysis **(Sensitivity)**	Collected one per 10 samples or once per sampling event.	Less than QL	1. Investigate problem. 2. Document in the case narrative.

Table 6
Metals using USEPA Methods 6010D/6020B
Quality Control Requirements and Corrective Actions

Audit (DQI) (where applicable)	Frequency	Control Limits	Corrective Action
Laboratory Control Sample (LCS) Analysis (Accuracy)	Every 20 samples or each digestion batch. Prepared independently from calibration standards. LCS must contain all target analytes.	Recovery within laboratory control limits. The lowest acceptable control limits for recovery will be 10%.	Reanalyze LCS and examine results of other QC analyses. If recovery is still outside limits, and other QC criteria are met, report both runs. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. Document corrective action in the case narrative.
Serial Dilution Analysis for ICP (Accuracy)	Required once per analytical batch when analyte concentration is >50 times the instrument IDL or MDL. Samples from the investigation must be used for Serial dilution analysis.	An analysis of a 1:5 dilution of the sample should provide a result within 20%D of the original determination (for concentrations 25x the MDL.	1. Report results. 2. Document corrective action in the case narrative.
Serial Dilution Analysis for ICP/MS (Accuracy)	Required when analyte concentration is >100 times the reagent blank and is within the linear range of the ICP/MS. Performed for every 20 samples for each matrix or per batch.	An analysis of a 1:5 dilution of the sample should provide a result within 20%D of the original determination (for concentrations 25x the MDL).	1. Qualify data. 2. Document corrective action in the case narrative.
Spectral Interference Check (SIC) Solution Analysis for ICP (Accuracy)	Beginning of each analytical for ICP. Solution A consists of the interferents, and Solution AB consists of the analytes mixed with the interferents.	Results for the unspiked analytes must be less than 2xQL. Percent recoveries for the spiked analytes must be within 80-120%R.	1. Reanalyze. 2. If limits are still exceeded, adjust instrument. 3. Restart analytical run and reanalyze samples analyzed since last satisfactory SIC solution. 4. Document corrective action in the case narrative.
Spectral Interference Check (SIC) Solution Analysis for ICP/MS (Accuracy)	Beginning of each analytical run or once during every 12 hours, whichever is more frequent for ICP/MS. For measurement of elemental, molecular-ion isobaric interference corrections. SIC solution contains known concentration of interfering elements that will demonstrate the magnitude of the molecular-ion isobaric interferences to verify that the interferences are corrected by the data system within the control limits.	Percent recovery of spiked elements must be within current laboratory control limits. Results for the unspiked analytes must be <2xQL.	1. Reanalyze. 2. If limits are still exceeded, adjust interference corrections for instrument, contact QAO, samples cannot be analyzed until ICSA/ICSAB control limit criteria have been met. 3. Restart analytical run and reanalyze samples analyzed since last satisfactory ICS. 4. Document corrective action in the case narrative.

Table 6
Metals using USEPA Methods 6010D/6020B
Quality Control Requirements and Corrective Actions

Audit (DQI) (where applicable)	Frequency	Control Limits	Corrective Action
Matrix Spike/ Matrix Spike Dup. (MS/MSD) Analysis (Accuracy/Precision)	Collected per QAPP requirements. Samples from the investigation must be used for MS/MSD analysis. Spike must contain complete list of target analytes.	Recovery within laboratory control limits or 75-125%, or in-house laboratory limits. Recovery does not apply if sample concentration > 4 X spike concentration. Spike must contain all analytes. The lowest acceptable laboratory control limits for recovery will be 10%.	Analyze post-digestion/post-distillation spike. 1. Document corrective action in the case narrative.
Post-Digestion Spike (Recommended for Metals) (Accuracy)	Spike must contain all target elements. Performed when MS/MSD fails.	Recovery within 75-125% of true value.	1. Dilute sample and reanalyze. 2. If recovery is outside limits, document in the case narrative. 3. Standard additions may be used to compensate for matrix effects.
Internal standard (Metals) (Accuracy)	May be used for each sample instead of post-digestion spike.	Internal Standard counts must be within 30% of Internal Standard counts of ICB.	Reanalyze.
Laboratory Duplicate or Matrix Spike Duplicate Analysis (Precision)	Collected one per 20 samples or one per matrix (for less than 20 samples) Samples from the investigation must be used for Laboratory Duplicate and MSD analysis	Laboratory control limit or 20% for RPD shall be used for original and duplicate sample values greater than or equal to five times the QL. A control limit of the QL value shall be used if either the sample or duplicate value is less than five times the CRRL.	1. Investigate problem and reanalyze. 2. Document corrective action in the case narrative.
Field Duplicate Analysis (Precision)	Collected 1 per matrix; every 20 samples of similar matrix. The field duplicate identification will not be provided to the laboratory.	Validation criteria: 30% RPD for waters and 50% RPD for solids. For sample results that are less than or equal to five times the QL, the criterion of plus or minus two times the QL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.
Percent solids	For solid samples, the percent solids will be determined and sample results will be corrected for percent solids.	Not applicable	Not applicable

Notes:

Data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP.

Communications with OBG will be documented and included in the data packages.

Table 7
Mercury using USEPA Methods 7470A/7471B and Total Cyanide using USEPA Method 9012B
Quality Control Requirements and Corrective Actions

Audit (DQI) (where applicable)	Frequency	Control Limits	Corrective Action
Sample preservation	Samples must be preserved based on method and QAPP requirements	For aqueous and soil samples: cooler temperature ≤6°C. See Table 1 for sample preservation information.	Notify Project Manager since re-sampling may be required. Document corrective action in the case narrative.
Holding times (Sensitivity)	Samples must be digested and analyzed within holding time.	Mercury: 28 days from collection to analysis. Total Cyanide: 14 days from collection to analysis. Mercury prepared by TCLP - 28 days from collection to extract generation, 28 days from extraction to analysis.	If holding times are exceeded for initial or any re-analyses required due to QC excursions. Notify QAO since re-sampling may be required. Document corrective action in the case narrative.
Initial Calibration Verification and Continuous Calibration Verification (ICV, CCV) (Accuracy)	Five-point calibration for Hg including a blank. Five-point calibration for remaining methods, with one standard at the QL level. Calibrate each time instrument is set up. After calibration, Initial calibration verification (ICV) is performed. The ICV is from a source independent of the calibration standards. A continuing calibration verification (CCV) is analyzed at the beginning of the run, at 10% or every 2 hours. Also verify at the end of each run.	ICV, CCV - 90% to 110% of expected value for ICP, AA, colorimeter, and spectrophotometer. ICV for Mercury – 90% to 110% of expected true value. CCV for Mercury - 80% to 120% of expected true value. Correlation coefficient for first or second order curve must be ≥ 0.995. For cyanide the ICV must meet 85 to 115% recovery. For cyanide the CCV must meet 90-110% recovery.	Reanalyze. If criteria are still not met, identify and correct problem, recalibrate. Document corrective action in the case narrative - samples should not be analyzed until calibration control limit criteria have been met.

Table 7
Mercury using USEPA Methods 7470A/7471B and Total Cyanide using USEPA Method 9012B
Quality Control Requirements and Corrective Actions

Audit (DQI) (where applicable)	Frequency	Control Limits	Corrective Action
Lower Limit of Quantitation Check (LLQC) (Accuracy)	For AA, and cyanide, LLQC is the QL concentration at the beginning of each run for all elements at the QL.	The percent recovery of the LLQC must meet the control limits of 70-130%.	The LLQC shall be re-analyzed immediately for those analytes; if the results of the re-analysis for those analytes fall within the control limits, no further corrective action is required. If the results of the re-analysis for those analytes do not fall within the control limits, the analysis shall be terminated, the problem corrected, the instrument recalibrated, the LLQC analyzed, and the samples associated with the LLQC re-analyzed. Document corrective action in case narrative.
Initial and Continuing Calibration Blank (ICB/CCB) (Mercury, cyanide)	After ICV, CCV, at beginning and end of run and at a rate of 10^{th} sample or every 2 hours during run.	The absolute value of the ICB and CCB must not exceed the QL.	Identify and correct problem. If criteria are still not met, recalibrate and reanalyze affected samples. Document corrective action in the case narrative - samples should not be analyzed until blank control limit criteria have been met.
Preparation Blank Analysis (Sensitivity)	1 per batch of samples digested, or 1 in 20, whichever is greater. PB shall be carried through the complete procedure and contain the same acid concentration in the final solution as the sample solution used for analysis.	The absolute value of the method blank must not exceed the QL.	Reanalyze blank. If limits are still exceeded, clean instrument and recalibrate analytical system and re-preparation and reanalyze affected samples if detected. Document corrective action in the case narrative - samples cannot be analyzed until blank criteria are met.
Field Blank Analysis (Sensitivity)	Collected one per 10 samples or once per sampling event.	Less than QL	Investigate problem. Document in the case narrative.
Rinse Blank (Sensitivity)	Rinse blank must be analyzed following every sample and standard to flush the instrument.	Not applicable.	Not applicable.

Table 7
Mercury using USEPA Methods 7470A/7471B and Total Cyanide using USEPA Method 9012B
Quality Control Requirements and Corrective Actions

Audit (DQI) (where applicable)	Frequency	Control Limits	Corrective Action
Laboratory Control Sample (LCS) Analysis (Accuracy)	Every 20 samples or each digestion batch. Prepared independently from calibration standards. LCS must contain all target analytes.	Recovery within laboratory control limits. The lowest acceptable control limits for recovery will be 10%.	Reanalyze LCS and examine results of other QC analyses. If recovery is still outside limits, and other QC criteria are met, report both runs. If other QC criteria have not been met, stop analysis, locate and correct problem, recalibrate instrument and reanalyze samples since last satisfactory LCS. Document corrective action in the case narrative.
Matrix Spike/ Matrix Spike Dup. (MS/MSD) Analysis (Accuracy/Precision)	Collected per QAPP requirements. Samples from the investigation must be used for MS/MSD analysis. Spike must contain complete list of target analytes.	Recovery within laboratory control limits or 75-125%, or in-house laboratory limits. Recovery does not apply if sample concentration > 4 X spike concentration. Spike must contain all analytes. The lowest acceptable laboratory control limits for recovery will be 10%.	Analyze post-digestion/post-distillation spike. Document corrective action in the case narrative.
Post-Digestion Spike Accuracy)	Spike must contain all target elements. Performed every 20 samples as necessary.	Recovery within 75-125% of true value.	Dilute sample and reanalyze. If recovery is outside limits, document in the case narrative. Standard additions may be used to compensate for matrix effects.
Internal standard (Accuracy)	May be used for each sample instead of post-digestion spike.	Internal Standard counts must be within 30% of Internal Standard counts of ICB	Reanalyze.
Laboratory Duplicate or Matrix Spike Duplicate Analysis (Precision)	Collected one per 20 samples or one per matrix (for less than 20 samples) Samples from the investigation must be used for Laboratory Duplicate and MSD analysis	Laboratory control limit or 20% for RPD shall be used for original and duplicate sample values greater than or equal to five times the QL. A control limit of the QL value shall be used if either the sample or duplicate value is less than five times the CRRL.	Investigate problem and reanalyze. Document corrective action in the case narrative.

Table 7
Mercury using USEPA Methods 7470A/7471B and Total Cyanide using USEPA Method 9012B
Quality Control Requirements and Corrective Actions

Audit (DQI) (where applicable)	Frequency	Control Limits	Corrective Action
Field Duplicate Analysis (Precision)	Collected 1 per matrix; every 20 samples of similar matrix. The field duplicate identification will not be provided to the laboratory.	Validation criteria: 30% RPD for waters and 50% RPD for solids. For sample results that are less than or equal to five times the QL, the criterion of plus or minus two times the QL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.
Percent solids	For solid samples, the percent solids will be determined and sample results will be corrected for percent solids.	Not applicable	Not applicable
Laboratory control limits	Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable	Not applicable
Analyte quantitation	Concentrations for ICP/MS, cyanide and mercury analysis are reported based on dry weight of the sample. Calculations for the ICP/MS should include appropriate interference corrections, internal standard normalization, and summation of signals at 206, 207, and 208 mass to charge for lead. All QC criteria must be met when applying correction equations. If interference is detected, elements impacted are flagged to indicate percentage interference correction applied to the data or an uncorrected interference because of the equation used for quantitation.	Not applicable	Not applicable
MDL Determination	Before any field samples are analyzed, the MDLs shall be determined for non-prepared analyses, each digestion procedure and instrument used, prior to the start of analyses, and annually thereafter.	Not applicable	Not Applicable
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable	Not applicable

Table 7
Mercury using USEPA Methods 7470A/7471B and Total Cyanide using USEPA Method 9012B
Quality Control Requirements and Corrective Actions

Audit (DQI) (where applicable)	Frequency	Control Limits	Corrective Action
Dilutions	When target analyte concentration exceeds upper limit of calibration curve. When matrix interference demonstrated by lab and documented in the case narrative. Laboratory will note in the data deliverables which analytical runs were reported.	Not applicable	Not applicable
Deliverables as required	Full CLP-like deliverables must be provided to document each audit item for easy reference and inspection. An example calculation may be requested for each analysis, for each type of matrix in the data package using samples from the project. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. Final spiking concentrations will be presented in summary form. Standard tracing information will be provided. Cooler temperatures will be provided in the data packages. Run logs will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes.
Method and QAPP Requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable	Not applicable

Notes:

Data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP.
Communications with OBG will be documented and included in the data packages.

Table 8
TOC, Corrosivity/pH, Ignitability, Flashpoint, Reactive Cyanide and Reactive Sulfide
Quality Control Requirements and Corrective Actions

Audit (DQI) (Where applicable)	Frequency (Where applicable)	Control Limits (Where applicable)	Corrective Action (Where applicable)
Sample preservation	Samples must be preserved based on method and QAPP requirements	For aqueous samples: cooler temperature ≤6°C. See QAPP for sample preservation information.	1. Notify Project Manager since re-sampling may be required. 2. Document corrective action in the case narrative.
Holding times (Sensitivity)	Samples must be prepared and analyzed within holding time.	TOC- Analyze 28 days from collection. Ignitability, flashpoint, reactive cyanide, reactive sulfide: Analyze 2 days from collection.	1. If holding times are exceeded for initial or any reanalysis required due to QC excursions, notify the QAO since re-sampling may be required. 2. Document corrective action in the case narrative.
Initial Calibration (Accuracy)	Three- to five-point calibration standards prior to sample analysis. One standard must be at the QL concentration.	1. Linear calibration using response factor with RSD less than or equal to 10%. If RSD <10% the average calibration factor (external calibration) is used for quantitation. 2. For compounds with RSD greater than 10% use linear calibration that does not pass through the origin with least squares regression (r for un-weighted least squares regression, Coefficient of Determination or r^2 must be greater than 0.990) or non-linear calibration using no more than third order with seven standards, (COD or r^2 must be greater than 0.990).	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action in the case narrative - samples cannot be analyzed until calibration control limit criteria have been met.
Initial Calibration Verification and Continuous Calibration Verification (ICV, CCV) (Accuracy)	ICV analyzed following calibration and CCV after every 10 samples and at the end of the sequence.	ICV, CCV recovery must be within 90- 110% of the true value.	1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action in the case narrative - samples cannot be analyzed until calibration control limit criteria have been met.
Initial and Continuing Calibration Blank (ICB/CCB)	After ICV/CCV at beginning and end of run and at a rate of 10% or every 2 hours during run.	The absolute value of the ICB and CCB must not exceed the QL.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate and reanalyze affected samples. 3. Document corrective action in the case narrative - samples cannot be analyzed until blank control limit criteria have been met.

Table 8
TOC, Corrosivity/pH, Ignitability, Flashpoint, Reactive Cyanide and Reactive Sulfide
Quality Control Requirements and Corrective Actions

Audit (DQI) (Where applicable)	Frequency (Where applicable)	Control Limits (Where applicable)	Corrective Action (Where applicable)
Preparation Blank Analysis (Sensitivity)	1 per batch of samples prepared or 1 in 20, whichever is greater.	The absolute value of the method blank must not exceed the QL. Preparation blank for turbidity and color interference check is subtracted for phosphate analysis.	1. Reanalyze blank. 2. If limits are still exceeded, re-prepare and reanalyze affected samples. 3. Document corrective action in the case narrative - samples cannot be analyzed until blank criteria are met.
Laboratory Control Sample (LCS) Analysis (Accuracy)	Every 20 samples or each preparation batch. Prepared independently from calibration standards.	Recovery within laboratory control limits. The lowest acceptable control limits for recovery will be 10%.	1. Reanalyze LCS and examine results of other QC analyses. 2. If recovery is still outside limits, and other QC criteria are met, report both runs. 3. If other QC criteria have not been met, stop analysis, locate and correct problem, reanalyze samples since last satisfactory LCS. 4. Document corrective action in the case narrative.
Matrix Spike/ Matrix Spike Dup. (MS/MSD) Analysis (Accuracy/Precision	Collected one per 20 samples or one per matrix (for less than 20 samples) Samples from the investigation must be used for MS/MSD or MS/Duplicate analysis.	Recovery within laboratory control limits or 75-125%. Recovery does not apply if sample concentration > 4x spike concentration. Spike must contain all analytes. The lowest acceptable laboratory control limits for recovery will be 10%.	1. If LCS criteria are met, document in the case narrative. 2. If LCS criteria are not met, examine other QC data to identify the source of the problem. 3. Re-prepare/ reanalyze samples associated with the matrix spike and LCS. 4. Document corrective action.
Laboratory Duplicate or Matrix Spike Duplicate Analysis (Precision)	Collected one per 20 samples or one per matrix (for less than 20 samples) Samples from the investigation must be used for Laboratory Duplicate and MSD analysis	RPD within laboratory control limits or 20% for RPD shall be used for original and duplicate sample values greater than or equal to five times the QL. A control limit of the QL value shall be used if either the sample or duplicate value is less than five times the CRQL.	1. Investigate problem and reanalyze. 2. Document corrective action.
Field Blank Analysis (Sensitivity)	Collected one per sampling event, or one per 20 samples or one per matrix (for less than 20 samples)	Less than QL	1. Investigate problem. 2. Document in the case narrative.
Field Duplicate Analysis (Precision)	Collected 1 per matrix; every 20 samples of similar matrix. The field duplicate identification will not be provided to the laboratory.	Validation criteria: 50% RPD for waters. For sample results that are less than or equal to five times the QL, the criterion of plus or minus two times the QL will be applied to evaluate field duplicates.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case-by-case basis.

Table 8
TOC, Corrosivity/pH, Ignitability, Flashpoint, Reactive Cyanide and Reactive Sulfide
Quality Control Requirements and Corrective Actions

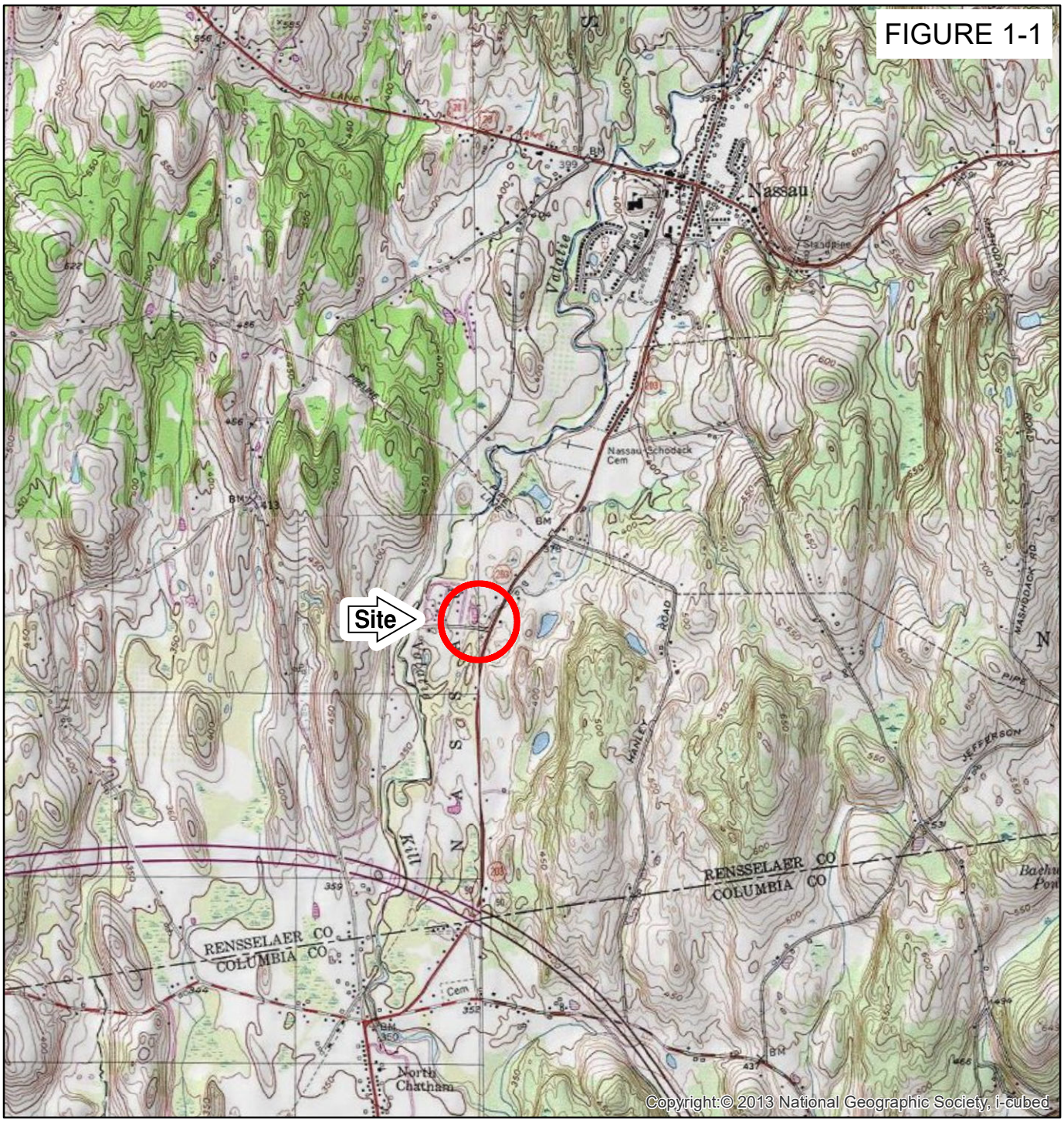
Audit (DQI) (Where applicable)	Frequency (Where applicable)	Control Limits (Where applicable)	Corrective Action (Where applicable)
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable	Not applicable
Dilutions	1. Dilute and reanalyze samples with concentrations that are greater than the linear range of the instrument. 2. The laboratory will note in the data package which analytical runs were used to report the sample results.	Not applicable	Not applicable .
Laboratory control limits	Generated with results for an analyte from a minimum of 20 sample analyses. The average of the sample results and the standard deviation are calculated. The internal warning limits are established at 2 times the standard deviation and the control limits are established at 3 times the standard deviation. The control limits are updated annually.	Not applicable	Not applicable
Deliverables	1. Full CLP-like deliverables must be provided to document each audit item for easy reference and inspection. 2. An example calculation will be provided for each analysis, for each type of matrix in the data package. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. Standard tracing information will be provided upon request. 6. Cooler temperatures will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes.
Method and QAPP requirements	The laboratory will perform the method as presented in this QAPP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable	Not applicable

Table 8
TOC, Corrosivity/pH, Ignitability, Flashpoint, Reactive Cyanide and Reactive Sulfide
Quality Control Requirements and Corrective Actions

Audit (DQI) (Where applicable)	Frequency (Where applicable)	Control Limits (Where applicable)	Corrective Action (Where applicable)
Notes: Data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods that are currently used by the laboratory. Excursions from QA/QC criteria will be qualified based on guidance provided in this QAPP. Communications with the QAO will be documented and included in the data packages.			

FIGURES

FIGURE 1-1



I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 1-1 - Site Location.mxd

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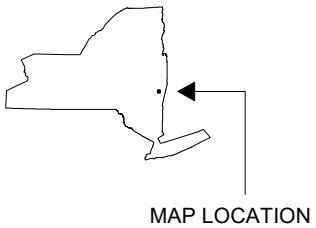

MAP LOCATION

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

SITE LOCATION MAP

N

0 0.1250.25 0.5 0.75 1

Miles

73458
OCTOBER 2019

1:31,680

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I:\Ge-Cep.61\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 1-2 - Site Map.mxd

N

LEGEND

- Loeffel Route 203 Property
- Existing Supply Well
- Drum Area
- Former Aboveground Storage Tank / Potential Lagoon Area
- Underground Storage Tank
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert

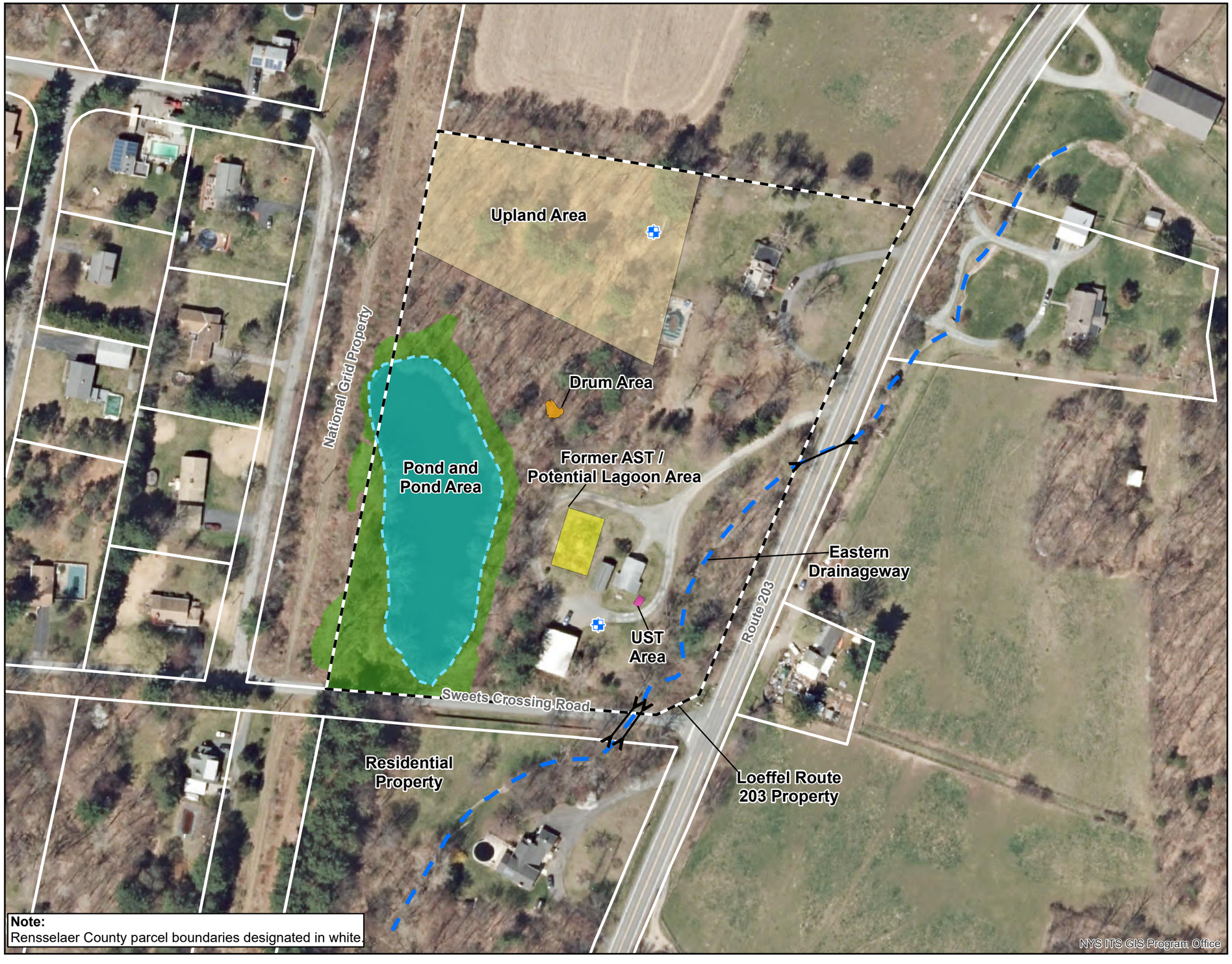
LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

SITE MAP

0 50 100 200
Feet

612.73458
OCTOBER 2019

O'BRIEN & GERE ENGINEERS, INC.



Note:
Rensselaer County parcel boundaries designated in white.

N

LEGEND

- Loeffel Route 203 Property
- Existing Supply Well
- Former Aboveground Storage Tank / Potential Lagoon Area
- Approximate Pond and Pond Area
- Underground Storage Tank
- Upland Area
- Drum Area
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

INVESTIGATION AREAS

0 50 100 200
Feet

612.73458
JANUARY 2020

O'BRIEN & GERE ENGINEERS, INC.

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I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 1-3 - Investigation Areas.mxd

N

LEGEND

Loeffel Route 203 Property

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

AREA MAP

0 250 500 1,000
Feet

612.73458
NOVEMBER 2019

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11/26/2019 8:40:25 AM

I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 1-4 - Area Map.mxd

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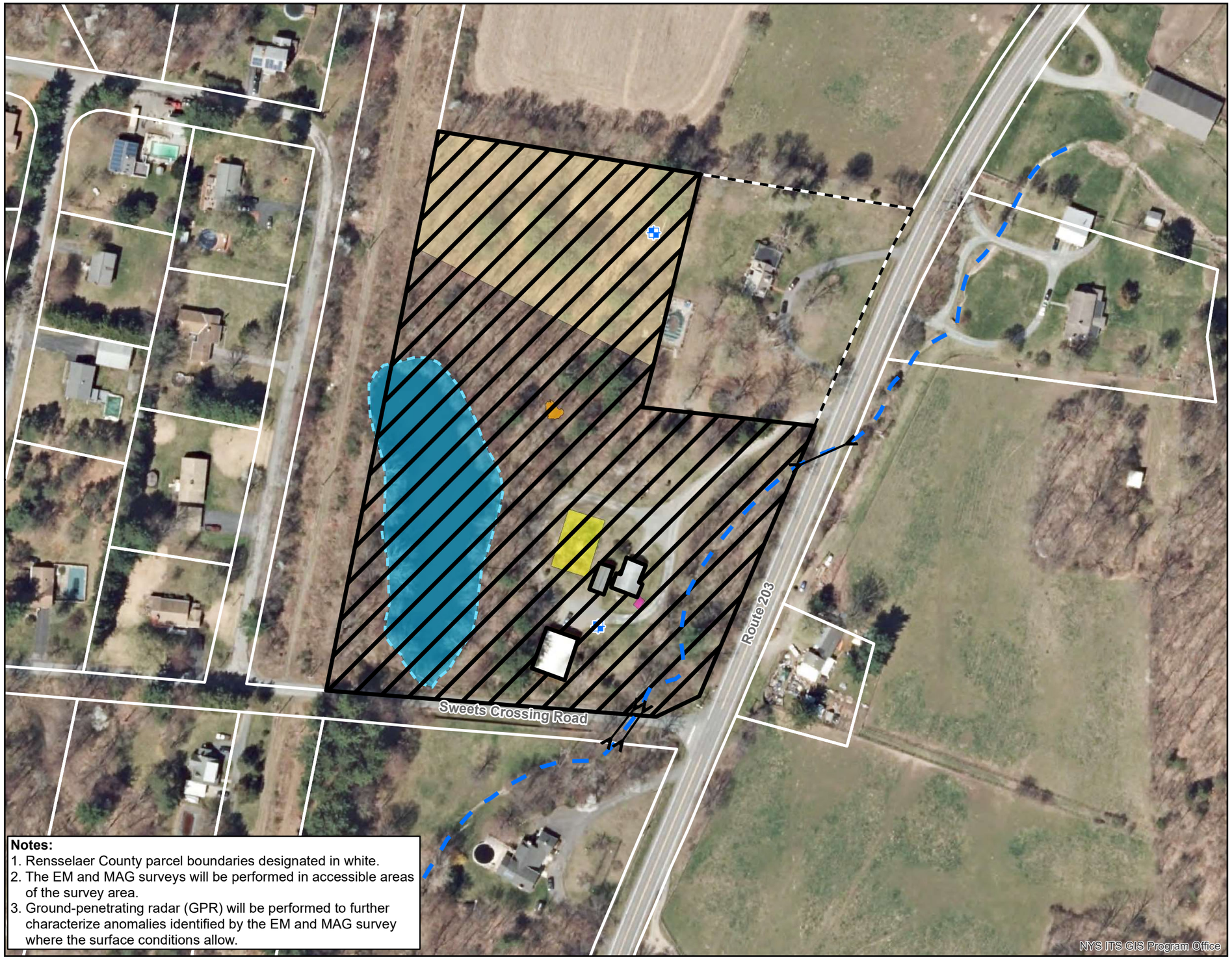
I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 2-1 - Surface Geophysical Survey Area.mxd



Notes:
1. Rensselaer County parcel boundaries designated in white.
2. The EM and MAG surveys will be performed in accessible areas of the survey area.
3. Ground-penetrating radar (GPR) will be performed to further characterize anomalies identified by the EM and MAG survey where the surface conditions allow.

N

LEGEND

- Loeffel Route 203 Property
- Existing Supply Well
- Former Aboveground Storage Tank / Potential Lagoon Area
- Pond and Pond Area
- Underground Storage Tank
- Upland Area
- Drum Area
- Approximate Electromagnetic (EM) and Magnetic (MAG) Survey Area(2 & 3)
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

SURFACE GEOPHYSICAL SURVEY AREA

0 50 100 200
Feet

612.73458
DECEMBER 2019

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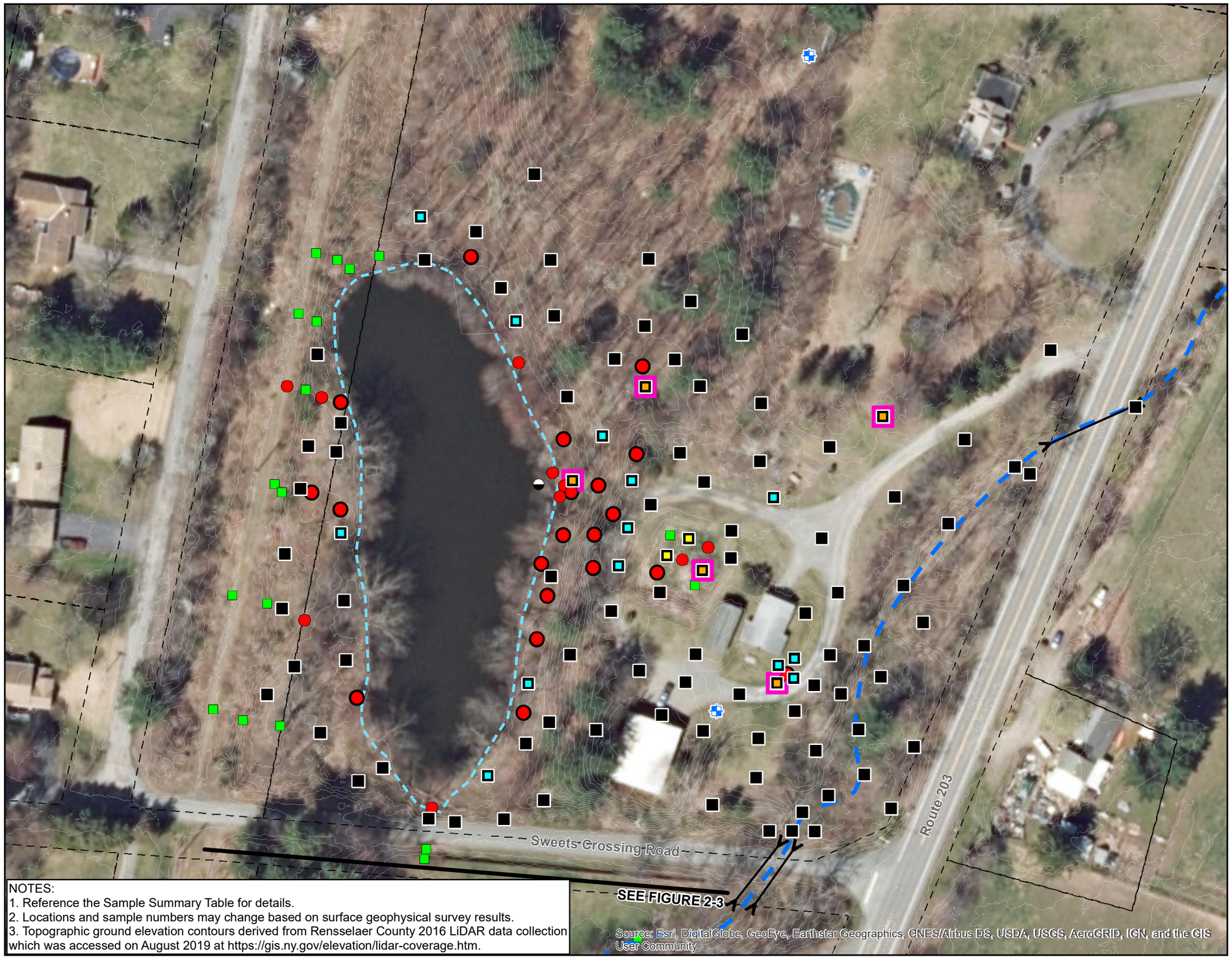
I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 2-2 Conceptual Soil Sample Locations - Onsite.mxd



NOTES:
1. Reference the Sample Summary Table for details.
2. Locations and sample numbers may change based on surface geophysical survey results.
3. Topographic ground elevation contours derived from Rensselaer County 2016 LiDAR data collection which was accessed on August 2019 at https://gis.ny.gov/elevation/lidar-coverage.htm.

N

LEGEND

Proposed Soil Sample Locations

- Shallow Soil Sampling Location
- Deep Soil Sampling Location to 10 feet
- Deep Soil Sampling Location to 15 feet
- Deep Soil Sampling Location to 30 feet
- Proposed Monitoring Well Location
- Total PCB Result ≥ 1 ppm
- Bottom Sample Total PCB Results ≥ 1 ppm
- Total PCB Results < 1 ppm
- Proposed Staff Gauge
- Existing Supply Well
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert
- Minor Elevation Contour (1 foot)
- Rensselaer County Tax Parcel

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

PROPOSED SOIL SAMPLE AND MONITORING WELL LOCATIONS (NORTH OF SWEETS CROSSING ROAD)

0 25 50 100
Feet

612.73458
NOVEMBER 2019

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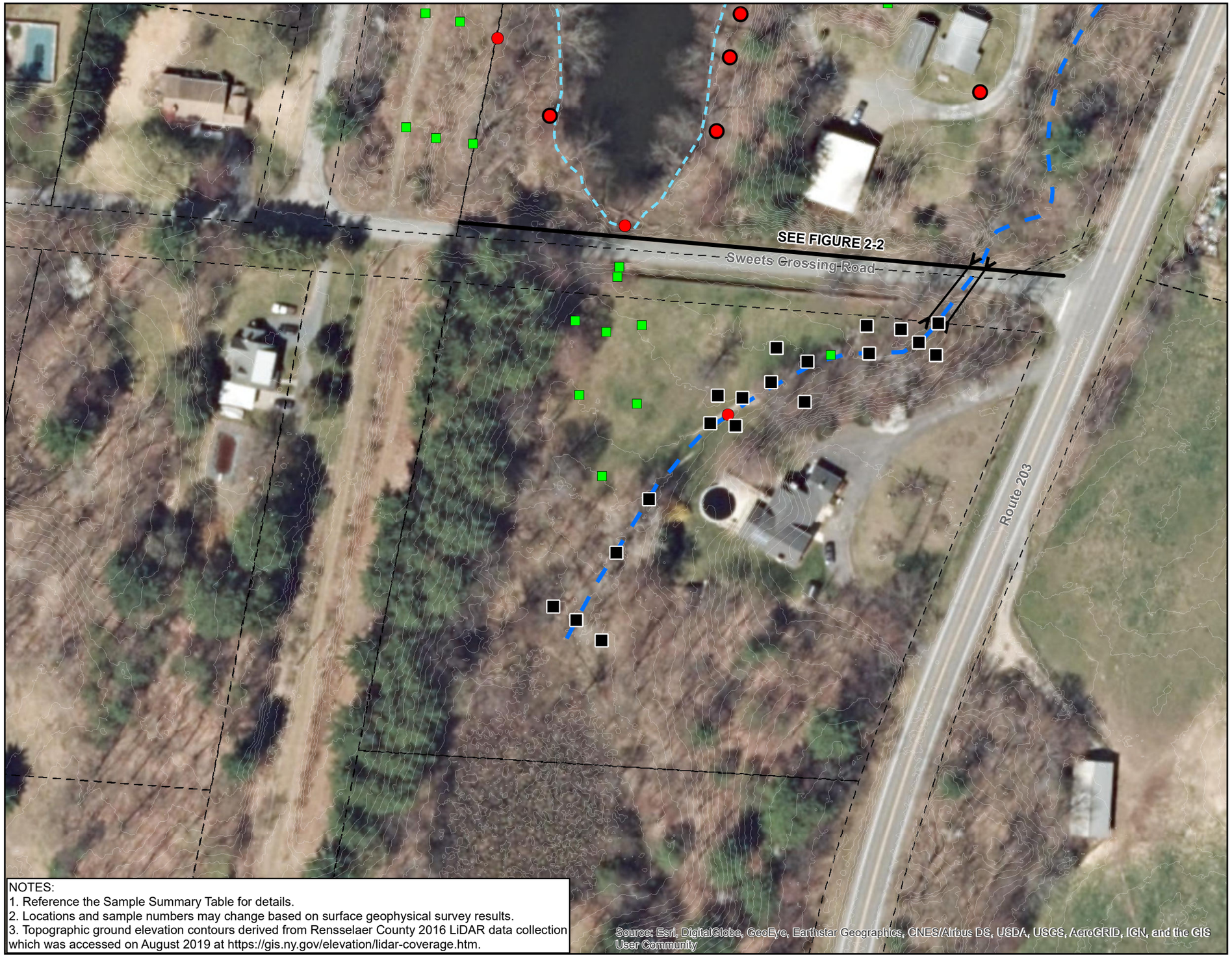

NOTES:
1. Reference the Sample Summary Table for details.
2. Locations and sample numbers may change based on surface geophysical survey results.
3. Topographic ground elevation contours derived from Rensselaer County 2016 LiDAR data collection which was accessed on August 2019 at https://gis.ny.gov/elevation/lidar-coverage.htm.

N

LEGEND

- Proposed Shallow Soil Sampling Location
- Total PCB Result ≥ 1 ppm
- Bottom Sample Total PCB Results ≥ 1 ppm
- Total PCB Results < 1 ppm
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert
- Minor Elevation Contour (1 foot)
- Rensselaer County Tax Parcel

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

PROPOSED SOIL SAMPLE LOCATIONS (SOUTH OF SWEETS CROSSING ROAD)

0 25 50 100
Feet

612.73458
NOVEMBER 2019

O'BRIEN & GERE ENGINEERS, INC.

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I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 2-3 Conceptual Soil Sample Locations - Offsite.mxd

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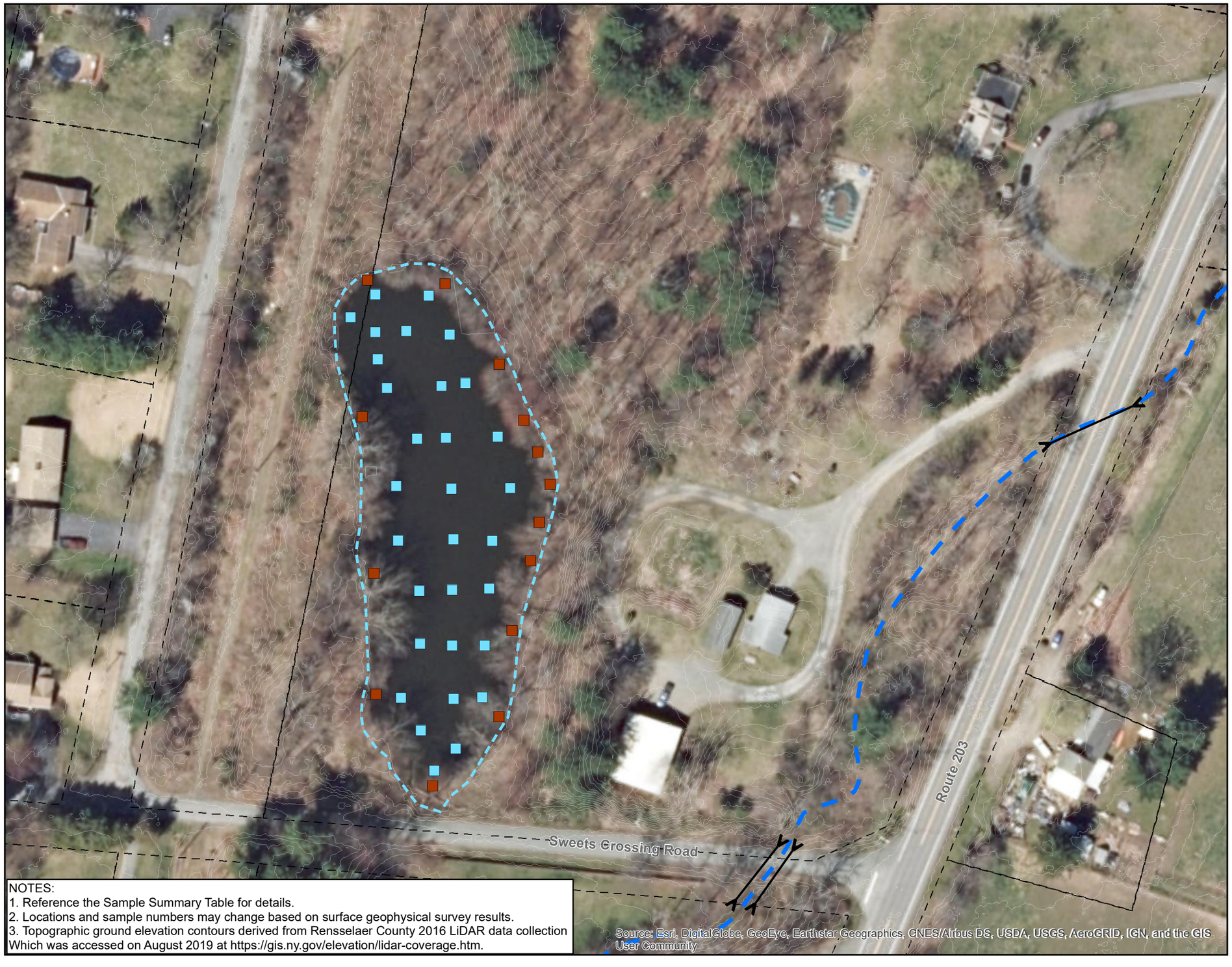
I:\Ge-Cep.612\73458.Route-203-Prope\Docs\Reports\Investigation Work Plan\Figures\Figure 2-4 Conceptual Sediment Sample Locations.mxd



NOTES:
1. Reference the Sample Summary Table for details.
2. Locations and sample numbers may change based on surface geophysical survey results.
3. Topographic ground elevation contours derived from Rensselaer County 2016 LiDAR data collection Which was accessed on August 2019 at https://gis.ny.gov/elevation/lidar-coverage.htm.

N

LEGEND

- Proposed Sediment Sampling Location
- Prior Sediment Sample Location
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert
- Minor Elevation Contour (1 foot)
- Rensselaer County Tax Parcel

LOEFFEL ROUTE 203 PROPERTY
NASSAU, NEW YORK

PROPOSED SEDIMENT SAMPLE LOCATIONS

0 25 50 100
Feet

612.73458
NOVEMBER 2019

O'BRIEN & GERE ENGINEERS, INC.

APPENDICES

APPENDIX A
LABORATORY STANDARD OPERATING PROCEDURES, QUALITY ASSURANCE MANUAL AND NELAC CERTIFICATION FOR EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL LLC

eurofins	Always check on-line for validity. **Separatory Funnel Extraction by Method 3510C, 608, 608.3 or 622 for Pesticides and PCBs in a Wastewater**	Level: **Work Instruction**
Document number: **T-OE-PEST-WI10920**		
Old Reference: **1-P-QM-WI -9015079**		
Version: **20**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date **22-MAR-2019**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Pest/PCB Waters, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

LIMS ID

Analysis - 6654, 10241, 11112, 11113, 11114, 11116, 11117, 11118, 11119, 11120, 11121, 11123, 11126, 11960, 12026, 12822, 13086, 13093, 13183, 13187

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Revision Log
Reference
Cross Reference
Purpose
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Preparation of Glassware
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision 20		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Title	Reflect current protocols	Added Method 608.3

eurofins	Always check on-line for validity. **Separatory Funnel Extraction by Method 3510C, 608, 608.3 or 622 for Pesticides and PCBs in a Wastewater**	Level: **Work Instruction**
Document number: **T-OE-PEST-WI10920**		
Old Reference: **1-P-QM-WI -9015079**		
Version: **20**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date **22-MAR-2019**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Pest/PCB Waters, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

Revision 20	**Effective Date:** This version	
Reference	Reflect current documentation	Added Method 608.3
Procedure 1	Reflects current procedure	Clarified wording to describe volumes to be extracted.
Procedure 1.a(2)	Reflects current procedure	Added information regarding reduced volumes for 250ml extractions
Procedure 1.c(4)	Reflects current procedure	Clarified that samples for analysis 0950 get brought to 250 mL with Di water in the sep funnel
Procedure 2	Reflects current procedure	Clarified that the blank, LCS, and LCSD for analysis 0950 get brought to 250 mL with Di water in the sep funnel.
Procedure 5.b(6)	Reflects current procedure	Changed surrogate and amount to be added to samples.
Procedure 5.c.1(d)	Reflects current procedure	Changed spike and amount to be added to samples.
Procedure 4.e	Reflects current procedure	Replaced extractor with sep funnel.
Procedure 6	Reflects current procedure	Added reference to *T-OE-GEN-FRM23822*
Procedure 17 through 22	Clarification	Clarified the concentration procedure for samples that require GPC and samples that do not require GPC.
Procedure 19 D,E	Reflects current procedure	Added exception for prep group 1114.

Revision 19	**Effective Date:** Oct. 7, 2016	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Procedure 1	Reflects current analyses numbers	Added analyses 13086, 0950, 12013, 12686, 13093
Procedure 1 C(1-3)	Reflects current practice	Changed volumes to reflect current 250 mL volumes
Procedure 2	Reflects current practice	Changed amount of extraction fluid to 50 mL
Procedure 6 b (5)	Reflects current practice.	Changed surrogate amounts for 250ml extractions
Procedure 6 c (1) (d,h,l,n,o)	Reflects current practice	Changed matrix spike amounts and names.
Procedure 18 b	Reflects current practice	Changed Rapid-Vap temp to 90°C.

eurofins	Always check on-line for validity. **Separatory Funnel Extraction by Method 3510C, 608, 608.3 or 622 for Pesticides and PCBs in a Wastewater**	Level: **Work Instruction**
Document number: **T-OE-PEST-WI10920**		
Old Reference: **1-P-QM-WI -9015079**		
Version: **20**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date **22-MAR-2019**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Pest/PCB Waters, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

Revision 19	**Effective Date:** Oct. 7, 2016	
Procedure 18 c	Reflects current practice	Added the concentration volume of extracts.
Procedure 18 c	Reflects current practice	Added Rapid-Vap and KD apparatus
Procedure 19 a (2)	Reflects current practice	Changed concentration volume to approximately 2 mL.
Procedure 19 a (4)	Reflects current practice	Changed FV for 250 mL extractions to 5 mL.
Procedure 19 b (2)	Reflects current practice	Changed concentration volume to 3-5 mL.
Procedure 19 c (1)	Reflects current practice	Added details regarding concentration step
Procedure 19 c (2)	Reflects current practice	Added details regarding bringing extracts to FV.
Procedure 19	Reflects current practice	Changed SOP numbers to reflect D4 numbers.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3510C, Rev. 3, December 1996.

2. USEPA, 40 CFR Part 136, Appendix A, Method 608.

3. USEPA, 40 CFR Part 136, Appendix A, Method 608.3, December 2016. MUR Effective September 2017.

4. USEPA, 40 CFR Part 136, Appendix A, Method 622.

5. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #0177, 0950, 0180, 1954	Pesticides in Water by Method 8081A using GC-ECD
Analysis #2257, 2253	Captan and Captafol by Method 8081A in Waters and Solids using GC-ECD
Analysis #5366, 10410, 10593, 12144, 13182, 13186	Organophosphorous Pesticides by Methods 8141A/8141B/622 in Aqueous Samples using GC-NPD
Analysis #6030, 10227	Polychlorinated Biphenyls (PCBs) by Method 608.3 or 8082 in Waters
Analysis #7572	Pesticides in Aqueous Samples by Method 608.3

Analysis #10589, 10647	Pesticides in Water by Method 8081B using GC-ECD
Analysis #10591, 13092	Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD
Analysis #12013, 12686	Low Level PCBs in Water by Method 8082/8082A using GC-ECD
T-OE-PEST-WI11410	Pesticide Extract Cleanup Using Gel Permeation Chromatography
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling
T-OE-GEN-FRM23822	Instructions for Checking pH During Extraction Procedures

Purpose

The purpose of this SOP is to provide clear instructions for performing the separatory funnel extraction procedure on samples that are to be analyzed for pesticides and PCBs.

Scope

This procedure is for the extraction of organochlorine and organophosphorous pesticides and PCBs from wastewaters.

Basic Principles

An aliquot of the sample is placed into a separatory funnel. The volume of sample extracted is adjusted (if appropriate) depending on the physical appearance of the sample and the volume sent for analysis. A surrogate standard is added to the sample to monitor recovery. The sample is then extracted with methylene chloride. The extract is dried, concentrated, and exchanged to hexane. Several cleanup procedures are available to eliminate matrix interferences before the sample is analyzed. They include sulfuric acid treatment, copper treatment, florisil, and Gel-Permeation Cleanup (GPC).

Reference Modifications

1. Surrogate and matrix spiking solutions are not added before the transfer to the extractor. For several reasons:

a. Samples must be poured from the amber bottles to determine the matrix and volume of sample to use for each extraction.

b. Many sample bottles have no headspace and there is no room to add surrogate to the sample in the bottle.

c. Due to the volume of samples extracted, a separate graduated cylinder for each sample is unrealistic.

d. To maintain consistency with all extractions, no samples are spiked in the bottle or graduated cylinders.

2. In Procedure Step 19 the joint of the KD is not rinsed with fresh solvent when the ampule is removed. Quad and MDL studies have shown that this step is unnecessary.

Interferences

Impurities in solvents, reagents, glassware, or other hardware used in sample processing interfere with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the employees training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the extraction and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, or one blind sample.

Sample Collection, Preservation, and Handling

Samples are collected in amber glass bottles with PTFE-lined lids, preserved with sodium thiosulfate, and stored refrigerated at 0 - 6°C, not frozen. Sample extraction must be started within 7 days of collection. Extracts are stored frozen at ≤-10°C.

Apparatus and Equipment

1. Separatory funnel for extracting organic components from an aqueous matrix

2. Kuderna-Danish (K-D) assembly with appropriate ampule for extracting the solvent used during the extraction

3. Water bath – VWR/LLI Model #1127 or equivalent

4. Sodium sulfate column with extra course frit

5. Nitrogen evaporation (N-Evap) with nitrogen supply – Organomation Associates or equivalent

6. pH paper – Wide range

7. Automatic shaker – Glass Col or equivalent, capable of holding 2-L separatory funnels

8. Pipettes – Class A, assorted sizes

9. Graduated cylinders – Class A, assorted sizes

10. Pipettes – Disposable

11. Solvent dispenser – Brinkmann, adjustable or equivalent

12. Balance – Capable of weighing to 0.01 g

13. Centrifuge – Beckman GS-6 or equivalent

14. Micro-Snyder columns

15. Wash bottles – Teflon

16. Vials – Assorted sizes

17. Teflon boiling chips

18. Syringes - Assorted sizes

19. Micro-pipetter

20. Turbo Vap – Zymark Turbo Vap II concentration station or equivalent

21. Turbo Vap tubes- 250ml Zymark tubes or equivalent
22. Automated Water Extraction Bench – capable of holding separatory funnels for 250 mL extractions.

23. Rapid-Vap Evaporators – for concentration of 250 mL extractions

24. Rapid-Vap Evaporator Tubes – Class A

Reagents and Standards

1. Methylene chloride (CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

2. Acetone – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

3. Hexane – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

4. 10N Sodium hydroxide (NaOH) – Lab Chem or equivalent. Store at room temperature. Follow manufacturer's expiration date.

5. Sulfuric acid (H_2SO_4) – ACS grade or equivalent. Store at room temperature. Follow manufacturer's expiration date.

6. Sodium Sulfate (Na_2SO_4) – Reagent grade or equivalent. Bake at approximately 400°C for a minimum of 4 hours in a shallow pan to remove organic contaminants. Store in a glass jar at room temperature for up to 1 year after baking.

7. Reagent water – water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the reagent water supplied at the taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.

8. Extraction fluid – Prepared and delivered by the leachate department. Store refrigerated at 0-6°C, not frozen, in a glass container with a PTFE-lined lid.

9. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical Analysis #0177, 0950, 0180, 1954,14134; *Analysis #2257, 2253*; Analysis #5366 10410, 10593, 12144, 13182, 13186; Analysis #6030, 10227, 14169, 14188; *Analysis #7572*, 13634; *Analysis #10589, 10647*, 14166; analysis 10591, 13092, 14184, 14186 ; and Analysis #12013, 12686.

Calibration

Not applicable to this procedure.

Preparation of Glassware

See SOP *T-OE-GEN-WI10864*.

Procedure

1. Determine the volume of sample to be used for each extraction. Typically, this is 1L or 250 mL. For analysis 1114: 50 mL of sample is measured from the sample bottle and diluted to 250 mL in a sep funnel.

1 Liter Analyses: 0177, 0180, 1954, 2257, 2253, 5366, 10410, 10593, 12144, 13182, 13186, 6030, 10227, 7572, 10589, 10647, 10591, 13092, 12013, 12686, 13086, 0950,12013,12686,13093

250 mL Analyses: 13634, 14134, 14166, 14169, 14184, 14186, 14188

a. If uncertain of the volume to extract for any sample, ask your supervisor.

b. Use one full bottle for all analysis scans (with the exception of scan #0950) unless the matrix is poor (thick, lots of sediment, extremely foul odor).

(1) If using reduced volume due to matrix, take as much as possible while trying to minimize matrix problems, document why the reduced volume was used.

(2) Reduced volume aliquots due to matrix are typically are 500, 200, or 100 mL (100, 50, or 25 mL for 250 mL extractions).

c. For analysis 0950:

(1) If the sample bottle contains at least 100 mL of sample, measure 50 mL.

(2) If the sample bottle contains <100 mL of sample, use 1/2 of the available volume or 10 mL, whichever is greater.

(3) If a matrix spike (MS) or MS/matrix spike duplicate (MSD) is required for the sample, use 50 mL each.

(4) After adding the 50 ml of sample add approximately 200 mL of Di water to bring the volume in the sep funnel to 250 mL.

d. The background, MS, and MSD are performed on three separate aliquots of a field sample.

2. Prepare the blank, laboratory control sample (LCS), laboratory control sample duplicate (LCSD) (if applicable) with 1 L of reagent water (or 250mL for 250 mL extractions) measured into the separatory funnel.

Exception: For Analysis #0950 - The blank, LCS, and LCSD (if applicable) are prepared using 50 mL of extraction fluid measured into the separatory funnel. Approximately 200 mL of Di water to bring the volume to 250 mL.).

3. For samples using 1 entire bottle:

   a. Etch the outside of the bottle with a scriber at the meniscus.

   b. Shake the bottle vigorously and then pour the contents into a separatory funnel.

4. For all samples requiring a specified volume:

   a. Shake each bottle vigorously.

   b. Use a clean graduated cylinder to measure the desired volume.

   c. Pour the sample from the graduated cylinder into the sep funnel.

   d. Record and comments about the sample appearance or odor. Also record comments if a reduced volume was taken due to sample matrix or insufficient available sample.

   e. If <1000 mL (or <250mL for 250mL extractions) of sample is used, use a graduated cylinder to add enough reagent water to bring the volume in the sep funnel to 1-L (or 250mL for 250mL extractions).

5. Use pipettes to add surrogate standards and spiking solutions to the aqueous sample in the separatory funnel.

   a. Be certain the standard drips directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

   b. Surrogates – Surrogates are added to all samples, blanks, and spikes.

   The type of surrogate is determined by the analysis scan number. Typically they are as follows:

   (1) For analyses 0177, 0180, 1954, 2257, 6030, 7572, 10589, 10591, 13092, 10647, 13092 – 1.0 mL SW-846 Surrogate.

   (2) For analysis 5366, 10593, 10410, 12144, 13182, 13186 – 1.0 mL NP Surrogate.

   (3) For *Analysis #12013, 12686* – 0.1 mL of SW-846 Surrogate.

   (4) For Analysis #10227 – If entered for prep 11117 use 1.0 mL of SW846 Surrogate. If entered for prep 13086 use 0.25 mL of SW846 Surrogate.

(5) For Analyses #13634, 14134, 14166, 14169, 14184, 14186, 14188 - Use 0.25 mL of SW846 Surrogate

(6) For analyses 00950 and 10647 - Use 1.0 mL of Mini Sep. SW846 Surrogate

c. Spiking Solutions – Spiking solutions are added to the LCS, LCSD (if applicable), MS, and MSD.

(1) The type of spike is determined by an analysis number. Typically they are as follows:

(a) For analysis 6030, 10591, 13092 – 1.0 mL PCB Spike.

(b) For analysis 10227 – If entered with prep 11117 use 1.0 mL of PCB spike. If entered with prep 13086 use 0.25 mL of PCB spike.

(c) For analysis 7572, 10589, 0177 – 1.0 mL SW-846 Spike.

(d) For analysis 0950 & 10647 – 1.0 mL of Mini TCLP Pesticides Spike regardless of initial volume

(e) For analysis 5366 – 1.0 mL Triazine Herb Spike.

(f) For analyses 10593 and 10410 – 1.0 mL OPPA Spike.

(g) For analysis 2257 – 1.0 mL Captan/Captafol Spike

(h) For analysis 0180 – 1.0 mL of Chlordane spike for 1000 ml extractions and 0.25 mL for 250 mL extractions.

(i) For analysis 1954 – 1.0 mL of SW846 spike and an additional LCS/LCSD with 1.0 mL of Alaclor.

(j) For analysis 12013 – 0.1 mL of PCB Spike.

(k) For Analysis 13093 – 1.0 mL of PCB Spike and prepare a separate LCS/LCSD using 1.0 mL of 5442 Arochlor Spike.

(l) For Analysis 13182 and 13186 – 1.0mL of Appendix IX Water Spike for 1000 mL extractions and 0.25 mL of Appendix IX water Spike for 250mL extractions.

(m) For analysis 13634, 14134, 14166 – 0.25 mL of SW846 Spike

(n) For analysis 14169, 14184, 14188 – 0.25 mL of PCB Spike

(o) For analysis 14186 – 0.25 mL of PCB Spike and prepare a separate LCS/LCSD using 0.25 mL of 5442 Arochlor Spike.

(2) Spike details can be found in the corresponding analytical SOP(s)

(3) This is changed to accommodate specific-client requirements, if appropriate.

(4) If a sample requires any special compounds in addition to the standard list, an appropriate spike containing those compounds is added at this time.

(5) See SOP *T-OE-GEN-WI10876* for storage and handling of spikes.

6. Measure and record the pH of the sample using wide-range pH paper. See *T-OE-GEN-FRM23822* for instructions to check and adjust pH.

a. If necessary, adjust the pH to between 5 and 9 using 10N NaOH (to bring up the pH) or concentrated H_2SO_4 (to lower the pH).

b. To adjust the pH, add a few drops of the appropriate solution with a disposable pipette, swirl the separatory funnel and re-check the pH.

c. If the pH now falls between 5 and 9, record the adjusted pH on the extraction sheet.

d. If the pH is still out of range, continue adding small aliquots of base or acid, shaking and checking the pH until it is within the specified range.

e. Record the adjusted pH.

NOTE: Any samples from North Carolina require that the volume of acid or base added to the sample to adjust the pH to be recorded on the extraction sheet.

7. If the original sample bottle is empty:

a. Use a solvent pump to measure 60 mL (15 mL for 250 mL extractions) of methylene chloride. Add the methylene chloride to the sample bottle. Then cap the bottle and invert several times. Add the solvent to the separatory funnel.

b. Fill the bottle to the marked level with water and transfer the water to a graduated cylinder to determine the initial volume.

c. Alternatively, for all analyses **except Analysis #7572, and analysis 6030 (Method 608)** weigh the empty bottle and tare the balance.

(1) Fill the bottle to the marked level with water and place the bottle onto the tared balance.

(2) This weight rounded to a whole number is the initial sample volume.

d. Record the initial volume on the extraction sheet.

8. If the sample container is not empty, measure 60 mL (15 mL for 250mL extractions) of methylene chloride to the graduated cylinder used to measure out the sample volume and add it to the separatory funnel.

9. Cap the funnel, invert it, and vent immediately. With the cap on shake the sep funnel and vent. Continue shaking and venting until the pressure in the funnel has equalized.

10. For 1 Liter Analyses: Place the sample on the automatic shaker and shake at the designated speed for 2 minutes with the stopcocks closed.

For 250 mL Analyses: Separatory funnels remain on the Automated Water Extraction Bench. Press the green “start” button to lower the hood and activate the Automated Water Extraction Bench. The bench will tumble for 2 minutes. The sash will rise after the samples have tumbled.

NOTE: Shaker speeds vary greatly between instruments so the proper setting is marked on each.

11. For 1 Liter Analyses: Place the separatory funnel on the rack and allow it to sit undisturbed until the solvent layer (bottom layer) has separated from the water layer (top layer). For 250 mL Analyses: the separatory funnel will sit undisturbed on the Automated Water Extraction Bench.

a. The time required for extracts to set undisturbed is based upon visual confirmation that the layers are adequately separated.

b. If an emulsion forms and is greater than 1/3 of the volume of the solvent layer, mechanical techniques such as stirring and centrifugation must be employed to complete the separation.

12. Removing the Solvent Layer.

a. For 1 Liter analyses (except 5366, 10593, 10410, 12144, 13182, and 13186) : Remove the solvent layer by opening the stopcock and collect the solvent in a metal beaker then pour through approximately 10cm of sodium sulfate into a K-D apparatus containing a Teflon boiling chip.

b. For analyses 5366, 10593, 10410, 12144, 13182, and 13186, remove the solvent layer by opening the stopcock and collecting the solvent in a metal beaker. The solvent layer is then poured into a sodium sulfate column and collected in a Turbo Vap tube.

c. For 250 mL analyses: drain the solvent layer directly into the sodium sulfate column containing approximately 5cm of sodium sulfate. This drains into a Rapid-Vap Evaporator Tube.

NOTE: Do not use more than the recommended quantity of sodium sulfate and take care not to transfer water into the column. Excessive sodium sulfate and/or water in the column results in low aldrin recovery.

13. Use a solvent pump to add 60 mL (15mL for 250mL extractions) of methylene chloride to the separatory funnel and repeat Procedure Steps 10 through 13, venting only as necessary.

14. Again, use a solvent pump to add 60 mL (15 mL for 250mL extractions) of methylene chloride to the separatory funnel and repeat Procedure Steps 10 through 13, venting only as necessary.

15. For 1L extractions only, rinse the metal beaker that was used for solvent collection with approximately 20 mL of methylene chloride. Pour into salt column.

16. Rinse salt column with approximately 20 mL (5mL for 250mL extractions) of methylene chloride.

17. Concentrating extracts for 1 Liter analyses for samples that do not require GPC. For samples that require GPC go to Procedure 20

For analyses 5366, 10593, 10410, 12144, 13182, and 13186 go to step 18.

a. Attach a 3-ball Snyder column to the K-D, wet with solvent, and concentrate the extract to approximately 3 to 5 mL on a steam bath at 85° to 99°C. Adjust the vertical position of the apparatus and the water temperature, as required, to complete the concentration in 10-20 minutes.

At the proper rate of distillation the balls of the column will actively chatter, but the chambers will not flood. This steam bath temperature ensures concentration in a reasonable length of time.

Note: Do not allow the extracts to reach a point off dryness. Loss of analytes may occur.

b. Add 50 mL of hexane directly through the Snyder column after the apparent volume in the ampule reaches 3-5 mL. Continue concentrating on the steam bath until an apparent volume of 3-5 ml is reached. Allow the extracts to cool for 10 minutes prior to removing the ampule from the KD.

Note: Do not allow the extracts to reach a point off dryness. Loss of analytes may occur.

c. Bring the extracts to a final volume of 10 mL in the ampule with hexane.

d. Go to Procedure 23 for details on cleanup procedures.

18. Concentrating 1 Liter extracts for analyses 5366, 10593, 10410, 12144, 13182, and 13186 that do not require GPC. For samples that require GPC go Procedure 21

a. place the Turbo Vap tubes in a Turbo Vap with the temperature set between 45°and 50° C. Allow the samples to concentrate to approximately 5 mL and then rinse down the sides of the turbo vap tubes with methylene chloride. This ensures all potential analytes are rinsed off the glass into the extract.

b. Continue concentrating until a volume of approximately 3 mL is reached.

Note: Do not allow the extracts to reach a point off dryness. Loss of analytes may occur.

c. Add 50 mL of hexane to the turbo vap tubes and continue concentrating to a volume of approximately 5 mL is reached. Rinse the sides of the turbo vap tubes with hexane to ensure all potential analytes are rinsed off the glass into the extract.

d. Continue concentrating until the volume in the turbo vap tubes reaches approximately 3 mL.

Note: Do not allow the extracts to reach a point off dryness. Loss of analytes may occur.

e. Quantitatively transfer the extracts from the turbo vap tubes into a class A volumetric using hexane. Bring the extract to a final volume of 10 mL.

f. Go to Procedure 23 for details on cleanup procedures.

19. Concentrating extracts for 250 mL analyses for samples that do not require GPC.

Note: For samples that require GPC go to Procedure 22

a. Place the Evaporator Tube containing the solvent extract into the pre-heated (approximately 80°C) Rapid-Vap Evaporator. Set the timer for 10 minutes and speed at 75% (the speed is the rotation within the unit while the sample is evaporating). Confirm that the nitrogen is set at 15 psi (this is adjusted on the regulator attached to the nitrogen line).

b. Concentrate the extract in the Rapid-Vap Evaporator until a volume of approximately 3 mL is reached.

c. Add 50 mL of hexane to the rapid vap tube. When adding the 50 mL of hexane make sure to rinse down the inside of the rapid vap tubes. This ensures all analytes sticking to the glass are rinsed into the extract.

d. Continue concentrating until the volume in the rapid vap tube is approximately 3 mL. Rinse down the inside of the rapid vap tube with approximately 1 mL of hexane to ensure all analytes have been rinsed off the glass into the extract.

Exception: All samples in prep analysis 1114 should be concentrated to approximately 1 mL.

e. Quantitatively transfer the extract to a class A volumetric using hexane to a final volume of 5.0 mL.

Exception: All samples in prep analysis 1114 are quantitatively transferred to a class A volumetric using hexane to a final volume of 2.0 mL

f. Go to Procedure 23 for details on cleanup procedures.

20. Concentrating samples that require GPC
for all 1 Liter analyses except for analyses 5366, 10593, 10410, 12144, 13182, and 13186. For those analyses go to Procedure 21.

a.. Attach a 3-ball Snyder column to the K-D, wet with solvent, and concentrate the extract to approximately 4 to 6 mL on a steam bath at 85° to 99°C. Adjust the vertical position of the

apparatus and the water temperature, as required, to complete the concentration in 10-20 minutes. At the proper rate of distillation the balls of the column will actively chatter, but the chambers will not flood. This steam bath temperature ensures concentration in a reasonable length of time.

b. After an apparent volume of 4 to 6 mL is reached remove the KD from the steam bath and allow it to cool for 10 minutes.

c. Remove the ampule and bring the sample to final volume of 10.0 mL in the ampule. Be sure to mix the sample thoroughly to ensure the extract is homogenous.

d. Filter the samples through a 0.45 µm filter (Whatman cat no. 6874-2504 or equivalent) attached to a disposable syringe (Fisher cat no. 14955459 or equivalent) into a 12 mL glass screw top vial. Place the extracts into the appropriate GPC queuing area for storage until the cleanup is performed.

e. Perform GPC cleanup following SOP *T-OE-PEST-WI11410*

21. Concentrating samples that require GPC for analyses 5366, 10593, 10410, 12144, 13182, and 13186

a. place the Turbo Vap tubes in a Turbo Vap with the temperature set between 45°and 50° C. Allow the samples to concentrate to approximately 5 mL and then rinse down the sides of the turbo vap tubes with methylene chloride. This ensures all potential analytes are rinsed off the glass into the extract.

b. Continue concentrating until a volume of approximately 3 mL is reached.

Note: Do not allow the extracts to reach a point off dryness. Loss of analytes may occur.

c. Quantitatively transfer the extracts into a 10 mL class A volumetric and bring to a final volume of 10.0 mL using methylene chloride.

d. Thoroughly mix the extract to ensure it is homogenous.

e. Filter the samples through a 0.45 µm filter (Whatman cat no. 6874-2504 or equivalent) attached to a disposable syringe (Fisher cat no. 14955459 or equivalent) into a 12 mL glass screw top vial. Place the extracts into the appropriate GPC queuing area for storage until the cleanup is performed.

f. Perform GPC cleanup following SOP *T-OE-PEST-WI11410*

22. Concentrating samples that require GPC for 250ml analysis

a. Place the Evaporator Tube containing the solvent extract into the pre-heated (approximately 80°C) Rapid-Vap Evaporator. Set the timer for 10 minutes and speed at 75% (the speed is the rotation within the unit while the sample is evaporating). Confirm that the nitrogen is set at 15 psi (this is adjusted on the regulator attached to the nitrogen line).

b. Allow samples to concentrate to approximately 7 mL and then bring to final volume of 10.0 mL in a class A volumetric. Make sure to mix the extract thoroughly to ensure the extract is homogenous.

c. Filter the extracts using a Whatman 0.45 µm filter (part number 6875-2504) and 10 mL Fisher disposable syringe (part number 14955459) into 12 mL glass screw top vials. Place the extract into the appropriate GPC queuing area for storage until the cleanup is performed

d. Perform GPC cleanup following SOP *T-OE-PEST-WI11410*

23. Perform cleanup procedures following Steps 24 through 27 as needed.

24. If the extract is scheduled for analysis 6030, 10227, 12013, 14169, 14184, 14186, 14188 treat the extract with sulfuric acid as described in SOP *T-OE-PEST-WI10281*.

25. If the extract is scheduled for analysis 0177, 7572, 10589, 13634, 14134, 14166 florisil the sample 2 mL to 2 mL as described in the Pesticide Florisil section of SOP *T-OE-PEST-WI10281*.

Pesticide florisil is also being performed for analysis 0950 and 2257 if required due to matrix or client request.

26. If the extract is scheduled for analysis 6030, 10227, 12013, 14169, 14184, 14186, 14188 florisil the extract following the PCB Florisil section of SOP *T-OE-PEST-WI10281*.

27. If the extract has a sulfur odor, perform copper cleanup of the extract as described in SOP *T-OE-PEST-WI10281*. for analysis 6030 only. Other samples are cleaned up with GPC.

Calculations
See analysis method as listed in the Cross Reference section.

Statistical Information/Method Performance
See analysis method as listed in the Cross Reference section.

Quality Assurance/Quality Control
A batch is defined as the samples to be extracted on any given day, but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. Exception: For analyses referencing Methods 608 or 622 (i.e. 7572, 6030, 11119, 11123,13634, 14188) batches cannot exceed 10 field samples.

For each batch of samples extracted a blank, an LCS, an MS and an MSD must be extracted. For method 608, the laboratory must, on an ongoing basis, spike at least 10% of the samples, if enough sample volume is received, to assess accuracy. If there is limited sample preventing the preparation of the MS/MSD, an LCSD must be prepared instead. If the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing must be used.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed instead.

T-OE-GEN-FRM23822 Instructions for Checking pH During Extraction Procedures
T-OE-GEN-WI10864 Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876 Organic Extraction Standards Storage and Handling
T-OE-PEST-WI10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-PEST-WI11410 Pesticide Extract Cleanup Using GPC by Method 3640A
T-PEST-WI11970 Organophosphorous Pesticides by Methods 8141A/8141B/622 in Aqueous Samples using GC-NPD
T-PEST-WI11971 Polychlorinated Biphenyls (PCBs) by Method 608 or 8082 in Waters
T-PEST-WI9238 Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-

ECD
T-PEST-WI9843 Captan and Captafol by Method 8081A in Waters and Solids using GC-ECD
T-PEST-WI9961 Low Level PCBs in Water by Method 8082/8082A using GC-ECD
T-PEST-WI9997 Pesticides in Aqueous Samples by Method 608
T-PEST-WI9998 Pesticides in Water by Method 8081A using GC-ECD
T-PEST-WI9999 Pesticides in Water by Method 8081B using GC-ECD

End of document

Version history

Version	Approval	Revision information
19	07.OCT.2016	
20	22.MAR.2019	

An error has happened on file: /D4Doc/formularer/2016/09/Quality Document # 1-P-QM-WI -9015079_18_665410241.doc
Errortext: The remote server returned an error: (404) Not Found.

eurofins	Always check on-line for validity. **Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035 and Method 5035A**	Level: **Work Instruction**
Document number: **S-SS-WI11170**		
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LIMS ID

Analysis DOD - 8389, 8390, 6130, 6117, 6174, 7578, 7320

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Revision Log
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To Determine Final Extract Volume
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Revision Log

Revision: 18		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM -QMA-9017356	Removed revision logs up to the previous version
Reference	Reflects revision in use	Changed 5035 reference to Dec 1996; Added Revision number to 5035A reference.

Revision: 18	**Effective Date:** This version	
Procedure	Reflects the current procedure Changed to reflect industry standard	Referenced the option to use pre-purchased vials Changed 4° ± 2°C to 0° to 6°C

Revision: 17	**Effective Date:** Feb 21, 2015	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflects re-identification of documents in EtQ Reflects new reference to the information management system	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers Removed references to Parallax and replaced with LIMS

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 5035, Revision 0, December 1996.
2. *Test Methods for Evaluating Solid Wastes*, SW-846, Method 5035A, Revision 1, July 2002.
3. *Method AK101 for the Determination of Gasoline Range Organics*, April 8, 2002.
4. *Chemical Hygiene Plan*, current version.

Cross Reference

Not applicable

Purpose

The purpose of this SOP is to describe the proper technique to perform the preparation of soil samples for low and high concentration volatile analysis when submitted in a coring device.

Scope

This SOP covers the preparation of vials used when preparing soil samples for low and high concentration volatile analysis. It also covers preparing soil samples that have been collected in a coring device for analysis, such as the Encore™ sampler.

Basic Principles

The sample is collected in a coring device (Encore™) and extruded into a pre-weighed volatile-free container and preserved within 48 hours of collection. The weight of the container, preservative, and soil is captured and the net weight of the sample is calculated and captured in the Volatile Preparation program in LIMS.

Definitions

VOA Prep Summary and VOA Prep Summary by SDG - Reports that reside on the LIMS database. Using the Volatile Prep application and moisture results pulled from LIMS, the report is populated and the calculations are performed to achieve a Final Extraction Volume to be used when necessary by the GC and GC/MS groups.

Interferences

Sample preparation must be performed in a volatile free environment to avoid contamination. Therefore, this process must be performed in one of the designated volatile free laboratories. It is possible for samples to become contaminated by diffusion of volatiles through the sample vial septum; a trip blank carried through sampling, storage and handling acts as a check for such contamination.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Methanol is flammable. Containers of this solvent must be kept away from any sources of open flames or sparks. Due to the potentially toxic nature of samples received from clients for analysis, safety precautions must be observed when handling samples. Safety glasses, lab coats, and gloves are required. Weighing of hazardous samples must always take place in a hood; see lab notes for further direction.

The solvents utilized in this procedure are disposed of in a solvent waste container which is transferred to a lab-wide disposal facility. Expired standards in methanol are disposed of as hazardous waste. Bulk sample containers and methanolic sample preparations are returned to the sample storage area for future disposal. Other wastes generated by Lancaster Labs are disposed of via incineration at EPA licensed facilities.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP which is maintained in the employee's training record.

The initial training consists of observing the procedure being carried out by an experienced analyst/technician. Next, the trainee performs the procedure while the experienced person watches, answers questions, and gives feedback. Following the initial training, experienced individuals are available as a resource until no longer required. Analysts are considered proficient when able to perform the procedure independently.

Sample Collection, Preservation, and Handling

Samples in either Encore™ sampling devices or jars used for the effervescence check must be refrigerated at 0° to 6°C, not frozen. (Jars used for collection must be glass with a PTFE-lined lid.) Samples must be preserved or frozen in reagent water at $\leq$-10°C within 48 hours of collection. See individual technical area SOPs for method specific hold times.

Apparatus and Equipment

It is acceptable to use alternate weights and volumes as long as the final concentrations remain the same.

1. 40-mL vials with stir bars, Teflon™-lined low-bleed septa, and screw caps. SciSpec Catalog #376740-MB or equivalent.

2. Encore™ sampler, or equivalent.

3. Pipette capable of dispensing up to 25 mL.

4. Analytical balance capable of weighing 0.01 g

5. Preprinted labels with vial ID code.

6. Extruder tool for EnCore™ sampler.

7. Voa Prep Application - integrates a PC with a balance to collect data directly from the balance. It organizes the data, performs calculations (when required), and stores final results in the Laboratory Information Management System. This procedure must be used whenever possible to facilitate data transfers and other tracking; however, it is allowable to record data traditionally in a logbook if necessary.

Reagents and Standards

The sodium bisulfate and methanol used must have been previously tested and approved for use by the labs.

NOTE: A rinse using reagent water followed by methanol must be performed on the pipette dispensers before adding a new lot of solution or standards.

1. Methanol – Purge and trap grade, store at room temperature and re-analyze yearly. The methanol used must have been previously tested and approved for use by the labs.

2. 8260A/B Surrogate Mix, Restek Catalog #30340 (2500 µg/mL) or equivalent. Store at ≤ -10° C for up to 1 year. This standard is used as is or diluted in methanol to a final concentration of 2.5 µg/mL. Diluted standard must be stored at ≤ -10°C for up to 6 months. This standard is used for the GC/MS analyses.

3. Custom a,a,a-trifluorotoluene (TFT), Restek Catalog #54357 (15,000 µg/mL) or equivalent. This standard is used as is or diluted in methanol to a final concentration of 750 µg/L. Store at ≤ -10°C for up to 30 days. This standard is used for the GC analyses.

4. Sodium hydrogen sulfate anhydrous powder, Fluka, Catalog #2316657 or equivalent. Store at room temperature and re-analyze yearly. If compounds are detected above the method detection limit (MDL), prepare another vial and repeat the analysis. If compounds are still detected above the MDL, a new container must be tested and used.

5. Sodium Bisulfate Solution – prepared by diluting 200 ± 0.5 g of the sodium hydrogen sulfate anhydrous into 1000 mL of reagent water in 1000-mL volumetric flask. Cap and invert at least 10 times to mix. Store at room temperature and re-analyze every six months if supply remains. If compounds are detected above the method detection limit (MDL), repeat the analysis. If compounds are still detected above the MDL, remake the solution and test before using.

6. Reagent water – water in which target analytes are not detected at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.

Calibration

Not applicable to this procedure

Procedure

A. Preparing vials

NOTE: Pre-purchased vials can be used for selected preps. Vials containing 5 mL of DI Water, vials containing 5 mL of Sodium Bisulfate and vials containing 5 mL of methanol are available for Encore preparations. The vials contain the initial tare weight, vial lot number, and the preservative lot number. When using the pre-purchased vials the vial information must be added to the volatile prep application before performing any preperations.

1. Sodium bisulfate solution vials used in preparation for low concentration analysis 8389.

   a. Add 5 mL of sodium bisulfate solution to a clean 40-mL vial with a magnetic stir bar.

   b. Seal the vial with a screw cap and septum seal. (Septum seal must be able to withstand an acidic solution—low bleed septum recommended).

   c. Label the vial with a tracking number and capture the information using the Volatile Prep application.

   d. Store at room temperature until sample preparation occurs.

2. Reagent water vials used when effervescence occurs during preparation for low level concentration analyses.

a. Add 5 mL of reagent water to a clean 40-mL vial with a magnetic stir bar.

b. Seal the vial with a screw cap and septum seal. (Septum seal must be able to withstand an acidic solution—low bleed septum recommended).

c. Label the vial with a tracking number and capture the information using the Volatile Prep application.

d. Store at room temperature until sample preparation occurs.

3. Methanol vials used in preparation for high concentration GC/MS analysis 8390, 6174, and 7578.

a. Add required amount of methanol with 8260 surrogate (pre-made solution) to a clean 40-mL vial.

b. Seal the vial with a screw cap and septum seal.

c. Label the vial with a tracking number and capture the information using the volatile prep application.

d. Store at ≤ -10°C

4. Methanol vials used in preparation for high concentration GC analysis 6117 and 6130.

a. Add required amount of methanol with TFT surrogate (pre-made solution) to a clean 40-mL vial.

b. Seal the vial with a screw cap and septum seal.

c. Label the vial with a tracking number and capture the information using the volatile prep application.

d. Store at 0° to 6°C, not frozen.

B. Preparing the sample

1. Samples are stored at 0° to 6°C, not frozen, prior to preparation.

2. Samples are removed from the refrigerator/cooler for preparation in small numbers to ensure that they remain cold.

3. Samples for low concentration analysis require three replicate collections.

   a. Two replicates are prepared into sodium bisulfate.

   b. One replicate is prepared into methanol as a back up in case we need to change to high level.

   c. If the sample effervesces in sodium bisulfate, those two replicates are prepared into reagent water and frozen.

4. Samples for high concentration analysis only require one collection prepared into methanol.

5. The methanol vial must be prepared first to ensure at least one vial is available for each required solution.

6. Sodium bisulfate solution or reagent water vials

NOTE: Take a representative sample from a container not collected in an EnCore™ sampler and place it in a vial containing sodium bisulfate solution. Check the pH of the sample in solution to ensure that it is <2. If it is not, add enough sodium bisulfate to bring the pH <2. Also check for effervescence. If a rapid or vigorous reaction occurs, prepare the EnCore™ collections into vials that contain a stir bar and 5 mL reagent water and then freeze at ≤ -10°C.

   a. Weigh a prepared vial to the nearest 0.01 g. Capture the weight.

   b. Extrude the sample from the sampling device into the vial and immediately recap the vial.

   c. Weigh the vial which now contains the soil to the nearest 0.01 g and capture the weight.

   d. The weight of the soil is determined by a calculation performed by the volatile prep program based on subtracting the weight of the prepped vial from the weight of the vial with soil. Note in the comment section if the Encore™ sampling device is not properly sealed or if the device is not full causing a low weight. The volatile prep application generates an e-mail and sends it to the appropriate client services representative.

   e. Record any unusual observations about the sample.

7. Methanol vials

   a. Weigh a prepared vial to the nearest 0.01 g. Capture this weight.

   b. Extrude the sample from the sampling device into the vial and immediately recap the vial.

c. Weigh the vial, which now contains the soil to the nearest 0.01 g, and capture this weight.

d. The weight of the soil is determined by a calculation performed by the volatile prep program based on subtracting the weight of the prepped vial from the weight of the vial with soil. Note in the comment section if the Encore™ sampling device is not properly sealed or if the device is not full causing a low weight. The volatile prep application generates an e-mail and sends it to the appropriate client service representative.

e. Record any unusual observations about the sample.

C. Deliver sample to the labs

Once the samples are prepared into either sodium bisulfate or methanol, or frozen in reagent water, they must be transported to the laboratory that performs the analysis. Each department has a designated drop-off spot. Analysis is then performed per the methods of that department.

Calculations

Calculation of sample weight : Wn = Ws - Wf

Where:

Wf = weight of container + solution (first weight)

Ws = weight of container + solution + soil (second weight)

Wn = net weight of soil sample

To Determine Final Extract Volume

When there is no moisture value to consider, the Final Extract Volume = the preservation volume (mL) + MeOH added (mL).

When the moisture volume is to be considered, the Final Extract Volume = the preservative volume (mL) + MeOH added (mL) + the moisture volume (mL).

The moisture volume (mL) = weight (g) x (% moisture/100)

Statistical Information/Method Performance

Not applicable to this procedure.

Quality Assurance/Quality Control

The number of sampling devices requested from client services must include enough extra to serve as matrix QC for the volatile analyses requested. Generally, the low-level analysis requires a total of seven Encore™ sampling devices. Four are prepared in sodium bisulfate: two for the unspiked sample, one for the matrix spike sample (MS), and one for the matrix spike duplicate sample (MSD). Three are prepared in methanol: one for the unspiked sample, one for the MS, and one for the MSD. Other numbers of sampling devices for matrix QC purposes are sent at the client's request.

All other QC samples such as the Laboratory Control Samples (LCS), Laboratory Control Sample Duplicates (LCSD), and method blanks are prepared and outlined in the individual technical areas SOPs.

The only surrogate addition performed under this procedure is for the high level containers as noted in Procedure A.3.a and A.4.a, are prepared and outlined in the individual technical areas SOPs.

End of document

Version history

Version	Approval	Revision information
18	17.MAY.2016	
19	31.JUL.2018	

eurofins	Always check on-line for validity. **Sample Prep of Sediments, Sludges, Soils, and Tissues by SW846 3050B for ICP and ICP-MS**	Level: **Work Instruction**
Document number: **T-MET-WI8636**		
Old Reference: **1-P-QM-WI-9015160**		
Version: **25**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **08-MAR-2019**	Document users: **6_EUUSLA_Metals_ICP Prep, 6_EUUSLA_Metals_ICP Prep Verifiers, 6_EUUSLA_Metals_ICP-MS Prep, 6_EUUSLA_Metals_ICP-MS Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

LIMS ID

Analysis #14049, 10681

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Revision Log

Revision	25	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
LIMS ID	Follow current procedure		Added analysis number for sieving
Apparatus and Equipment	Follow current procedure		Added sieves and changed temperature to 90C-100C
Procedure	Follow Current Procedure		Clarified if sample is not split
Procedure	Follow current procedure		Added section on how to dry and sieve samples

eurofins	Always check on-line for validity. **Sample Prep of Sediments, Sludges, Soils, and Tissues by SW846 3050B for ICP and ICP-MS**	Level: **Work Instruction**
Document number: **T-MET-WI8636**		
Old Reference: **1-P-QM-WI-9015160**		
Version: **25**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **08-MAR-2019**	Document users: **6_EUUSLA_Metals_ICP Prep, 6_EUUSLA_Metals_ICP Prep Verifiers, 6_EUUSLA_Metals_ICP-MS Prep, 6_EUUSLA_Metals_ICP-MS Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

Revision	25	**Effective Date:**	This version
Procedure	Update to Method		Updated 90C-95C to be 90C-100C
LIMS ID	Follow Current Procedure		Removed old analysis numbers
Quality Assurance/Quality Control	Clarification		Added sentence about sample and batch QC must be the same

Revision:	24	**Effective Date:**	27-FEB-2018
Section	**Justification**		**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356		Removed revision logs up to the previous version
Cross Reference	Reference to Level 2 documents is not necessary		Removed reference to Demonstration of Capability SOP

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3050B, December 1996.

2. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI11933	Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A (aqueous, solid, tissue) and EPA 200.8 (aqueous)
T-MET-WI11931	Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010B/C (aqueous, solid, tissue) and EPA 200.7(aqueous)
T-MET-WI9082	Working Instructions for Prep Solutions and Standards

Purpose

This digestion procedure is for the preparation of solid samples for analysis by ICP and ICP/MS following SW-846 protocol.

Scope

This method is used for preparation of metals in solid samples for analysis by ICP and ICP/MS.

Basic Principles

A representative sample is digested with repeated additions of nitric acid (HNO3) and hydrogen peroxide (H2O2). Hydrochloric acid (HCl) is added to the initial digestate and the sample is refluxed. The resultant digestate is diluted and analyzed.

This method is not a total digestion technique for most samples; it is a very strong acid digestion that dissolves almost all elements that could become "environmentally available." By design, elements bound in silicate structures are not normally dissolved by this procedure.

Definitions

1. ACS – American Chemical Society
2. D – Sample Duplicate
3. DOC – Demonstration of Capability
4. IDOC – Initial Demonstration of Capability
5. LCS/LCSD – Laboratory Control Sample/ Laboratory Control Sample Duplicate
6. LCSW– Laboratory Control Sample Water
7. LLENS - the computer program that integrates a PC with an analytical balance to collect data directly from the balance. The program organizes the data and transmits the readings to the LIMS.
8. LIMS – Laboratory Information Management Systems
9. Sample ID – unique 7-digit number assigned to a client sample.
10. LOQ – Limit of Quantitation
11. MDL – Method Detection Limit
12. MS (R) – Matrix Spike
13. MSD (M) – Matrix spike duplicate
14. PB/PBW–Preparation Blank/ Preparation Blank Water
15. QC – Quality Control
16. Method Blank - equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is

typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.

17. SOP- Standard Operating Procedure

18. U or US – unspiked background sample

Interferences

When analyzing sample by ICP-MS using this digestion procedure we follow the instrument manufacturer's guidelines to eliminate polyatomic interferences typically caused by Chlorine. The process we follow involves the use of a collision/reaction cell on the ICP-MS. Below is a description of how the collision/reaction cell works.

Reaction Process - The primary method of interference removal is through a reaction event. When using a reaction gas, either the target interference is more reactive than the target analyte, leading to preferential removal of the interferent or (less commonly) the target analyte is more reactive and is converted to a new species at a different mass which is free from any existing or newly-formed overlap.

Collision Process - The primary method of interference removal is through a non-reactive event. This process of interference removal is kinetic energy discrimination (KED). Energy Discrimination is most commonly used with an inert gas, which means the interference removal process is not affected by reactions in the cell.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO3) – This acid can cause skin burns. Add nitric acid to samples in a hood or use the designated dispensing equipment to avoid exposure to toxic fumes.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCI with concentrated H2SO4 to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

Hydrogen peroxide (H2O2) - This is a strong oxidizing agent and causes severe burns. Avoid contact with skin.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.
Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X -A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four LCSs that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four LCSs or one blind sample.

Sample Collection, Preservation, and Handling

Solid samples require no chemical preservation.

Samples must be submitted in glass or plastic containers and stored at 0° to 6°C, not frozen, prior to digestion. Samples must be analyzed within 6 months of sample collection.

Digested samples are stored in polypropylene bottles at room temperature.

Apparatus and Equipment

1. Polypropylene containers and covers (digestion vessels) - certified clean and Class A equivalent

2. Whatman No. 41 filter paper or equivalent

3. Funnels

4. Environmental Express HotBlock (block digestor) - adjustable and capable of maintaining a temperature of 90 to 100°C

5. Balance capable of reading 0.01 g

6. Chemware Ultra-Pure PTFE boiling stones, or equivalent.

7. Computer and software LLENS (Lancaster Laboratories Electronic Notebook System)

8. Sieves size depending upon client request

Reagents and Standards

For reagent preparation, shelf life, and storage conditions, see Form *T-MET-WI9082*.

1. Nitric acid (HNO3) – Fisher, Trace Metal Grade, or equivalent. Store at room temperature. Re-evaluate annually.

2. Nitric acid (1:1) – Add 500 mL of HNO3 to 500 mL of reagent water. Store in polypropylene at room temperature. Expires 6 months from date of preparation. (Different volumes are acceptable but ratios must stay the same.)

3. Hydrogen peroxide, 30% (H2O2) – Fisher, Certified ACS or equivalent. Store at room temperature. Re-evaluate annually.

4. Hydrochloric acid (HCl) – Baker Instra-Analyzed, or equivalent. Store at room temperature. Re-evaluate annually.

NOTE: It is acceptable to prepare using multiples of indicated weights and volumes if ratios are maintained.

Procedure

A. Soil Sample Digestion

1. Turn block digestor on and allow block to reach the Control Point setting that provides 90° to 95°C sample temperature. (The block temperature setting is not necessarily the sample temperature.) See below for **Block Digestor Instructions** section.

2. If sample is not located in split bin weigh 1.00 to 1.50 g (to the nearest 0.01 g) of a well mixed sample into a polypropylene digestion vessel. (If the sample is watery use 5.00 to 5.50 grams for analysis. Additional information on non-standard matrices is found at the end of the procedure section.) Add 1.00 to 1.49 g of Chemware Ultra-Pure PTFE boiling stones to the digestion vessel for the blank and LCS. Enter the blank and LCS weight as 1.0000 to 100.0000 final volume in the LLENS. For sample batch spiking procedures see *T-MET-WI9082*. All spiking must be performed prior to starting the digestion procedure.

3. Add 10 mL of (1:1) HNO3, swirl to mix, and cover with a polypropylene cover.

4. Place sample vessel in block digestor. Heat (reflux) the sample at 90° to 100°C for 10 to 15 minutes without boiling.

5. Remove vessel from digestion block and allow sample to cool.

6. Add 5 mL of concentrated HNO3. Add 20 mL of reagent water. Replace cover, return vessel to digestion block and heat for 30 minutes.

NOTE: If brown fumes are generated (indicating oxidation of the sample by HNO3) continue the process of adding 5 mL HNO3 and heating until no brown fumes are given off by the sample. This indicates that the reaction with HNO3 is complete. Add the same amount of HNO3 to the entire digestion batch.

7. With cover on, heat at 90° to 100°C without boiling for 2 hours. Maintain a covering of solution over the bottom of the vessel at all times (add reagent water if necessary).

8. Remove vessel from digestion block and allow sample to cool.

9. Add 2 mL of reagent water and 3 mL of 30% H2O2. With cover on, return vessel to digestion block and heat until effervescence subsides. Care must be taken to ensure that losses do not occur due to excessively vigorous effervescence.

10. Continue to add 30% H2O2 in 1-mL aliquots with warming until the effervescence is minimal or until the general sample appearance is unchanged.

NOTE: Do not add more than a total of 10 mL 30% H2O2.

11. With cover on, continue heating the acid-peroxide digestate at 90° to 100°C without boiling for 2 hours. Maintain a covering of solution over the bottom of the vessel at all times (add reagent water if necessary).

12. Remove sample vessel from digestion block and allow to cool.

13. Add 10 mL of HCl. With the cover on, return vessel to digestion block and heat at 90° to 100°C for 15 minutes.

14. Remove sample vessel from digesti on block.

15. If floating particulate is evident after digestion, the sample must be filtered.

    a. Filter through Whatman No. 41 filter paper into a polypropylene container.

    b. Wash sample vessel, residue, and paper thoroughly with reagent water.

    c. If any samples are filtered, the prep blank and LCS must also be filtered.

16. Adjust volume to the 100mL mark on the digestion vessel with reagent water and mix. Seal vessel with a screw cap. The sample is now ready for analysis.

NOTE: When special limits of quantitation are required by the client, use more sample weight.

B. For wipe samples:

When wipes are digested by this method, one blank media each must be used for the batch preparation blank, the LCS, and the LCSD. Refer to Form *T-MET-WI9082* for the spiking of the LCS and LCSD. Digest wipes in their own batch. Use reagent water to rinse any particulate matter from the wipe container into the vessel containing the wipe before digesting. If brown fumes are evolved during wipe sample digestion, perform only two 5 mL HNO3 additions with 30-minute refluxing each; add the same amount of HNO3 to the entire batch. Proceed with digestion.

C. For tissue samples:

When fish tissues, or other tissue samples are digested by this method, refer to Form *T-MET-WI9082* for the spiking of the LCS, LCSD (if needed), R (matrix spike), and M (matrix spike duplicate). Add 1.00 to 1.49 g of Chemware Ultra-Pure PTFE boiling stones to the digestion vessel for the blank and LCS. Digest tissue samples in their own batch.

D. For soil samples that need to be dried and sieve prior to digestion Analysis #10681

1. Lay out sample on a clean surface of either glass or aluminum foil
2. Allow sample to dry. When sample is done drying, but is dried in a large chunk take appropriate clean tools to break down the large chunk in order to sieve the sediment.

3. Pour entire sample that has been laid out to dry into the appropriate sieve size defined by client and shake sieve to get sample to fall through.

4. Take the sieved sample and place into the appropriate bottle code needed for analysis.

5. Rinse the sieve and the sieve filter with reagent water until no particulate is left on sieve.

6. Dry sieve in open air or in an oven until no reagent water is present.

Block Digestor Instructions

1. Turn block digestor on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. PRESS and hold STAR (*) key.

4. The display shows Control Point temperature.

5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used. If necessary, adjust Control Point temperature to the proper setting as instructed below.

NOTE: Polypropylene containers must not be heated above 130°C.

Calculations
Not applicable.

Statistical Information/Method Performance
Not applicable to this procedure. See analysis method.

Quality Assurance/Quality Control

For sample batch spiking instructions see form *T-MET-WI9082*. Refer to ICP section when prepping ICP analysis. Refer to ICP/MS section when prepping ICP/MS analysis. Prepare a method blank, sample duplicate, MS, MSD, and LCS with every digestion batch (20 samples or less). Each piece of batch QC is digested following the procedure in this SOP. If any samples are filtered the prep blank and LCS must also be filtered.

Any extra digestion step done on one sample in a batch must be done to batch QC as well. Example if 1 mL of H202 is added to a sample it must also be added to the batch QC.

Refer to ICP Analysis *T-MET-WI11931* for sample batch quality control requirements, acceptance criteria and corrective action.

Refer to ICP/MS Analysis *T-MET-WI11933* for sample batch quality control requirements, acceptance criteria and corrective action.

T-MET-WI11931 Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)
T-MET-WI11933 Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A/6020B(aqueous, solid, tissue) and EPA 200.8 (aqueous)
T-MET-WI9082 Working Instructions for Prep Solutions and Standards

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End of document

Version history

Version	Approval	Revision information
23	23.DEC.2015	
24	13.FEB.2018	
25	06.MAR.2019	

eurofins	Always check on-line for validity. **Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry**	Level: **Work Instruction**
Document number: **T-MET-WI11941**		
Old Reference: **1-P-QM-WI-9015159**		
Version: **12**		Organisation level: **5-Sub-BU**
Approved by: **UBFR** Effective Date **19-JAN-2015**	Document users: **6_EUUSLA_Metals_ICP Prep, 6_EUUSLA_Metals_ICP Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

LIMS ID

Analysis DOD - 5705, 10636

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Quality Assurance/Quality Control

Revision Log

Revision: 12		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM -QMA-9017356	Removed revision logs up to the previous version
Reference Modifications	To be consistent with EPA procedure 3010A	Removed 3 and 4

Revision: 12	**Effective Date:** This version	
Procedure A and B	Clarification	Reworded numbers 2, 5 and 6 to clarify steps found in the EPA procedure for 3010A

Revision: 11	**Effective Date:** Nov 27, 2013	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers
Sample Collection, Preservation, and Handling	Process change	Changed sample storage temperature from 4° ± 2° C to 0° to 6°C but not frozen.
Procedure A	Reflect current procedure	Added text to NOTE pertaining to the blank and LCS must also be filtered if any samples are filtered due to insoluble matter present in the digested sample. Added text to NOTE pertaining to the blank and spiked LCS must also be prepared with filtered reagent water, if any samples are filtered due to soluble metals analysis Delete text in NOTE pertaining to using a smaller sample aliquot if insufficient sample is submitted. Deleted text to NOTE pertaining to samples concentration. Added NOTE pertaining to using reduced volumes is acceptable as long as the sample reagent rations are maintained.
Procedure A.1	Clarification	Added text pertaining to adding spike solution, after the sample has been poured.
Procedure B	Reflect current procedure	Added text to NOTE pertaining to the blank and LCS must also be filtered if any samples are filtered due to insoluble matter present in the digested sample. Added text to NOTE pertaining to the blank and spiked LCS must also be prepared with filtered reagent water, if any samples are filtered due to soluble metals analysis. Deleted text in NOTE pertaining to using a smaller sample aliquot if insufficient sample is submitted. Deleted text to NOTE pertaining to samples concentration. Added NOTE pertaining to using reduced volumes in acceptable as long as the sample reagent rations are maintained.
Procedure B.1	Clarification	Added text pertaining to adding spike solution, after the sample has been poured.
Block Digestor Instructions	Reflect current procedure	Clarified instruction steps. Deleted text pertaining to the difference between sample temperature and display temperature.
Quality Assurance/Quality Control	Reflect current procedure	Added reference to Analysis #6966, 1643, 6935,… for batch quality control requirements.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3010A, July 1992

2. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, …	Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010B/C (aqueous, solid, tissue) and EPA 200.7(aqueous)
1-P-QM-FOR-9009182	Working Instructions for Prep Solutions and Standards
1-P-QM-QMA-9015390	Demonstrations of Capability

Purpose

This digestion procedure is used to prepare wastewater and leachate samples for measurement of total metals by inductively coupled plasma atomic emission spectrometry (ICP-AES) following SW-846 protocol.

Scope

This digestion procedure is used by the Metals department of the Environmental Sciences division.

Basic Principles

A mixture of nitric acid and the sample is refluxed in a covered beaker or a covered polypropylene container (digestion vessel) at low volume. Then it is refluxed with hydrochloric acid and brought up to volume with reagent water.

Reference Modifications

1. A 50-mL final volume is used instead of 100-mL to improve digestion throughout, conserve sample usage, and limit waste generation. Because all reagents are also adjusted so that concentrations are equivalent to a 100-mL aliquot, there is no impact on the data.

2. Ribbed watch glasses are not used; samples are evaporated without watch glasses in nonmetallic hoods to speed evaporation. No contamination trends have been observed in prep blanks evaporated without using watch glasses.

Definitions

1. ACS – American Chemical Society

2. ASTM – American Society of Testing and Materials

3. D – Sample Duplicate

4. DOC – Demonstration of Capability

5. IDOC – Initial Demonstration of Capability

6. LCS/LCSD – Laboratory Control Sample/ Laboratory Control Sample Duplicate

7. LCSW – Laboratory Control Sample Water

8. LLENS – the computer program that integrates a PC with an analytical balance to collect data directly from the balance. The program organizes the data and transmits the readings to the LIMS.

9. LIMS – Laboratory Information Management Systems

10. LLI Sample ID – unique 7-digit number assigned to a client sample.

11. LOQ – Limit of Quantitation

12. MDL – Method Detection Limit

13. MS (R) – Matrix Spike

14. MSD (M) – Matrix spike duplicate

15. PB/PBW–Preparation Blank/ Preparation Blank Water

16. QC – Quality Control

17. Method Blank – equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix

or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.

18. SOP – Standard Operating Procedure

19. SPLP – Synthetic Precipitation Leaching Procedure

20. STLC – Soluble Threshold Limit Concentration

21. TCLP – Toxicity Characteristic Leaching Procedure

22. U or US – unspiked background sample

Interferences

Not applicable to this procedure

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO_3) – This acid can cause skin burns. Add nitric acid to samples in a hood or use the designated dispensing equipment to avoid exposure to toxic fumes.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with c oncentrated H_2SO_4 to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are

kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability for this or an equivalent procedure.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an IDOC.

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Refer to 1-P-QM-QMA-9015390, for specific requirements. A DOC is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling

Samples are collected in plastic containers and preserved to a pH of < 2 with HNO3 (samples submitted for soluble metals that are to be lab filtered must be unpreserved. The sample is run through a 0.45 micron filter within 5 days of receipt and then preserved.) The pH is checked upon receipt and adjusted as necessary by Sample Support; samples that are pH adjusted at the lab must not be digested for a minimum of 24 hours. If samples fail to maintain a pH of < 2 the Client Service Representative is notified for further direction. Samples are stored at 0° to 6°C, but not frozen, prior to digestion. Sample must be digested within 6 months of collection. Digested samples are stored in plastic at room temperature and have a 6 month holding time.

Apparatus and Equipment

1. Polypropylene containers (digestion vessels) – certified clean and Class A equivalent

2. Watch glasses or reflux caps

3. 50-mL graduated cylinders or other appropriate graduated cylinders if necessary

4. 50–mL volumetric flasks or other appropriate Class A volumetric flasks if necessary

5. 250-mL beakers, or other appropriate beakers

6. Hotblocks or hot plates, adjustable and capable of maintaining a temperature of 90° to 95°C

Reagents and Standards

For reagent preparation, shelf life, and storage conditions, see Form 1-P-QM-FOR-9009182.

1. Nitric Acid, HNO_3 - Fisher, Trace Metal Grade, or equivalent. Store at room temperature and re-evaluate annually.

2. Hydrochloric acid - Fisher, Trace Metal Grade, or equivalent. Store at room temperature and re-evaluate annually.

3. Hydrochloric Acid (1:1) – Add 500 mL of HCl to 500 mL of reagent water. Store at room temperature. Expires in 6 months.

NOTE: It is acceptable to prepare solutions using multiples of indicated volumes if exact ratios are maintained.

Calibration

Not applicable to this procedure

Procedure

This SOP has been set up to outline the procedures for both hot plate and hotblock digestions (see below). Choose the procedure that corresponds to the sample heating technique being used for sample digestion.

A. Hotblocks

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45–micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

1. Shake sample well. Transfer 50 mL of well-mixed sample to a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see Form 1-P-QM-FOR-9009182. For sample batch quality control requirements see Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, …

NOTE: For leachate samples, use the appropriate extraction fluid for the PBW and LCS. The extraction fluid are as follows: TCLP, SPLP, STLC, ASTM, Filtration, and Elutriate.

2. Add 1.5 mL of concentrated HNO_3. Place the digestion vessel in a hotblock at 90° to 95°C, and cautiously evaporate to low volume (about 5 mL), making certain that the sample does not boil and that no portion of the bottom of the digestion vessel is allowed to go dry.

3. Allow the digestion vessel to cool then add another 1.5-mL portion of concentrated HNO_3.

4. Cover the digestion vessel with a reflux cap and return to the hotblock. Increase the temperature of the hotblock so that a gentle reflux action occurs.

NOTE: If a sample is allowed to go to dryness, low recoveries result. If this occurs, discard the sample and re-prepare in a new batch.

5. Continue heating (refluxing), adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing).

6. When digestion is complete, uncover the digestion vessel and evaporate to low volume (about 3 mL). Do not allow any portion of the bottom of the digestion vessel to go dry. Allow the digestion vessel to cool.

7. Add 5 mL (1:1) HCl, cover the digestion vessel, and reflux for an additional 15 minutes to dissolve any precipitate or residue from evaporation. Allow the digestion vessel to cool.

8. Adjust sample volume to 50 mL mark on the certified digestion vessel with reagent water, cap and mix.

9. The sample is now ready for analysis.

B. Hotplates

NOTE: If boron (B) is requested on a sample, use Teflon vessels.

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45–micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

1. Shake sample well. Use a 50-mL graduated cylinder to transfer 50 mL of well-mixed sample to a 250-mL beaker. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 7164. For sample batch quality control requirements see Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, …

NOTE: For leachate samples, use the appropriate extraction fluid for the PBW and LCS. The extraction fluids are as follows: TCLP, SPLP, STLC, ASTM, Filtration, and Elutriate.

2. Add 1.5 mL of concentrated HNO_3. Place the beaker on a hot plate and cautiously evaporate to low volume (about 5 mL), making certain that the sample does not boil and that no portion of the bottom of the beaker is allowed to go dry.

3. Allow the beaker to cool then add another 1.5-mL portion of concentrated HNO_3.

4. Cover the beaker with a watch glass and return to the hot plate. Increase the temperature of the hot plate so that a gentle reflux action occurs.

NOTE: If a sample is allowed to go to dryness, low recoveries result. If this occurs, discard the sample and re-prepare in a new batch.

5. Continue heating (refluxing), adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing).

6. When digestion is complete, uncover the beaker and evaporate to low volume (about 3 mL). Do not allow any portion of the bottom of the beaker to go dry. Allow the beaker to cool.

7. Add 5 mL (1:1) HCl, cover the beaker, and reflux for an additional 15 minutes to dissolve any precipitate or residue from evaporation. Allow the beaker to cool.

8. Transfer the solution to a 50–mL volumetric flask. Adjust sample volume to the 50 mL mark with reagent water and mix.

9. Pour the mixed sample into a polypropylene container and cap.

10. The sample is now ready for analysis.

Block Digestion Instructions

1. Turn block digestor on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. PRESS and hold STAR (*) key.

4. The display shows the Set Point Temperature.

5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

NOTE: Polypropylene containers must not be heated above 130°C.

Calculations
Not applicable to this procedure.

Statistical Information/Method Performance
Not applicable to this procedure.

Quality Assurance/Quality Control
Perform a method blank, sample duplicate, sample matrix spike, sample matrix spike duplicate, and laboratory control sample with every digestion batch (20 samples or less). Each piece of batch QC is digested following the procedure in this SOP.

For sample batch quality control requirements see Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, …

End of document

eurofins	Always check on-line for validity. **Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry**	Level: **Work Instruction**
Document number: **T-MET-WI11941**		
Old Reference: **1-P-QM-WI-9015159**		
Version: **12**		Organisation level: **5-Sub-BU**
Approved by: **UBFR** Effective Date **19-JAN-2015**	Document users: **6_EUUSLA_Metals_ICP Prep, 6_EUUSLA_Metals_ICP Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

Version history

Version	Approval	Revision information
12	19.JAN.2015	

eurofins	Always check on-line for validity. **Sample Preparation of Waters for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Optical Emission Spectrometry**	Level: **Work Instruction**
Document number: **T-MET-WI8639**		
Old Reference: **1-P-QM-WI-9015133**		
Version: **16**		Organisation level: **5-Sub-BU**
Approved by: **UBFR** Effective Date **03-DEC-2014**	Document users: **6_EUUSLA_Metals_ICP Prep, 6_EUUSLA_Metals_ICP Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

LIMS ID

Analysis DOD - 1848, 10635

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Revision Log

Revision: 16		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Historical/Local Document Number	No longer part of current procedure	Removed 5720
Reference	No longer part of current procedure	Removed CLP ILM02.1, ILM04.0, ILM05.2

Revision: 16	**Effective Date:** This version	
Scope	No longer part of current procedure	Removed reference to CLP
Apparatus and Equipment	Reflect current procedure	Included DEENA to item 6.
Procedure A	No longer part of current procedure	Removed Analysis 5720 (CLP) entire section
Procedure B	Clarification No longer part of current procedure	NOTE: Reworded text pertaining to the preparation of the PB and LCS for soluble metals analysis Removed Analysis 5720 (CLP)
Procedure C	Reflect current procedure	Included analysis 10635 (SW-846)
Procedure C.2	Reflect current procedure	Added DEENA temperature 90° to 95°C
Procedure C.5	Updated to current procedure	Replaced DI water with reagent water.
Quality Assurance/Quality Control	No longer part of current procedure	Removed reference to CLP digestion 5720 batch.

Revision: 15	**Effective Date:** Nov 27, 2013	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers
Sample Collection, Preservation, and Handling	Process change	Changed sample storage temperature from 4° ± 2°C to 0° to 6° C but not frozen, prior to digestion.
Procedure A	Reflect current procedure	Added text, to NOTE, pertaining to the blank and LCS must also be filtered if any samples are filtered due to insoluble matter present in the digested sample. Added NOTE, pertaining to using a smaller aliquot of the sample and bring sample to final volume, if contains high solids Added NOTE, pertaining to filtering unpreserved sample and preparing the blank and spiked LCS using filtered reagent water, for soluble metals analysis
Procedure A.1.a	Clarification	Added text pertaining to adding spike solution, after the sample has been poured.
Procedure A.2.a	Clarification	Added text pertaining to adding spike solution, after the sample has been poured.
Procedure A.2.a	Reflect current procedure	Added reference to Analysis 6966, 1643…… Deleted reference to SOP SOP-IO-014
Procedure A.2	Reflect current procedure	Added 2nd NOTE pertaining to Lab filtering.

Revision: 15	**Effective Date:** Nov 27, 2013	
Procedure B	Reflect current procedure	Added text, to NOTE, pertaining to the blank and LCS must also be filtered if any samples are filtered due to insoluble matter present in the digested sample. Added NOTE, pertaining to filtering unpreserved sample and preparing the blank and spiked LCS using filtered reagent water, for soluble metals analysis Added NOTE, pertaining to using a smaller aliquot of the sample and bring sample to final volume, if contains high solids.
Procedure B.1.a	Clarification	Added text pertaining to adding spike solution, after the sample has been poured.
Procedure B.2	Reflect current procedure	Added NOTE pertaining to Lab filtering.
Procedure B.2.a	Clarification	Added text pertaining to adding spike solution, after the sample has been poured.
Procedure C	New equipment in use	Added entire section pertaining to DEENA Auto-digester.
Procedure C	Reflect current procedure	Added NOTE, pertaining to using a smaller aliquot of the sample and bring sample to final volume, if contains high solids. Added NOTE, pertaining to filtering sample, prep blank, and LCS if insoluble matter is present in the digested sample, or allow to settle by gravity. Added NOTE, pertaining to filtering unpreserved sample and preparing the blank and spiked LCS using filtered reagent water, for soluble metals analysis
Block Digester Instruction	Reflect current procedure	Clarified instruction steps. Deleted text pertaining to the difference between sample temperature and display temperature.
Quality Assurance/Quality Control	Reflect current procedure	Added reference to SOP 6966, 1643…for batch quality control requirements.

Reference

1. *Test Methods for Evaluating Solid Waste*, SW-846 Method 3005A, July 1992

2. *Chemical Hygiene Plan*, current version

Cross Reference

Document	Document Title

Document	Document Title
Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, …	Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010A/B/C (aqueous, solid, tissue), CLP 2.1(water/solid/tissue), CLP 4.0(water/solid/tissue), CLP 5.2 (water/solid/tissue) and EPA 200.7(aqueous)
1-P-QM-FOR-9009182	Working Instructions for Prep Solutions and Standards
1-P-QM-QMA-9015390	Demonstrations of Capability

Scope

This acid digestion procedure is used by the Metals Department of the Environmental Sciences Division at Lancaster Laboratories to prepare wastewater, surface water, and groundwater samples for measurement of total recoverable metals by inductively coupled plasma optical emission spectroscopy (ICP-OES) following SW-846 protocol.

This method is used whenever SW-846 Method 3010 is not requested or required for total metals.

Basic Principles

Samples are heated with nitric and hydrochloric acids with a substantial reduction in volume during digestion to dissolve metals.

Reference Modifications

1. A 50-mL sample aliquot and final volume is used instead of 100 mL to improve digestion throughput, conserve sample usage, and limit waste generation. Because all reagents are also adjusted so that concentrations are equivalent to a 100-mL aliquot, there is no impact on the data.

2. Ribbed watch glasses or reflux caps are not used during evaporation; samples are heated without watch glasses in non-metallic hoods to speed evaporation. No contamination trends have been observed in prep blanks evaporated without using watch glasses.

3. Samples are heated at 90º to 95°C on hotplates or Hotblocks, not 92° to 95°C as stated in ILMO4.0; hotplates cannot be maintained within 3°C range.

Definitions

1. ACS – American Chemical Society

2. D – Sample Duplicate

3. DOC – Demonstration of Capability

4. IDOC – Initial Demonstration of Capability

5. LCS/LCSD – Laboratory Control Sample/ Laboratory Control Sample Duplicate

6. LCSW– Laboratory Control Sample Water

7. LLENS - the computer program that integrates a PC with an analytical balance to collect data directly from the balance. The program organizes the data and transmits the readings to the LIMS.

8. LIMS – Laboratory Information Management Systems

9. LLI Sample ID – unique 7-digit number assigned to a client sample.

10. LOQ – Limit of Quantitation

11. MDL – Method Detection Limit

12. MS (R) – Matrix Spike

13. MSD (M) – Matrix spike duplicate

14. PB/PBW–Preparation Blank/ Preparation Blank Water

15. QC – Quality Control

16. Method Blank - equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.

17. SOP- Standard Operating Procedure

18. U or US – unspiked background sample

Interferences

Not applicable to this procedure

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO_3) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes or use the designated dispensing equipment.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with concentrated H_2SO_4 to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability for this or an equivalent procedure.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an IDOC.

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Refer to1-P-QM-QMA-9015390, for specific requirements. A DOC is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling

Samples are collected in plastic containers and preserved to a pH of <2 with HNO_3. (Samples to be analyzed for soluble metals requiring filtration at the lab must be submitted unpreserved. The sample is run through a 0.45 micron filter within 5 days of receipt and then preserved.) The pH is checked upon receipt and adjusted as necessary by Sample Support; samples that are pH adjusted at the lab must not be digested for a minimum of 24 hours. If samples fail to maintain a pH of < 2 the Client Service Representative is notified for further direction. Samples are stored at 0° to 6°C, but not frozen, prior to digestion. Samples must be digested within 6 months of collection. Digested samples are stored in plastic at room temperature and have a 6 month holding time.

Apparatus and Equipment

1. Polypropylene containers (digestion vessels) – certified clean and Class A equivalent

2. 250-mL beakers, 400-mL beakers (or other volumes as appropriate)

3. 100-mL graduated cylinders (or other volumes as appropriate)

4. 100-mL Class A volumetric flasks (or other volumes as appropriate)

5. 125-mL Nalgene bottles (or other volumes as appropriate)

6. Hot plates, Hotblocks, or DEENA, adjustable and capable of maintaining a temperature of 90° to 95°C

Reagents and Standards

For reagent preparation, shelf life, and storage conditions, see Form 1-P-QM-FOR-9009182.

1. Nitric acid, HNO_3 - Fisher, Trace Metal Grade, or equivalent. Store at room temperature and reevaluate annually.

2. Hydrochloric acid, HCl - Fisher, Trace Metals Grade, or equivalent. Store at room temperature and reevaluate annually.

3. Nitric acid (1:1) – Add 500 mL of HNO_3 to 500 mL of reagent water. Store at room temperature. Expires in 6 months.

4. Hydrochloric acid (1:1) – Add 500 mL of HCl to 500 mL of reagent water. Store at room temperature. Expires in 6 months.

NOTE: It is acceptable to prepare solutions using multiples of indicated volumes if exact ratios are maintained.

Calibration

Not applicable to this method.

Procedure

This SOP has been set up to outline the procedures for hotblock, hot plate, and auto-digester (see below). Choose the procedure that corresponds to the sample heating technique being used for sample digestion.

A. Hotblocks

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

NOTE: When insoluble matter is present after digestion, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

See Hotblock Control Point Temperature Logbook to obtain control point temperature setting for the Hotblock being used for digestion. If necessary, adjust control point temperature to the proper setting as instructed below.

Analyses 1848 and 10635 (SW-846):

NOTE: The procedures for analysis 1848 and 10635 are equivalent as outlined below. Analysis 10635 is used only for SW-846 Update IV. When entering the batch number in the LIMS the “1” is omitted (i.e. use YYDDD0635###, where YY is the year, DDD is the julian day, and ### is the digest number).

1. Shake sample well. Transfer 50-mL of well-mixed sample into a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see SOP Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, …

2. Add 2 mL of (1:1) HNO3 and 5 mL of (1:1) HCl.

3. Heat the solution in a Hotblock at about 90° to 95°C until sample volume is reduced to between 15 and 20 mL, making certain the sample does not boil.

4. Allow to cool.

5. Adjust volume to the 50-mL mark on the digestion vessel with reagent water, cap and mix.

6. The sample is now ready for analysis.

B. Hot Plates:

NOTE: If boron (B) is requested on a sample, use Teflon vessels.

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

Analyses 1848 and 10635 (SW-846):

1. Shake sample well. Using a 50-mL graduated cylinder, transfer 50 mL of well-mixed sample into a 250-mL beaker. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see SOP Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, …

2. Add 2 mL of (1:1) HNO_3 and 5 mL of (1:1) HCl.

3. Heat the solution on a hot plate at 90º to 95°C until sample volume is reduced to between 15 and 20 mL, making certain the sample does not boil.

4. Allow to cool.

5. Transfer the solution to a 50-mL volumetric flask. Adjust volume to the 50-mL mark with reagent water and mix.

6. Transfer the solution to a 125-mL Nalgene container and cap.

7. The sample is now ready for analysis.

C. DEENA Auto-digester

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

NOTE: When insoluble matter is present after digestion, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

Analysis 1848 and 10635 (SW-846):

1. Shake sample well. Transfer 50-mL of well mixed sample into a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see. SOP Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, …

2. Verify the DEENA temperature is 90° to 95°C

3. Place samples into 20 position sample trays starting in position one. Place the trays into the DEENA.

4. Open the DEENA software. Click the Rack Definition button and input the total number of samples to be run.

5. Make sure all reagents have sufficient volume and that the transfer tubes are in the appropriate reagent. Make sure the waste beaker is clean and has 5-10 mL of reagent water in it.

6. Press the Green traingle (GO) button.

Block Digestor Instructions

1. Turn block digestor on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. PRESS and hold STAR (*) key.

4. The display shows the Set Point Temperature.

5. The digits can be changed to the desired value by pressing the up and down arrows keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

NOTE: Polypropylene containers must not be heated above 130°C.

Calculations
Not applicable to this procedure.

Statistical Information/Method Performance
Not applicable to this procedure.

Quality Assurance/Quality Control
A method blank, sample duplicate, sample matrix spike, sample matrix spike duplicate, and laboratory control sample must be performed for every SW-846 digestion batch (analysis 1848 or 10635). A batch is 20 samples or less.

A method blank, sample duplicate, sample matrix spike, and laboratory control sample must be performed every CLP digestion batch (analysis 5720). A batch is 20 samples or less.

Each piece of batch QC is digested following the procedures in this SOP.

For sample batch quality control requirements see Analysis #6966, 1643, 6935, 7914, 6946, 6947, 1650, 6949, 6952, 6951, 6953, 1654, 1662, 1656, 1657, 6958, 6960, 1667, 6961,10145, 6955, 6944, 6936, 6969, 7968, …

End of document

Version history

Version	Approval	Revision information
16	03.DEC.2014	

eurofins	Always check on-line for validity. **Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)**	Level: **Work Instruction**
Document number: **T-MET-WI11931**		
Old Reference: **1-P-QM-WI-9018442**		
Version: **13**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **17-JUL-2019**	Document users: **6_EUUSLA_Metals_ICP Analysis, 6_EUUSLA_Metals_ICP Analysis Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

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Appendix I

Revision Log

Revision: 13	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Table II	Correction	LLC windows are 50-150%, removed 20% WW on LCS

Revision: 12	**Effective Date:**	05-MAR-2019
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version

Revision: 12	**Effective Date:**	05-MAR-2019
Section	**Justification**	**Changes**
Cross Reference	Enhancement	Added pH and turbidity check SOP
Routine Methods	Update to Current Practice	Removed Te from Chart
Basic Principals	Unnecessary	Removed procedural details
Safety Precautions and Waste Handling	Update to Current Practice	Removed Hydrogen Peroxide and information that pertains to the prep room
Sample Collection, Preservation and Handling	Clarification	Rewrote section
Apparatus and Equipment	Current Equipment	Changed "Y" connect to "T" Connect and added the 6500 and 7000series Thermos
Procedure B	Enhancement	Updated process and added procedure for dilutions
Instrument Operations 2.p	Clarification	Added information on signing off on the seq sheet
Instrument Operations 2.q.	Enhancement	Added information for Multi Point Method
Quality Assurance/Quality Control Section G	Clarification	Clarified when IDLs, MDLs and linear ranges are performed.
Table 1 and Table 2	Addition	Add requirements if using Multi Point Calibration

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 6010B, December 1996.

2. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 6010C, February 2007.

3. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 6010D, Rev.4, July 2014.

4. Method 200.7 (rev. 4.4), Determination of Metals and Trace Metals in Water and Wastes by Inductively Coupled Plasma-Atomic Emission Spectrometry, USEPA 600/R-94/111 May 1994.

5. ICAP™ 6000 Series ICP-OES Spectrometer Operator Manual, 2005/2006.

6. *Hardness Calculation SM 2340 B.*

7. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
S-SS-WI10695.	Liquid Sample Preservation, Sample Splitting, and Turbidity for metals by EPA Methods 200.7 and 200.8
T-MET-FRM8802	ICP LOQs (mg/L)
T-MET-FRM9070	MSA Prep for Samples with MS/MSD <50%
T-MET-FRM9072	MSA Prep for Samples within TCLP Limits
T-MET-WI12063	Working Instructions for Preparation of ICP Solutions and Standards
T-MET-WI9082	Working Instructions for Prep Solutions and Standards
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Document	Document Title
QA-SOP11896	Establishing Control Limits

Scope

This procedure applies to analyses performed in the Metals department using Inductively Coupled Plasma (ICP) Atomic Emissions Spectroscopy for identification and quantitation of metallic constituents by Methods 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous).

The limits of quantitation (LOQ) are based on annual statistical evaluation of laboratory data and are subject to change without notification. The current method detection limits (MDLs) and LOQs are maintained in the laboratory information management system (LIMS).

This SOP also outlines the proper operation and maintenance of the ICP instrumentation and provides consistent guidelines for the evaluation of ICP data.

Routine Methods

Elements routinely analyzed on the Thermo Scientific iCAP 6000 Series Analyzer include LIMS analyses #:

Element	Waters Analysis #	Solids Analysis #	Wavelength (nm)
Ag	7066	6966	328.06
Al	1743	1643	308.21
As	7035	6935	189.04
B	8014	7914	249.67
Ba	7046	6946	455.4
Be	7047	6947	313.04
Ca	1750	1650	317.93
Cd	7049	6949	226.5
Co	7052	6952	228.62
Cr	7051	6951	267.72
Cu	7053	6953	327.4
Fe	1754	1654	261.19
K	1762	1662	766.49
Li	1756	1656	670.78
Mg	1757	1657	285.21
Mn	7058	6958	257.61
Mo	7060	6960	202.03
Na	1767	1667	589.59
Ni	7061	6961	231.6
P	10143	10145	177.49
Pb	7055	6955	220.35

S	12004	12003	182.03
Sb	7044	6944	206.83
Se	7036	6936	196.09
Si	1765	12763	251.6
Sn	7069	6969	189.99
Sr	8068	7968	421.55
Th	13495	13499	401.913
Ti	7070	6970	334.94
Tl	7022	6925	190.86
V	7071	6971	292.4
W	13496	13500	207.911
Zn	7072	6972	213.86
Zr	10144	10146	339.19

Basic Principles

If required, samples are digested with acids and heated to solubilize metals. Samples are received from the prep area in digestion vials.
After the analytical batch is prepared it is loaded onto the autosampler rack for trace metals analysis.

Samples are transported to a nebulizer via an autosampler and peristaltic pump. The nebulizer introduces an aerosol into a spray chamber; the resulting mist is then transported to an argon plasma torch where excitation of atoms occurs. Characteristic atomic-line emission spectra are produced by a radio-frequency (R.F.) inductively coupled plasma. The spectra are dispersed by a diffraction grating and the intensities of the light at each wavelength are monitored by a photosensitive device. The signals from the photosensitive device are processed by a computer. A background correction technique is required to compensate for variable background contribution to the spectra of trace elements.

Interferences

Spectral interferences are caused by background emission, stray light from high concentration elements or overlap from a spectral line from another element. Spectral interferences are compensated for by the use of background points, alternate wavelengths and interelement corrections.

Physical interferences caused by the change in sample matrix affecting sample transport and/or nebulization must be compensated for by using internal standardization.

Memory interference, or carryover, is the contribution of analyte signal from a previous sample onto the next sample analysis. Adequate rinse time of the autosampler tubing overcomes any memory interference.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO3) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCI with concentrated H2SO4 to avoid a violent reaction. Always use in a fume hood.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Fill reagent bottles in an operating fume hood using caution to avoid spills.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the sequence editor to set up the run, perform calculations, interpret raw data, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an IDOC (Initial Demonstration of Capability).

The IDOC consists of four laboratory control samples (LCS) that are carried through all steps of the prep and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples or one blind sample.

Sample Collection, Preservation, and Handling

A. Preservation and Holding time

1. All samples are typically shipped and stored at 0°to 6°C, not frozen, but room temperature is acceptable. Samples are analyzed within 6 months of collection.

2. Aqueous samples are collected in plastic or glass containers and are preserved to pH <2 with nitric acid. If samples are received > pH 2, they are preserved at the lab and held at least 24 hours until digestion. See *S-SS-WI10695*.

3. Drinking water samples are digested if the turbidity is > 1 NTU. See *S-SS-WI10695*.

4. Dissolved metals must be filtered within 15 minutes of sampling. If this is not done, the lab filters the samples of unpreserved bottles within 5 days of submission to the laboratory. Lab-filtered samples are preserved to pH <2 with nitric acid after filtration.

5. Solid samples are collected in glass containers with no chemical preservation.

6. Sample digestates are stored in plastic bottles at room temperature.

B. Sample Discard - The general practice in the metals group is to discard the digestions after all the required metals from a batch of samples have been analyzed and verified in the LIMS. Samples which require the digestate to be held for long term storage are periodically evaluated for discard.

Apparatus and Equipment

The following is a list of the hardware and apparatus necessary for ICP analysis. More detailed hardware information is located in the *Operator's Manuals*.

1. 15-mL graduated polypropylene screw cap tubes (certified ±1%)

2. 16-mL polystyrene tubes

3. Filter paper – Whatman No. 540, 90-mm ashless

4. FilterMate filtration device with 0.45-µm PTFE fiber filter and insertion tool

5. 1 ´ 100 10-mL sterile disposable syringes

6. 25-mm syringe filters, PTFE, 0.45-µm

7. 30-mL polypropylene medicine cups

8. Calibrated electronic hand-held pipettes and tips (10 – 5000 µL) - FisherBrand or equivalent.

9. Spectrometer - The Thermo Scientific iCAP™ 6000, 6500, and 7000 series Trace Analyzer utilizes a high performance solid state Charge Injection Device (CID) camera system to deliver high contrast/low noise imaging and quantification of all wavelengths in the analytical range. With the entire spectrometer and foreoptics purged with either Argon or Nitrogen, it features a 52.91 grooves/mm grating and dual-view detector.

10. Auto-sampler – The ESI SC-14 auto-sampler and integrated "FAST" system offer increased capacity and reduce sample introduction times. The parameters for each automated run are entered into the auto-sampler table in the iTEVA™ software as described in Instrument Operation, Section A of this SOP.

11. Peristaltic pump – The peristaltic pump regulates the flow of the following: sample, internal standard, instrument rinse and spray chamber waste. Special care must be taken to ensure that all pump tubing is connected properly. The Teflon concentric and glass V-groove nebulizers have a natural uptake, but a peristaltic pump is used to compensate for differences in sample viscosity. After traveling through the peristaltic pump, the sample and internal standard tubing are combined by a "T" connector, and then allowed to mix in a mixing coil before entering the nebulizer.

12. R.F. generator –The iCAP™ 6000 series Trace Analyzer utilizes an internal solid state RF Generator at 27.12MHz with a power efficiency greater than 78%.

13. Coolflow –The ThermoFlex™ 900 cooling device for the iCAP™ 6000 series Trace Analyzer operates at 17°C.

14. Personal computer – The iCAP™ 6000 series Trace Analyzer is controlled by PCs.

Reagents and Standards

Reagent and standard information and the preparation of the following standard and solutions are located in *T-MET-WI12063*:

Initial Calibration (ICAL)
Blanks and calibration standard
Initial Calibration Verification (ICV) standard
Continuing Calibration Verification (CCV) standard
Rinse/Carrier and Profile Solutions
Interference Check Solutions (ICSA and ICSAB)
Low Level Check (LLC) standards
Post Digestion Spike (PDS)
Linear Range Standards (LRS)
Internal Standard Solution
Instrument Detection Limit (IDL) and MDL Solutions
Matrix Matched Standards

Calibration

See Tables I and II for the frequency, acceptance criteria and corrective action of the ICAL, ICV, ICB, LLC, ICSA/ICSAB.

Procedure

A. Setting up an ICP run sequence file

1. Determine the batches to be analyzed and determine any special requirements by viewing lab notes and/or project notes that are with the batch paperwork delivered from the metals prep area.

2. Assign an ICP metals storage location and document the location on the batch sheet(s) and on the sample lid for the Prep Blank of each batch.

3. Log in to LIMS and select Sequence Editor from the IDAT menu. In the Sequence Editor window, select the appropriate batch digest type (EPA or SW-846).

4. Choose the appropriate digest from the list, and click on "Get Batches"

5. Select a batch from the list to display the incomplete samples in that batch.

6. Select the appropriate template (pre-designed with the correct QC standards and auto-sampler locations) from the template list; a blank form is opened. If that batch has been previously documented, the existing sequence file is also loaded.

7. Add all required samples into the form, either by choosing "Add batch" for all samples, or by "dragging" individual samples into the field.

a. Sample names include:

PBW – Prep blank (water)
LCSW – Laboratory control sample (water)
LCSDW – Laboratory control sample duplicate (water)
PBS – Prep blank (solid)
LCSS – Laboratory control sample (solid)
LCSDS – Laboratory control sample duplicate (solid)
ELLEs' sample number
CCV – Continuing calibration verification
CCB – Continuing calibration blank
LLC – Low level check
ICSA – Interelement correction standard – A
ICSAB – Interelement correction standard – AB

b. Batches with only field blanks or equipment blanks do not need a post-digest spike or a serial dilution.

c. "As Received" samples must be run with a blank and LCS, LCSD (prepared and documented in LLENS by the analyst).

8. Edit dilution factors (DF), protocols, and auto-sampler locations as needed. Consult the Incomplete List sheet to determine the analysis requirements for each sample.

9. Remove all unnecessary QC standards by clicking on the "QC" button. Unnecessary lines are removed by selecting individual lines and clicking on the red "X" button.

10. Save the sequence file. Click "OK" to acknowledge that the file has been saved and the cover sheet document has been created. The document opens automatically.

11. Edit the cover sheet document as needed, including batch location information and any additional comments or instructions.

12. When setting up a run, Batch QC must be placed in the same block of ten or fewer samples. If there are two LCSs, they must be placed one after the other. [The order of the batch QC is typically PB, LCS, (LCSD), Bkg, PDS, DUP, MS, (MSD) and SD.]

a. ICV/ICB must be analyzed immediately after the calibration curve.

b. LLC, ICSA, ICSAB, CCV, CCB must immediately follow the ICV/ICB.

c. CCV/CCB must be analyzed after every ten analytical samples.

d. Additional QC are added per client requirements at the end of the run: LLC, ICSA, ICSAB.

e. Any deviations from protocol must be noted in the Comments Section of the cover page

f. Any unused portion of the run sheet must be "Z'd" out with initial and date.

B. Pouring an ICP run samples and QC samples

It is important to minimize any chance of contamination, both of yourself and the samples. Keep your hands and the work area clean at all times. Do not re-use any pipette tips.

Run QC standards are prepared separately, and kept in separate auto-sampler racks to be obtained at the time of analysis.

1. Use the batch location information on the selected run sheet to locate the corresponding batch(es). In the "Poured by:" section of the header, record: initials, employee number, and the date.

2. Carefully examine the batch to ensure there are no discrepancies between the Batch Preparation Sheet, run cover sheet, and the physical placement of samples in the batch.

3. Obtain and label all required test tubes, and place them in test tube racks. Any poured sample that does not require a graduated test tube is to be poured into a polystyrene tube.

4. Prepare and label the PDS required for each new batch (sample volume permitting).

a. A PDS is prepared using 0.2 mL of a custom-ordered PDS solution into 9.8 mL of background sample.

i. If sample volume is limited, reduce volumes but keep ratios equivalent (i.e. 0.1 mL PDS solution into 4.9 mL background sample.)

ii. If the background sample must be diluted, add a reduced volume of background sample and bring to volume with the appropriate matrix.

b. Record preparation details in the comments column of the ICP run sheet.

5. Prepare a serial dilution (SD) of the background sample with a DF5 by pipetting 0.2 mL background sample into 9.8 mL of the appropriate matrix.

a. If the background sample chosen for serial dilution has been diluted due to matrix interference or to bring the concentration into the linear range of the instrument, the serial dilution must also be diluted by 5 times the dilution factor of the background (i.e., if Bkg = DF5, S.D. must = DF25).

6. If present in the batch then samples that are cloudy or contain particulate, the prep blank (PB), and the laboratory control sample (LCS) must be filtered.

   a. Use Whitman No. 540 filter paper, filter syringe, or the Filter Mate filtration device to filter. If the filtrate remains cloudy, filter again.

   b. Samples with limited sample volume must be filtered using a 10-mL sterile disposable syringe fitted with a 0.45 µm PTFE syringe filter.

   c. If any samples are filtered, the prep blank and laboratory control sample must also be filtered.

   d. Document all filtrations on the run cover sheet and mark each sample lid with an "F" to indicate that it was filtered.

7. For TCLP samples that requires method of standard additions, refer to *T-MET-FRM9072* or *T-MET-FRM9070* for instructions.

8. Perform any additional spiking or dilutions and document preparation details in the comment section.

9. Cover the samples with lids or with plastic wrap to prevent contamination.

10. Place the poured batch on the bench top to await analysis, or return samples to their ICP sample storage location.

11. Take **NOTE** of the following:

   a. A PDS and a serial dilution (SD) must be performed on one sample in each digestion batch. Typically, the background sample is chosen. If the batch QC is split between two samples, the post-digest spike is performed on the background sample accompanied by a matrix spike; the serial dilution is performed on the background sample accompanied by a matrix duplicate. If sample volume is limited, it is acceptable to use the duplicate for the PDS and SD.

   b. Analysis information, including standard lot numbers, run number, method, analyst and date of analysis, are documented on the cover sheet at the time of analysis.

   c. Documentation is of utmost importance. Double check all entries.

   d. Dilute samples when necessary to yield a response that falls within the calibration range. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

   e. If a batch requires re-analysis, it is acceptable to re-use dilutions and/or spiked samples that were prepared for the previous analysis. A "P" in the comments section is used to indicate that a previously poured test tube is being re-used.

Instrument Operations

A. iTEVA™ software: The Thermo Scientific iCAP instrument is operated through iTEVA™ software. From the Start menu, select "iTEVA™ Control Center" to start the software.

1. Plasma ignition

   a. Open the plasma status window by clicking on the icon at the bottom of the screen.

   b. Verify that all parameters are within acceptable range for ignition as indicated by a green light.

   c. Ensure that the drain tubing for the spray chamber is properly connected to the peristaltic pump and positioned to drain into a waste carboy.

   d. Select "Ignite plasma". After the plasma has ignited, the instrument automatically performs optimization of the nebulizer gas pressure, and then starts the on-board peristaltic pump.

   e. If the plasma does not light, repeat steps b-d.

   f. Once the plasma operating parameters have engaged, exit the Plasma status window by clicking on Close.

   g. If the plasma has been off for more than 15 minutes let the instrument warm up for 30 minutes. If the plasma has been off less than 15 minutes, let the instrument warm up 5 to 10 minutes.

2. Automated analysis using the iTEVA™ software

   a. Open the Analyst window from the Control Center by clicking on the Analyst icon. When prompted, select the appropriate method.

   b. In the Analyst window, click on the Sequence tab at the bottom of the screen.

   c. From the Auto-session menu, select New Autosampler.

   d. The "New automation-session" window opens.

   e. Click on "New" to add a sequence and the "New sequence" window appears.

   f. Click on the "Import from delimited text file" option and choose an appropriate template or previously prepared run sequence from the drop-down menu for the run to be entered.

   g. Change the sequence name to reflect the run number, but do not change the method revision number in the parentheses.
   h. Click OK at the bottom of the New Automation session window to continue.
   i. The sequence template is loaded. When prompted in the import warning window, click OK to choose the populate the auto-sampler.

   j. Right-click on the most recent auto-sampler session and select "Auto-locate All" to have autosampler positions automatically assigned.

   k. Click on the "list view" icon and edit the table as needed to include sample number, class, dilution factor, batch number and protocol for each sample.

l. Additional samples and QC are added using the "Add sample" and "Add QC" icons, respectively, at the top of the screen. Unused rows are removed by selecting the entire row(s) and using the "remove sample" icon at the top of the screen.

m. Click on the printer icon and choose to print page 1 only. This printout is kept with the run cover sheet.

n. Verify that the sample list begins and ends at the correct tube numbers, and check all entries for errors. Document standards and batch cover sheet information.

o. Click on the "Initialize Autosampler" icon to initialize the autosampler.

p. Carefully examine the batch to ensure there are no discrepancies between the run cover sheet, auto-sampler sequence table and the physical placement of samples in the batch. Sign off on the sequence table sheet to indicate these items have been checked.

q. Click on the "Run auto-session" icon to start the run sequence. If a run sequence is to be started at a sample or standard other than the initial calibration, open auto session run using the plus sign. Open the run and use the plus sign to open the required sample or standards. Right-click on the appropriate sample or standard and choose "Start Auto-Session Run at this Sample". Deselect the reslope (or Calibration option if running Multi Point Method) and QC, then click OK.

3. Running an AutoPeak in iTEVA™

a. In an open autosampler session (autosampler must be initialized), right-click on the location of the AutoPeak solution, and choose "Go to..."

b. Click on the Analysis tab to open the Analysis window.

c. From the Instrument menu, select Perform AutoPeak.

d. Click on All elements, then OK.

e. When prompted to aspirate the high standard, click OK. The AutoPeak is now performed.

f. When the AutoPeak has finished, click on Done.

4. Manual analysis in iTEVA™

a. In an open autosampler session (autosampler must be initialized), add sample(s) to be analyzed to a new or existing sequence as detailed in section A.2 of this section.

b. To start analysis, right-click on the appropriate sample and choose "Start Auto-Session Run at this Sample" and elect not to run the "start actions."

c. When analysis is complete, results can be printed from the Analysis tab by right-clicking on the sample name and selecting "Print Sample…"

5. Performing an interelement correction (IEC) in iTEVA™

a. Prepare a solution of the interfering element at the linear range of the instrument. Perform manual analysis according to section A.4 of this section.

b. Note results of elements with a known interference that are greater than the limit of quantitation.

c. Divide the result of each interfered element by that of the interfering element. These values represent the amount the current IECs need to be adjusted.

d. In the Method window, click on Elements to expand the list of elements in the method.

e. Click on the targeted element to view the settings for that element.

f. Click on the IECs tab to view the current IECs for that element.

g. Add each calculated result to the correction factors currently in the first column corresponding to each pair of elements.

h. Enter the new correction factors in the table.

i. Repeat steps d-f as needed.

j. Click on the Save method icon to save the method.

k. For routine IECs that are completed every six months, computer services updates the IDAT database with the information provided by the analyst. For non-routine IECs the analyst must document changes in the instrument log book with updated information.

B. Import and QC review of run data

1. Open the iCAP Data Reprocessor and ensure the correct database is listed.

2. Click on "Get run name list". Select the appropriate run. Click on "Reprocess".

3. Start the LIMS software and log in. Select Import from the IDAT menu.

4. Open the appropriate run file.

5. If prompted, enter the storage location of batch(es) requested. Verify that the following information is accurate: sample number, standard name, class, batch number, matrix, protocol, method reference, LCS ID, initial volume, final volume and dilution factor. Make corrections as needed.

6. Enter the correct rinse time. Enter the appropriate analyst number.

7. Click on Check/Save. When the confirmation screen appears, verify that the file name and run number are the same. Choose to either Exit or Import another run.

8. Open IDAT and click QC Review. Select appropriate run and click Review. When finished reviewing, click OK. Print QC and Print re-read. Review QC print outs and upload the appropriate run number in IDAT.

Routine Maintenance for the ICAP™ 6000 Duo Analyzer

A. Sample introduction system removal and cleaning: Remove and clean the sample introduction system when instrument performance declines (See **Figure 1**). Any adjustment to an instrument (replacement of parts, etc.) must be documented in the appropriate instrument logbook.

1. Remove spray chamber and nebulizer.

   a. Unclamp spray chamber from spray chamber adapter by gently squeezing clamp with one hand while supporting the spray chamber with the other hand.

   b. Gently remove the nebulizer from the spray chamber by pulling it out.

   c. Disconnect the argon and sample tubing from the nebulizer by pinching the Luer lock and pulling the tubing off the nebulizer.

   d. Clean the spray chamber if residue is observed coating the sides. If cleaning is necessary, remove the drain tubing from the spray chamber.

2. Remove and disassemble the torch

   a. Gently pull the spray chamber adapter out of the torch assembly.

   b. Unlock the torch assembly by turning it clockwise and remove it from the instrument.

   c. Turn the injector tip assembly clockwise to separate it from the torch housing.

   d. Gently pull the center tube out of housing to clean.

3. Prepare ultrasonic bath. Make sure the bath is at least ½ full with clean reagent water.

4. Clean torch, injector tip, and nebulizer.

   a. Invert the torch in a 250-mL vacuum flask of 50% HCl and place in the sonicator for 10 minutes. After sonication, rinse the torch with reagent water. (Be careful not to get a lot of water down into the base of the torch.) Carefully dry the torch with a paper towel.

   b. Place the injector tip in 50% HCl for 10 minutes. Rinse the injector tip with reagent water and carefully dry with a paper towel.

   c. For a glass nebulizer, place the nebulizer in 50% HCl for 10 minutes. (Do not place nebulizer in the sonicator.) If there is a visible clog, carefully insert 0.13 diameter fishing line through the tip of the nebulizer to assist in removing the clog. Force the 50% HCl solution through the argon and sample inlets in the nebulizer and rinse with reagent water when finished. (Make sure all of the water is out of the argon cavity of nebulizer.) For a plastic nebulizer, use a syringe to force the 50% HCl solution through the nebulizer to clean and/or remove any clogs.

   d. If the spray chamber needs to be cleaned, place it in the sonicator for approximately 5 minutes, and then rinse it out with matrix B rinse, followed by reagent water.

B. Reassemble the sample introduction system: (See **Figure 1**)

1. Reassemble the torch.

   a. The o-rings on the metal torch mount must be inspected and replaced if any wear or damage is visible.

   b. The quartz torch is pushed fully into the metal torch mount with a gently twisting pressure.

   c. The circular "target" design on the torch **MUST** align with the circular notch on the torch mount.

   d. Insert the injector tip fully into the center tube holder.

   e. Insert the center tube assembly into the torch mount and rotate it counter-clockwise to lock it in position.

   f. Mount the torch assembly back into the instrument by inserting it straight through the torch hole and coil, being careful not to disturb the quartz bonnet above the radial view lens.

   g. Turn the assembly counter-clockwise to lock it into position.

   h. Gently push the spray chamber adapter into the back of the center tube assembly.

2. Reassemble the spray chamber and nebulizer.

   a. If removed for spray chamber cleaning, reattach the drain tube to the spray chamber.

   b. With a twisting motion, insert the nebulizer into the spray chamber so that the collar is a tight fit.

   c. Attach the sample and nebulizer gas tubing to the nebulizer.

   d. Clamp the spray chamber to the spray chamber adapter.

3. Ignite the plasma.

C. Changing the pump tubing: Change pump tubing on the peristaltic pump when the tubing shows wear. Inspect all tubing to insure that it is secure and in good condition.

D. Documentation for instrument/analysis tag out and return to service.

NOTE: The following information is taken from QA-SOP11901: In the event of an equipment failure, the following must be performed:

1. Document the nature of the failure in the maintenance logbook

2. Document how and when the defect was discovered

3. Notification of supervisor or responsible person who can decide on appropriate action to take

4. The instrument must be clearly tagged as *Out of Service*. The tag must contain the following information:

   a. Date taken out of service

   b. Employee who took the instrument out of service

   c. Reason for tagout

   Form Q-EQA-FRM6871is used for "tagging out".

5. The date taken out of service and the date returned to service must be documented in the logbook.

6. Document any corrective action that was taken to bring the equipment back into service.

7. Results of the corrective action (i.e., system calibration within specifications, etc.)

8. Supervisory personnel must perform a documented evaluation and review of instrumentation/equipment where a major or uncommon failure has occurred to assess the potential impact the failure could have on the calibration and/or qualification of the instrument. This is done on a case-by-case basis.

9. After repair, document whether the function has been fixed. Then determine if calibration or verification activities need to be performed before the instrumentation is put back into service.

Calculations

1. Final Result

   a. Water sample

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Volume}}$$

   b. Solid sample (mg/kg)

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Weight (grams)}}$$

2. Relative percent different (RPD)

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

S = first sample value

D = duplicate sample value

3. Spike recovery

$$\%\ Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = spiked sample result

SR = sample result

SA = spike added

4. Correlation Coefficient

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\left(\sum X^2 - \frac{(\sum X)^2}{N}\right)\left(\sum Y^2 - \frac{(\sum Y)^2}{N}\right)}}$$

Where :

X = the known concentration

Y = the instrument response

N = the total number of data points

5. Serial Dilution

$$\% \ Difference = \frac{(5 \times SDR) - SR}{SR} \times 100$$

Where:

SDR = serial dilution result

SR = sample result

6. Methods of standard additions (MSA)
Take either 4 identical aliquots (for 3 point MSA) or 2 identical aliquots (for one point MSA) of the same sample. Leave one unspiked. Spike the other 3 aliquots with different levels of a standard solution (for 3 point MSA) and spike the other aliquot at approximately the indigenous concentration of the sample (for one point MSA). Add blank solution to sample aliquots so that the final volume is the same for all. Use small volumes of spiking solution to avoid diluting the sample more than 10%. Analyze the 4 aliquots or 2 aliquots and record the instrument readings in absorbance. Use the readings and spike values to find the slope and x- and y-intercepts. The x- intercept is the result.

$$\text{Slope} = m = \frac{\sum x_i y_i - (\sum x_i \sum y_i)/n}{\sum x_i^2 - (\sum x_i)^2/n}$$

$$\text{Y-Intercept} = b = \bar{y} - m\bar{x}$$

$$\text{Result} = -\frac{b}{m}$$

$$\text{Correlation Coefficient} = r = \frac{\sum \{(x_i - \bar{x})(y_i - \bar{y})\}}{\sqrt{\left[\sum (x_i - \bar{x})^2\right]\left[\sum (y_i - \bar{y})^2\right]}}$$

The correlation coefficient (r) for the least squares fit must be ³0.995. If the r value is <0.995, the MSA must be repeated at the same dilution. If the r value is again low, the result with the higher r value is verified and both are flagged with a "+" in the data package. If the r value is <0.990, the sample is run at an interference dilution to overcome matrix effects. This usually requires a raised limit of quantitation. If a client requests a particular limit of quantitation that prohibits further dilution, then the sample is repeated at the same dilution and the best of the two results is verified.

7. #6256 Total Hardness Calculation, Standard Methods 2340B-2011. The calcium result (mg/l) is multiplied by a factor of 2.497, the magnesium result is multiplied by a factor of 4.118, and the two values are added together for the hardness result.

8. #2828 and #2829 are used to calculate Trivalent Chromium water and soils. Calculation is performed by subtracting hexavalent chromium from total chromium.

9. #2268 Ferric Iron is calculated by subtracting ferrous iron from the total iron.

Statistical Information/Method Performance

Generate MDLs and LOQs according to *QA-SOP11892*. Perform an MDL study on each instrument used for the analysis. Determine the MDL by taking seven spiked replicates through the entire digestion and analysis procedure. Compare and pool results to determine the final reporting MDL. The department supervisor maintains annual study data. The department supervisor requests that a Quality Assurance Specialist update to the LIMS as needed. Update the department database via a download from the LIMS.

QC acceptance limits (MS, MSD, LCS and LCSD) are established as statistical limits (see *QA-SOP11896* for guidance). Limits are evaluated every 6 months by the department and updated in LIMS by QA as directed by the department supervisor.

Quality Assurance/Quality Control

A. For 6010B, 6010C, and 6010D each digestion batch (up to 20 samples) must contain a method blank (PB), LCS, unspiked sample (U), Duplicate (D), MS, and MSD. If there is not sufficient sample or per client requirement and LCSD is included.

B. For 200.7, each digestion batch (up to 10 samples) must contain a PB, LCS, U, D, and MS. If there is not sufficient sample or per client requirement and LCSD is included.

C. Batch Quality Control - For the preparation and concentrations see *T-MET-WI12063* and for the frequency, acceptance criteria and corrective action see tables I and II.

D. Raw data quality checks

1. Confirm that the batch and cover sheets are correctly labeled, dated, and signed where necessary. Review the batch sheet, project notes and lab notes with the incomplete list for special comments and due dates. Check that the run protocol has been selected correctly.

2. Check to see that the autosampler table printout is with the run and has a review signature from the analyst and run importer.

3. Refer to the calculation section of this SOP for calculations used for ICP analysis.

4. Refer to Tables I, and II for run and batch calibration and QC frequency, acceptance criteria and corrective action.

5. Each analytical run must have a QC review attached. All samples on the run must be listed on the QC review with notation as to whether the sample was verified or needed to be redigested/reanalyzed. The verifier must document on the QC review if any sample(s) were selected/deselected.

6. For spike levels of run QC see *T-MET-WI12063*

7. Spike levels of batch QC are available in the LIMS and on *T-MET-WI9082*.

8. LOQs are available in the LIMS and on *T-MET-FRM8802*.

9. Check to make sure that all results are below 90% of the linear range. If a sample reading is above 90% of the linear range, then reread the sample at an appropriate dilution. Verifiers footnote the coversheet indicating that all dilutions were performed correctly by comparing to the previous undiluted sample data.

10. Check that the **absolute** value of all nondetected analytes is less than the LOQ. A technical decision must be made as to whether a reread is warranted for readings <(-LOQ). Comments are added during verification to any non-detect sample readings that were diluted due to <(-LOQ).

11. For SPLP and TCLP samples, an MSA (method of standard additions) is required if:

    a. The sample concentration falls between 80% to 100% of the regulatory limits.

    b. If the SPLP or TCLP Matrix Spike (QA) recovers < 20%, all samples in the leachate batch must be reanalyzed using the method of standard additions for that analyte.

12. For all EW samples (samples from public drinking water sources); check the results against the MCL (maximum contaminant level). If an analyte **exceeds** the MCL, notify a verifier at once. An automated email is sent to the Client Service Representative and the state for the analytes listed in QA-SOP11886. Suppliers must be notified within 24 hours.

13. Check the internal standard (Yttrium) level for the entire run. If the Yttrium reading for any sample is < 50% or >130% of the reading for S0, then reread the sample at a dilution.

NOTE: The internal standard is added in equal concentration to all of the samples and standards via a dedicated line on the peristaltic pump. The analytical lines referenced to an internal standard report a corrected concentration value based on the ratio of analyte to internal standard intensities. All of the calculations for determining concentration are based off of Intensity Ratio (IR). The IR is defined as the background corrected intensity signal of the analyte line (Ia) divided by the internal standard value (Iis). IR = Ia/Iis

14. For EPA600 series samples, an ICV2 is analyzed immediately after the initial ICV. The average of the six total replicates is used with a requirement of ±5% accuracy and an RSD of <3%.

15. Check for high concentrations of interfering elements. Analytes must be flagged for possible interference if any interfering element concentration is greater than the level used for semi-annual IECs. Comments must be added during verification to any samples reading under the reporting limit that were diluted due to possible interference(s). For the iCAP 6000 series instrument (T70, #11016; T71, #16315; T72, #16417, T73, #18255) Si is monitored due to an interference on Pb. Pb data must be reread if Si is not within ±10% in CCVs.

NOTE: All samples requiring postspikes must be postspiked at 2 times the CRQL or approximately 2 times the indigenous level of the sample.

F. When raw data checks are complete, check the following:

1. All samples requiring reread/redigestion are listed on the reread/redigestion schedule forms. Any dilutions required have been calculated correctly and added to the reread/redigestion form. Specific instrument has been noted for client requirements if necessary.

2. Data for samples following Good Laboratory Practices (GLP) must be retained as permanent storage.

3. The data are uploaded to the LIMS via IDAT by the reviewer and are verified from the LIMS by the verifier.

G. Instrument detection limits are performed when an instruments detector is changed or a new instrument is added to the lab. Method detection limits (MDLs) follow guidelines in SOP *QA-SOP11892*. Inter-Element Correction factors (IECs) are checked routinely every 6 months for each analytical instrument. Linear ranges are verified semi-annually.

H. Verification process

1. Confirm that all required pieces of QC have been uploaded to the LIMS and are within specification. If there is partial QC on the current run and the samples have been analyzed more than once, check to see if there are associated runs in the hold bin waiting on additional QC to be verified.

2. In the LIMS, choose method of verification. (Metals verification by run, or verify by individual element.)

3. Ensure that all lab notes and project notes were followed.

4. Non-compliant data can be reported only after all required corrective actions have been taken. Drinking water compliance data (EW) cannot be reported without permission from the regulatory body (*QA-SOP11892*).

5. Confirm calculation analyses are completed if requested. See calculation section for Total Hardness Calculation, Trivalent Chromium calculation and Ferric Iron calculation.

6. When all of the elements are verified for a digest, verify the digest number. Associated tracking numbers and suite numbers are routinely auto-verified within hours of verifying all of the elements and digests on each sample.

Table I - QC Requirements for SW-846 6010B, 6010C, and 6010D

QC	Frequency	Criteria			Corrective action
		SW-846 6010B	SW-846 6010C	SW-846 6010D	
Calibration	Every 24 hours	Single Point Calibration: The calibration contains a blank and 1 standard. Multi Point Calibration: The calibration contains a blank and 4 standards. R2 value =0.99			Recalibrate
ICV	Immediately after Calibration	%Recovery: 90-110%. If an element ICV is out high, accept element if the |result| < LOQ. RSD <5%			Re-calibrate and re-analyze
ICB	Immediately after ICV	|ICB| <3× IDL	|ICB| <1/2 LOQ	|ICB| <1/2 LOQ	Re-calibrate and re-analyze affected elements: If the results are < 10x the ICB detection If the results were <LOQ and ICV was out low Samples <LOQ can be reported if ICV is out high.
LLC	At the beginning of the run before ICSA/ICSAB. At the end of the run per client requirement.	%Recovery: 50-150% If out of range, accept element results >10× the true value of the LLC.	%Recovery: 70-130% If out of range, accept element results > CCV	%Recovery: 80-120% If out of range, accept element results > CCV	Data for that element cannot be reported from the run for the affected samples. If the LLC is out high, accept results <LOQ
ICSA	After LLC and at the end of the run per client requirement.	%Recovery: 80-120% |ICSA| < 2× LOQ for unspiked elements.	%Recovery: 80-120% |ICSA| < 2× LOQ for unspiked elements.	%Recovery: 80-120% |ICS|< LOQ for unspiked elements.	Reanalyze samples that require the element
ICSAB	After LLC and at the end of the run per	%Recovery: 80-120% |ICSAB| < 2× LOQ	%Recovery: 80-120% |ICSAB| < 2× LOQ	ICSAB is not required	Reanalyze samples that require the element

QC	Frequency	Criteria			Corrective action
		SW-846 6010B	SW-846 6010C	SW-846 6010D	
	client requirement.	for unspiked elements.	for unspiked elements.		
CCV	After every 10 samples and at the end of the run	%Recovery: 90-110%. If out high, accept element if the |result| < LOQ. RSD <5%			Data bracketed by the CCV: Reanalyze samples with affected element(s) > LOQ .
CCB	After every CCV, every 10 samples and at the end of the run	|CCB| <3× IDL	|CCB| <3× IDL	|CCB| < ½ LOQ	Data bracketed by the CCB: Reanalyze samples < 10x the CCB detection. Reanalyze if CCB was out low and the results were <LOQ Samples < LOQ can be reported if the CCB is out high.
PB	1 per analytical batch of 20 samples or less.	|PB| must be <1/2 LOQ. Not applicable if analyte reading in the sample is > 10× the PB reading or <LOQ.			Sample may be re-analyzed once. If still out of specification, redigest all associated samples.
LCS	1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of ±20%, as indicated by the client requirement.			Sample may be re-analyzed once. If still out of specification, redigest all associated samples. If the LCS is out high, only redigest samples > LOQ.
LCSD	If required, 1 per analytical batch of 20 samples or less.	Must meet same criteria as LCS RPD < 20%			Same as LCS corrective action. Redigest samples if RPD is out of specification.
MS/MSD	1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of ±25% as indicated by the client requirement. RPD must be <20%.			Data is flagged in the QC Summary and/or in the data package. If sample concentration <4× the spike added a PDS must be performed.
D	1 per analytical batch of 20	If the samples are >5× the LOQ the RPD must be <20%. If either the sample or duplicate is <5× the LOQ the difference			Data is flagged in the QC Summary and/or in the data package.

QC	Frequency	Criteria			Corrective action
		SW-846 6010B	SW-846 6010C	SW-846 6010D	
	samples or less.	between the two values must be <LOQ. Not applicable if both samples are <LOQ.			
PDS	1 per batch. When MS/MSD are out of specification or sample is <4x the spike added	%Recovery: 75-125%	%Recovery: 80-120%	%Recovery: 80-120%	The data is reported in the data package.
Serial Dilution	1 per batch. Evaluated when samples >50× IDL.	90 - 110% of U	90 - 110% of U	80 - 120% of U	The data is flagged in the data package.
Samples	Up to 20 per analysis batch.	Results must be < 90% of the linear dynamic range and > -LOQ. RSD <20% for results > 2x LOQ. Elements <LOQ are accepted if the ICV/CCV is out of specification high, and the sample is not < - LOQ.			Sample is diluted and reanalyzed. Sample is reanalyzed. Reanalyze for elements that do not meet this criteria.
Upper Linear Range	Analyzed once per run.	NA	NA	Once per run, Single Calibration only. %Recovery 90-110%	Samples reading greater than 90% of the linear range must be reanalyzed.
Mid Range Check	Analyzed once per run.	NA	NA	%Recovery 90-110%. Use the mid -point calibration standard.	Reanalyze all elements > |CCV|.
Internal Standard	Added to samples in line by use of a mixing T.	50% -130% of the calibration blank internal standard.			Reanalyze at a dilution.

Table II - QC Requirements for EPA 200.7 rev 4.4

*NOTE - PA EW SAMPLES ARE NOT ACCEPTED IF QC DOES NOT MEET CRITERIA. Redigest and reanalyze as needed if the acceptance criteria are not met.

QC	Frequency	Acceptance	Corrective Action

QC	Frequency	Acceptance	Corrective Action
Calibration	Every 24 hours	Single Point Calibration: The calibration contains a blank and 1 standard. Multi Point Calibration: The calibration contains a blank and 4 standards. R2 value =0.99	Recalibrate
ICV and ICV2	Immediately after Calibration	%Recovery: 95-105%. If an element ICV is out high, accept element if the |result| < LOQ* . RSD (6 replicates) <3%	Re-calibrate and re-analyze
ICB	Immediately after the ICV.	|ICB| < 3x IDL If the ICB is out high, accept element results > 10x the ICB detection or < LOQ. If ICB is out low, only accept results > 10 x ICB detection*.	Re-calibrate and re-analyze affected elements.
LLC	Analyzed after ICB. Analyzed at the end of the run per client requirement.	50-150% NA if samples are >10× the true value of the LLC. For LLC results >the high limit, samples <reporting limit can be accepted* .	Data for that analyte cannot be reported from the sample.
ICSA/ICSAB	Analyzed after LLC. Analyzed at the end of the run per client requirement.	± 20% of the true value for analytes that are spiked. |ICSA| or |ICSAB| must be <2× LOQ for analytes that are not spiked.	Data for that analyte cannot be reported from the run (reanalyze all samples requiring that element).
CCV	Every 10 samples and at the end of the run.	±10% of the true value. If out high, accept element if the |result| < LOQ*.	Data bracketed by the CCV: Reanalyze samples with affected elements.
CCB	Every 10 samples and at the end of the run.	|CCB| must be <3x IDL If out high, accept element if the |result| < LOQ or > 10 x the detection in the CCB*. If out low, only accept results > 10 x the detection in the CCB*.	Data bracketed by the CCB for the affected analyte cannot be reported (reanalyze all samples in the bracketing blocks for that element).

QC	Frequency	Acceptance	Corrective Action
PB	1 per analytical batch of 10 samples or less.	|PB| must be < 2.2x MDL. Does not apply to samples > 10x PB value or non-detects*. EW samples are not accepted for any reason if the PB is out of specification.	Redigest all associated samples.
LCS	1 per analytical batch of 10 samples or less. The LCS is spiked at or below the MCL for all primary drinking water metals. See QA-SOP11886 for MCLs.	Use statistical limits or the method limit of ±15% (PW, EW) If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken*. EW samples are not accepted if the LCS is out of specification.	Redigest all associated samples if the LCS is out of specification low. If the LCS is out of specification high redigest samples that are greater than the LOQ. EW samples must be redigested.
LCSD	If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a frequency of 1 per analytical batch of 10 samples or less.	Must meet LCS requirements RPD <20%	Redigest all associated samples.
MS	1 per analytical batch of 10 samples or less.	Use statistical limits or the method limit of ±30%, as indicated by the client requirement.	Data is flagged in the QC Summary and/or in the data package. If sample concentration <4× the spike added a PDS must be performed.
D	1 per analytical batch of 10 samples or less.	If the samples are >5× the LOQ the RPD must be <20%. If either the sample or duplicate is <5× the LOQ the difference between the two values must be <LOQ.	Data is flagged in the QC Summary and/or in the data package.

QC	Frequency	Acceptance	Corrective Action
		NA if both samples are <LOQ.	
PDS	1 per batch. Evaluated when matrix spike is not within specification.	±15% of the true value.	Data is reported in the data package.
Serial Dilution	1 per batch. Evaluated only when analyte concentrations are >50× IDL.	The percent difference must be <10%.	Data is flagged in the data package.
Samples		Results must be < 90% of the linear dynamic range, >-LOQ. RSD must be <20% for results > 2xLOQ. Elements reported as non-detect are accepted if the ICV/CCV is out of specification high and the sample is not < - LOQ.*	Sample is diluted and reanalyzed. Sample is reanalyzed EW must be redigested and reanalyzed.
Internal Standard	Added to samples in line by use of a mixing T.	Must be 50% -130% of the calibration blank.	Reanalyze at a dilution.

Appendix I

Definitions and explanations of the codes and symbols used on the raw data

A. Sample table information

1. The run number.
2. The page number.
3. The tube number.
4. The sample number.
5. The first and second of four asterisks denote whether the sample is a background (U*), duplicate (D*), spike (R*), MSD (M*), post-digestion spike (UP), serial dilution (UL), or not a QC sample (**).

6. The weight to volume or volume to volume digestion ratio, consisting of the initial quantity of sample used and the final digest volume.

7. The dilution factor – Indicating if the digest solution was diluted prior to analysis. An undiluted sample is labeled DF1.

8. Digestion batch number – Assigned when designated samples are scheduled for preparation, this number is used to track samples and QC prepared together.

9. The protocol by which the data is reviewed (SW-846, EPA-600).

10. Date and time of the sample injection into the instrument.

11. The ICAP identification number.

B. The ICP scans all of the method elements simultaneously during the analysis. The QC review lists all the samples on the run. The QC review lists elements verified, good phantom, and elements/phantom that are bad (need to be reread for run or batch QC). The reviewer or verifier documents on the QC review if any element (s)/sample(s) were selected/deselected.

C. The following are error codes in the iTEVA™ software.

1. S = Saturation – The concentration of the element is more than the detector can quantify.

2. K = The Elements Affected by a Saturated Element – The concentration listed is not accurate, and a more accurate result can be obtained by running the sample at a dilution.

D. Along with the average concentration (in ppm), the average intensity, %RSD and all three replicates are shown for each analyte. Internal standard values are intensities (cts/s).

QA-SOP11892 Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896 Establishing Control Limits
S-SS-WI10695 Liquid Sample Preservation, Sample Splitting, and Turbidity for metals by EPA Methods 200.7 and 200.8
T-MET-FRM8802 ICP LOQs (mg/L)
T-MET-FRM9070 MSA Prep for Samples with MS/MSD <50%
T-MET-FRM9072 MSA Prep for Samples within TCLP Limits
T-MET-WI12063 ICP Solutions and Standards Preparation
T-MET-WI9082 Working Instructions for Prep Solutions and Standards

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Attachment:
Figure 1

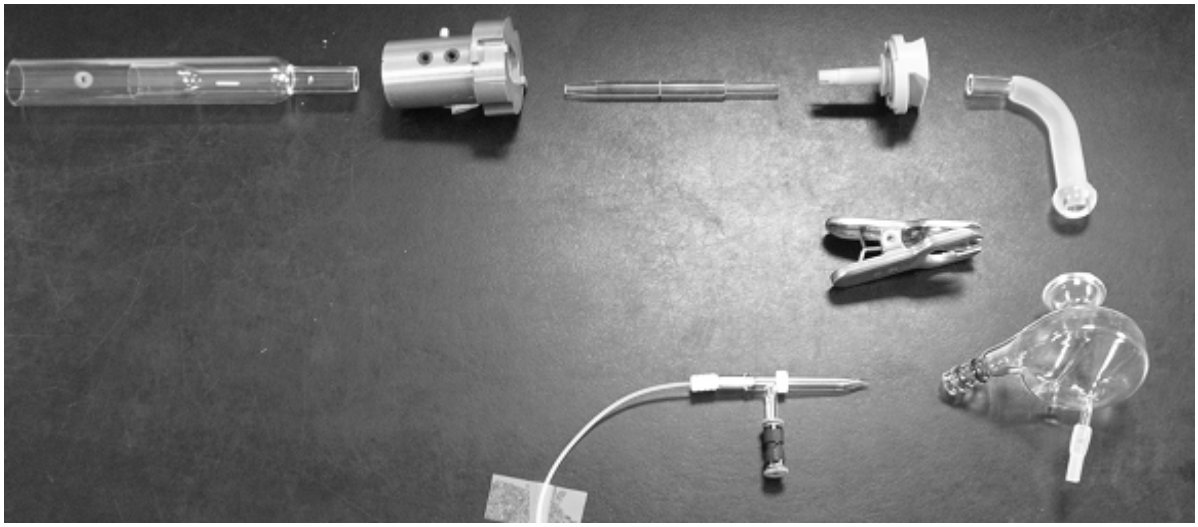
End of document

eurofins	Always check on-line for validity. **Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)**	Level: **Work Instruction**
Document number: **T-MET-WI11931**		
Old Reference: **1-P-QM-WI-9018442**		
Version: **13**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **17-JUL-2019**	Document users: **6_EUUSLA_Metals_ICP Analysis, 6_EUUSLA_Metals_ICP Analysis Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

Version history

Version	Approval	Revision information
11	02.OCT.2018	
12	05.MAR.2019	
13	12.JUL.2019	

Figure 1



eurofins	Always check on-line for validity. **Sample Preparation of Leachates and Other Wastewater for Analysis of Total Metals by Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)**	Level: **Work Instruction**
Document number: **T-MET-WI11937**		
Old Reference: **1-P-QM-WI-9015165**		
Version: **12**		Organisation level: **5-Sub-BU**
Approved by: **UBFR** Effective Date **19-JAN-2015**	Document users: **6_EUUSLA_Metals_ICP-MS Prep, 6_EUUSLA_Metals_ICP-MS Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

LIMS ID
Analysis DOD - 6050, 10639

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Revision Log

Revision: 12		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM -QMA-9017356	Removed revision logs up to the previous version
Reference	No longer applicable to the procedure	Removed 3010A Modified

eurofins	Always check on-line for validity. **Sample Preparation of Leachates and Other Wastewater for Analysis of Total Metals by Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)**	Level: **Work Instruction**
Document number: **T-MET-WI11937**		
Old Reference: **1-P-QM-WI-9015165**		
Version: **12**		Organisation level: **5-Sub-BU**
Approved by: **UBFR** Effective Date **19-JAN-2015**	Document users: **6_EUUSLA_Metals_ICP-MS Prep, 6_EUUSLA_Metals_ICP-MS Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

Revision: 12	**Effective Date:** This version	
Reference Modifications	No longer applicable to the procedure	Removed 3010A modifications
Procedure A and B	Clarification	Reworded numbers 2, 5 and 6 to clarify steps found in the EPA procedure for 3020A

Revision: 11	**Effective Date:** Nov 25, 2013	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflect re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers
Cross Reference	Reflect current procedure	Added reference to Analysis #6142, 6123, 6125,…
Sample Collection, Preservation, and Handling	Process change	Changed sample storage temperature from 4° ± 2° C to 0° to 6° C but not frozen, prior to digestion.
Safety Precautions and Waste Handling	No longer used	Deleted text pertaining to Hydrofluoric Acid.
Reagent and Standards	Reflect current procedure	Added text pertaining to preparing solutions using different volumes, is acceptable, if exact ratios are maintained.
Procedure A	Reflect current procedure	Deleted text, in NOTE, pertaining to using a smaller sample aliquot if insufficient sample is submitted. Deleted text, to NOTE, pertaining to samples concentration
Procedure A.1	Reflect current procedure	Added text pertaining to adding spike solution, after the sample has been poured. Added text pertaining to reference to Analysis #6142, 6123, 6125,… for batch quality control requirements.
Procedure B	Reflect current procedure	Deleted text in NOTE pertaining to using a smaller sample aliquot if insufficient sample is submitted. Deleted text to NOTE pertaining to samples concentration
Procedure B.1	Reflect current procedure	Added text pertaining to reference to Analysis #6142, 6123, 6125,… for batch quality control
Block Digestor Instructions	Reflect current procedure	Clarified instruction steps. Deleted text pertaining to the difference between sample temperature and display temperature.
Quality Assurance/Quality Control	Reflect current procedure	Added reference to Analysis #6142, 6123, 6125,… for batch quality control requirements.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3020A, July 1992.

2. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, …	Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A (aqueous, solid, tissue) and EPA 200.8 (aqueous)
1-P-QM-FOR-9009182	Working Instructions for Prep Solutions and Standards
1-P-QM-QMA-9015390	Demonstrations of Capability

Purpose

This digestion procedure is used to prepare leachate and other wastewater samples for measurement of total metals by inductively coupled plasma-mass spectrometer (ICP-MS) following SW 846 protocol.

Scope

This acid digestion procedure is used by the Metals Department of the Environmental Sciences Division to prepare leachate, wastewater, surface water, and groundwater samples for measurement of total recoverable metals by inductively coupled plasma-Mass Spectrometer (ICP-MS) following SW-846.

Basic Principles

A mixture of nitric acid and the sample is refluxed in a covered beaker/digestion vessel at low volume to dissolve metals. It is cooled and brought up to volume with reagent water.

Reference Modifications

1. A 50–mL sample aliquot and final volume is used instead of 100-mL to improve digestion throughput, conserve sample usage, and limit waste generation. Because all reagents are also adjusted so that concentrations are equivalent to a 100–mL aliquot, there is no impact on the data.

2. Ribbed watch glasses are not used; samples are evaporated without watch glasses in nonmetallic hoods to speed evaporation. No contamination trends have been observed in prep blanks evaporated without watch glasses.

Definitions

1. ACS – American Chemical Society

2. ASTM – American Society of Testing and Materials

3. D – Sample Duplicate

4. DOC – Demonstration of Capability

5. IDOC – Initial Demonstration of Capability

6. LCS/LCSD – Laboratory Control Sample/ Laboratory Control Sample Duplicate

7. LCSW – Laboratory Control Sample Water

8. LLENS – the computer program that integrates a PC with an analytical balance to collect data directly from the balance. The program organizes the data and transmits the readings to the LIMS.

9. LIMS – Laboratory Information Management Systems

10. LLI Sample ID – unique 7-digit number assigned to a client sample.

11. LOQ – Limit of Quantitation

12. MDL – Method Detection Limit

13. MS (R) – Matrix Spike

14. MSD (M) – Matrix spike duplicate

15. PB/PBW – Preparation Blank/ Preparation Blank Water

16. QC – Quality Control

17. Method Blank – equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix

or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.

18. SOP – Standard Operating Procedure

19. SPLP – Synthetic Precipitation Leaching Procedure

20. STLC – Soluble Threshold Limit Concentration

21. TCLP – Toxicity Characteristic Leaching Procedure

22. U or US – unspiked background sample

Interferences

Not applicable to this procedure.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

> **Nitric acid (HNO_3)** – This acid can cause skin burns. Add nitric acid to samples in a hood or use the designated dispensing equipment to avoid exposure to toxic fumes.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A , soda ash or equivalent, to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf. Soda ash is located in the stairwell adjacent to the prep room.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability for this or an equivalent procedure.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an IDOC.

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Refer to 1-P-QM-QMA-9015390, for specific requirements. A DOC is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling

Samples are collected in plastic containers and preserved to a pH of <2 with HNO_3. (Samples to be analyzed for soluble metals requiring filtration at the lab must be submitted unpreserved. The sample is run through a 0.45-micron filter within 5 days of receipt and then preserved.) The pH is checked upon receipt and adjusted as necessary by Sample Support; samples that are pH adjusted at the lab must not be digested for a minimum of 24 hours. If samples fail to maintain a pH of <2 the Client Service Representative is notified for further direction. Samples are stored at 0° - 6°C, but not frozen, prior to digestion. Samples must be digested within 6 months of collection. Digested samples are stored in plastic at room temperature and have a 6 month holding time.

Apparatus and Equipment

1. Polypropylene containers (digestion vessels) – certified clean and Class A equivalent
2. Watch glasses or reflux caps
3. 50–mL graduated cylinders or other appropriate graduated cylinders if necessary
4. 50–mL volumetric flasks or other appropriate Class A volumetric flasks if necessary
5. 250-mL beakers or other appropriate beakers
6. Hotblocks or hot plates, adjustable and capable of maintaining a temperature of 90° to 95°C

Reagents and Standards

For reagent preparation, shelf life, and storage conditions, see Form 1-P-QM-FOR-9009182. .

Nitric acid, HNO_3 – Fisher, Trace Metal Grade, or equivalent. Store at room temperature and re-evaluate annually.

NOTE: It is acceptable to prepare solutions using multiples of indicated volumes if exact ratios are maintained.

Calibration

Not applicable to this method.

Procedure

This SOP has been set up to outline the procedures for both hotblock and hot plate digestions (see below). Choose the procedure that corresponds to the sample heating technique being used for sample digestion.

A. Hotblock

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered water.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

1. Shake sample well. Transfer 50 mL of well mixed sample to a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see Analysis #6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, …

NOTE: For leachate samples, use the appropriate extraction fluid for the PBW and LCS. The extraction fluids are as follows: TCLP, SPLP, STLC, ASTM, Filtration, and Elutriate.

2. Add 1.5 mL of HNO_3. Place the vessel in the hotblock at 90° to 95°C, and cautiously evaporate to low volume (about 5 mL), making certain that the sample does not boil and that no portion of the bottom of the digestion vessel is allowed to go dry.

3. Cool the digestion vessel and add another 1.5–mL portion of HNO_3.

4. Cover the digestion vessel with a reflux cap and return to the hotblock. Increase the temperature of the hotblock so that gentle reflux action occurs.

NOTE: If a sample is allowed to go to dryness, low recoveries result. If this occurs, discard the sample and re-prepare in a new batch.

5. Continue heating (refluxing), adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing).

6. When digestion is complete, uncover the digestion vessel and evaporate to low volume (about 3 mL). Do not allow any portion of the bottom of the digestion vessel to go dry.

7. Remove the digestion vessel and add approximately 5 mL of reagent water, mix, and continue warming for 10 to 15 minutes to allow additional solubilization of any residue to occur.

8. Allow to cool. Adjust volume to the 50-mL mark on the digestion vessel with reagent water and mix. Seal vessel with screw cap.

9. The sample is now ready for analysis.

B. Hot Plates

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the prep blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The prep blank and spiked LCS must also be prepared with filtered reagent water.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

1. Shake sample well. Use a 50 mL graduated cylinder to transfer 50 mL of well mixed sample into a 250 mL beaker. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see form 1-P-QM-FOR-9009182. For sample batch quality control requirements see Analysis #6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, …

NOTE: For leachate samples, use the appropriate extraction fluid for the PBW and LCS. The extraction fluid are as follows: TCLP, SPLP, STLC, ASTM, Filtration, and Elutriate.

2. Add 1.5 mL of HNO_3. Place the beaker on a hot plate and cautiously evaporate to low volume (about 5 mL), making certain that the sample does not boil and that no portion of the bottom of the beaker is allowed to go dry.

3. Cool the beaker and add another 1.5–mL portion of HNO_3.

4. Cover the beaker with a watch glass and return to the hot plate. Increase the temperature of the hot plate so that gentle reflux action occurs.

NOTE: If a sample is allowed to go to dryness, low recoveries result. If this occurs, discard the sample and reprepare in a new batch.

5. Continue heating (refluxing), adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing).

6. When digestion is complete, uncover the beaker and evaporate to low volume (about 3 mL). Do not allow any portion of the bottom of the beaker to go dry.

7. Remove the beaker and add approximately 5 mL of reagent water, mix, and continue warming the beaker for 10 to 15 minutes to allow additional solubilization of any residue to occur.

8. Allow to cool. Transfer the solution to a 50–mL volumetric flask. Adjust volume to the 50 mL mark with reagent water and mix.

9. Transfer to a polypropylene bottle.

10. The sample is now ready for analysis.

Block Digestion Instructions

1. Turn block digestor on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. PRESS and hold STAR (*) key.

4. The display shows the Set Point Temperature.

5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

NOTE: Polypropylene containers must not be heated above 130°C.

Calculations

Not applicable to this procedure.

Statistical Information/Method Performance

Not applicable to this method. See analysis procedure.

Quality Assurance/Quality Control

A method blank, sample duplicate, sample matrix spike, sample matrix spike duplicate, and laboratory control sample must be performed with every digestion batch (20 samples or less). Each piece of batch QC is digested following the procedure in this SOP.

For sample batch quality control requirements see Analysis #6142, 6123, 6125, 10801, 6126, 6127, 6129, 6128, 6132, 6131, 6133, 6134, 6140, 6136, 6137, 6138, 6143, 6139, 6135, 6124, 6141, 6146, 6144, 6147, 6145, …

End of document

Version history

Version	Approval	Revision information
12	19.JAN.2015	

eurofins	Always check on-line for validity.	Level:
Document number: **T-MET-WI11933**	**Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A/6020B(aqueous, solid, tissue) and EPA 200.8 (aqueous)**	**Work Instruction**
Old Reference: **1-P-QM-WI-9018443**		
Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **12-JUL-2019**	Document users: **6_EUUSLA_Metals_ICP-MS Analysis, 6_EUUSLA_Metals_ICP-MS Analysis Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

LIMS ID
Water Analysis # 6027, 6043, 6036, 6023, 6040, 6029, 6047, 6048, 6031, 6037, 6034, 6032, 6039, 6033, 6049, 6025, 6041, 13171, 6044, 6038, 6042, 6028, 6046, 6024, 6026, 6045, 6035, 13501 Solid Analysis # 6127, 6143, 6136, 6123, 6140, 6129, 6147, 6148, 6131, 6137, 6134, 6132, 6139, 6133, 6149, 6125, 6141, 13172, 6144, 6138, 6142, 6128, 6146, 6124, 6126, 6145, 6135, 13502

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Figure I - Daily Performance Acceptance Criteria
Table I - ICP-MS Metals by EPA 200.8 rev 5.4
Table II - ICP-MS Metals by EPA 6020/6020A/6020B

Revision Log

Revision: 10	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Table II - ICPMS Metals by EPA 6020/6020A/6020B	Update to method requirements	Internal standard requirements

Revision: 9	**Effective Date:**	21-March-2019
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version.
Scope	Redundant Information	Deleted reference to elements list since this is already referenced in the procedure elsewhere.
Routine Methods	Clarification	Changed wording to include all ICP-MS, not specifying individual instruments.

eurofins	Always check on-line for validity.	Level:
Document number: **T-MET-WI11933**	**Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A/6020B(aqueous, solid, tissue) and EPA 200.8 (aqueous)**	**Work Instruction**
Old Reference: **1-P-QM-WI-9018443**		
Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **12-JUL-2019**	Document users: **6_EUUSLA_Metals_ICP-MS Analysis, 6_EUUSLA_Metals_ICP-MS Analysis Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

Revision: 9	**Effective Date:**	21-March-2019
Section	**Justification**	**Changes**
Basic Principles	Addition	Added instrument names and clarification about instrument analysis modes for gas and no gas modes.
Interferences	Clarification	Added that rinsing is done with an appropriate rinse solution
Safety Precautions and Waste Handling	Added/Deleted	Clarified information about which acids are used and how to use them safely, removed information about concentrated HF acid that is not used in this analysis. Only trace levels are used. Adjusted information according to trace use. Corrected the information on response to acid spills to current practice and EHS policies.
Personnel Training and Qualifications	Readability/Clarification	Added reference to DOC document *QA-SOP11178* and clarified data transfer for iDOCs.
Sample Collection, Preservation, and Handling	Readability/Clarification	Grammatical errors corrected.
Apparatus and Equipment	Addition	Added information regarding ICP MS equipment changes and the addition of the Agilent 7900.
Reagents and Standards	Readability/Clarification	
Calibration	Added/Deleted	Removed redundant information referencing forms in the previous section. Clarified warm up time requirements and when full tuning and optimization is done or needed. Clarified when a single point and multi-point calibration is done.
Procedure	Added/Deleted	Updated procedure for current practices and current equipment/software changes and added clarification for procedure steps when preparing a batch for analysis.

Reference

1. Method 200.8 (rev 5.4), Determination of Metals and Trace Metals in Water and Wastes by Inductively Coupled Plasma-Mass Spectrometry, USEPA 600/R-94/111 May 1994.

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 6020, September 1994.

3. Test Methods for Evaluating Solid Wastes, SW-846 Method 6020A, February 2007.

4. Test Methods for Evaluating Solid Wastes, SW-846 Method 6020B, Rev. 2, July 2014.

5. Agilent 7500 Series ICP-MS ChemStation (G1834B) Operator's Manual, Hardware Manual, Tuning & Application Handbook, and Maintenance Video (DVD).

6. ESI SC Manual.

7. Agilent 7700 and 7900 Series ICP-MS MassHunter Workstation Guide and Hardware Maintenance Manual.

8. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Q-EQA-FRM6869	Nonconformance Form
T-MET-WI12065	Working Instructions for Preparation of ICP-MS Solutions and Standards

eurofins	Always check on-line for validity.	Level:
Document number: **T-MET-WI11933**	**Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A/6020B(aqueous, solid, tissue) and EPA 200.8 (aqueous)**	**Work Instruction**
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Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **12-JUL-2019**	Document users: **6_EUUSLA_Metals_ICP-MS Analysis, 6_EUUSLA_Metals_ICP-MS Analysis Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

Document	Document Title
S-SS-WI10695	Liquid Sample Preservation
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896	Establishing Control Limits
QA-SOP11901	Instrument and Equipment Maintenance and Calibration
T-MET-WI18026	Instrument Operations for Agilent 7500
T-MET-WI18027	Instrument Operations for Agilent 7700
T-MET-WI18028	Instrument Maintenance for Agilent 7500
T-MET-WI18029	Instrument Maintenance for Agilent 7700
T-MET-WI21589	Instrument Operations for Agilent 7900
T-MET-WI21590	Instrument Maintenance for Agilent 7900
T-MET-FRM8822	ICPMS Analysis

Scope

This procedure applies to analyses performed at Eurofins Lancaster Laboratories Environmental (ELLE) using ICP-MS for identification and quantitation of metallic constituents.

Aqueous undigested samples and digestates (aqueous and solid matrices) are analyzed via this SOP.

Limits of Quantitation (LOQs), Method Detection Limits (MDLs) and linear ranges are maintained in the LIMS. These are subject to change without notification.

Routine Methods

Elements routinely analyzed on ICP-MS are outlined in *T-MET-FRM8822* and include the following:

Analyte	Mass	Soil Analysis LIMS #	Water Analysis LIMS #
Be	9	6127	6027
B	11	10801	10802
Na	23	6143	6043
Mg	24	6136	6036
Al	27	6123	6023
K	39	6140	6040
Ca	44	6129	6029
Ti	47	6147	6047
V	51	6148	6048
Cr	52	6131	6031
Mn	55	6137	6037
Fe	57	6134	6034
Co	59	6132	6032
Ni	60	6139	6039
Cu	63	6133	6033
Zn	66	6149	6049
As	75	6125	6025
Se*	78	6141	6041
Se**	82	6141	6041
Sr	88	6144	6044
Mo	98	6138	6038
Ag	107	6142	6042
Cd	111	6128	6028
Sn	120	6146	6046

Sb	121	6124	6024
Ba	137	6126	6026
Tl	203	6145	6045
Pb 206	206	6135	6035
Pb 207	207	6135	6035
Pb 208***	208	6135	6035
U	238	13502	13501
*Se 78 is the mass reported from collision cell ICPMS only **Se 82 is the mass reported from non-collision cell ICPMS only ***For Pb masses 206, 207 and 208 are summed for calibration and analysis			

Basic Principles

ICP-MS is an analytical instrument that uses the energy of inductively coupled plasma to generate ions to be analyzed in the mass spectrometer.

The instruments use a discrete sampling system that first loads the sample into a Teflon sample loop. The sample is then pushed by a carrier solution using a computer controlled peristaltic pump that delivers the sample from the loop into the nebulizer attached to an electronically cooled cyclonic spray chamber.

The Agilent 7500 (E03), 7700 (E05) and 7900 (E07) can analyze samples in 3 different modes of operation, although typically analysis is done in 3 mode or He mode only:

1. Mode 1 – no gas. This mode does not use a collision or reaction gas. Elements with a low atomic mass or that have no interferences can be analyzed using the "no gas" mode.

2. Mode 2 – Helium (He) mode. This mode uses He as a collision gas for reliable, predictable removal of unknown matrix interferences. No new interferences are formed in the cell, and no analytes are lost by a reaction.

3. Mode 3 – Hydrogen (H2) mode. This mode uses H2 as a reaction gas, since it reacts quickly and efficiently with the Argon-based interfering species, but reacts slowly or not at all with the analyte(s) of interest. In this mode, interferences can be reduced to the level of baseline noise, allowing lower detection limits to be achieved for some difficult elements.

Interferences

ICP-MS interferences include isobaric elemental interferences and polyatomic ion interferences derived from the plasma gas, reagents, and/or sample matrix. The Agilent 7500, 7700 and 7900 utilize helium as an inert collision gas to reduce or eliminate many types of polyatomic ion interferences.

Physical interferences caused by the change in sample matrix affecting sample transport and/or nebulization must be compensated for using internal standardization.

Memory interference is the contribution of analyte signal from a previous sample onto the next sample analysis. Adequate rinse time with an appropriate rinse solution of the sample introduction system overcomes any memory interference.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.
See the *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Hydrochloric acid (HCl) – This acid can cause skin burns. Only mix with approved solutions. Always use this chemical in a fume hood.

Hydrofluoric acid (HF) – This acid is very toxic and absorbs through the skin without pain. This acid is found at trace levels in standard solutions.
Hydrogen Peroxide 30% (H2O2) **-** This oxidizer can cause skin burns. Always use in a fume hood.

Nitric acid (HNO3) – This acid can cause skin burns and burning of the respiratory tract. Add nitric acid to samples in a fume hood to avoid exposure to toxic fumes.

When diluting strong acids, never add water to acid; always add acid to water.
Store concentrated acids in the prep room acid cabinets. Only acids are to be stored in these cabinets. Flammable solvents are stored in flammable liquid storage cabinets. Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Large spills are cleaned by HSE. For large spills of concentrated acid, immediately evacuate the area and dial 1-1-1. HSE will use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A, soda ash or equivalent, to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf. Soda ash is located in the stairwell adjacent to the prep room.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the sequence editor to set up the run, perform calculations, interpret raw data, and enter/transfer data into the LIMS. Proficiency is measured through documented audits of the tasks listed, and checking of data as well as an IDOC (Initial Demonstration of Capability) and continued DOCs (Demonstration of Capability) as defined in *QA-SOP11178*.

Sample Collection, Preservation, and Handling

Aqueous undigested samples, aqueous digestates, and solid digestates are analyzed via this SOP. Samples must be analyzed within 6 months of collection for all methods in this SOP.

Aqueous samples are collected in plastic or glass containers. Drinking Water samples are collected in 1-L plastic or glass containers. Aqueous samples are preserved with nitric acid with a pH of < 2 and stored at 0° to 6°C, not frozen.

Aqueous digestates are digested per the method in SOP *T-MET-WI11939* (aqueous samples). Aqueous samples are stored in 50 ml plastic vials at room temperature.

Solid samples are collected in glass containers and stored at 0° to 6°C, not frozen. Refer to the protocols in the digestion SOP T-MET-WI8636. Solid samples are stored in 100 ml plastic vials at room temperature.

Store standards and digestates separately.

The general practice in the metals group is to discard the digestions after all the required metals from a batch of samples have been analyzed and verified in the LIMS. Samples which require the digestate to be held for long term storage are periodically evaluated for discard.

Apparatus and Equipment

A. The following is a list of the hardware used in the Agilent 7500, 7700 and 7900 ICP-MS systems.

1. Inductively Coupled Plasma Mass Spectrometers (ICP MS)

   a. Agilent 7500ce - The sample introduction system consists of an ESI FAST discrete sampling system, Teflon nebulizer and electronically cooled spray chamber attached to a concentric quartz tube plasma torch.

   b. The Agilent 7700 and 7900 - The sample introduction system consists of an ESI FAST discrete sampling system, glass concentric or Teflon nebulizer and electronically cooled spray chamber attached to a concentric quartz tube plasma torch.

2. Autosampler

   a. The Agilent 7500 and 7700 systems use an ESI SC-8 FAST autosampler. The Agilent 7900 system uses an ESI SC-14 FAST autosampler. The autosampler parameters for each automated run are entered into the Edit Sample Log Table interface editor in the ChemStation software (7500) or in the Sample List in MassHunter software (7700 and 7900).

3. Coolflow

   a. The Agilent 7500 and 7900 G3292A Recirculating Chillers are set up to deliver cooling liquid to the ICP-MS at a regulated pressure of 60 psi.

   b. The Agilent 7700 G1879B Heat Exchanger is set up to deliver cooling liquid to the ICP-MS at a regulated pressure of 30 psi.

4. Computer

   a. The Agilent 7500ce is controlled by a Windows-based IBM compatible PC with ICP-MS ChemStation software installed.

   b. The Agilent 7700 and 7900 is controlled by a Windows-based IBM compatible PC with MassHunter software installed.

5. Vacuum Pumps

   a. The Agilent 7500ce, 7700 and 7900 both have a 3-stage vacuum system. A rotary pump evacuates the interface chamber; a turbomolecular pump evacuates the ion lens chamber; and a turbomolecular pump evacuates the analyzer chamber.

B. The following is a list of the apparatus necessary for the setup of an ICP-MS run for analysis:

1. ICP-MS run cover sheets. Cover sheets are generated using the IDAT Sequence Editor program in LIMS.

2. Test tube racks

3. 17 ´ 100-mm polystyrene tubes

4. Graduated 15-mL polypropylene tubes and caps

5. 50-mL polypropylene screw cap tubes

6. FilterMate 2 µm filters and plungers
7. 1 ´ 100 10-mL sterile disposable syringes
8. 25-mm syringe filters, PTFE, 0.45 µm
9. 30-mL polypropylene medicine cups
10. Adjustable electronic hand-held pipettes (10 - 5000 µL) - Fisherbrand® or equivalent.

NOTE: For routine operation, calibration, and maintenance of adjustable electronic hand-held pipettes, see *QA-SOP11880*.

11. Fixed volume hand-held pipettes (25 – 2000 µL) - Eppendorf or equivalent.

NOTE: For routine operation, calibration, and maintenance of fixed volume hand-held pipettes, see *QA-SOP11880*

Reagents and Standards

Refer to Form *T-MET-WI12065* for reagent and standard information and the preparation of the following standards and solutions

1. ICP-MS Calibration Standards and ICP-MS LOQ Check Standard Solution (LLC)
2. ICP-MS Initial and Continuing Calibration Verification Standards
3. Interference Check Solutions
4. Rinse/Carrier, Tuning, and Calibration Solutions
5. Internal Standard Solution
6. PDS Solutions
7. General Acids and Chemicals

Calibration

Before calibration is performed, allow the instrument to warm up for the recommended time, usually at least 15 minutes, if the plasma has been off for 15 minutes or less, or at least 30 minutes if the plasma has been off for more than 15 minutes. Daily tuning requirements must be performed prior to calibration of the instrument and after warm up occurs. Refer to forms *T-MET-WI18026*, *T-MET-WI18027* and *T-MET-WI21589* for detailed tuning and calibration information. Full Tuning and Optimization is done as needed, or when required by the Group Leader.

Calibration is performed daily. Calibrations consist of a blank and one to three standards, followed by analysis of an ICV, ICB, CCV, LLC, ICSA/ICSAB, CCV and CCB.

A single point calibration, consisting of a blank and one standard, is used for all analysis except samples requiring a multi-point calibration (either MA MCP or CT RCP protocol or a lab note indicating a multi-point calibration is needed). For samples requiring a multi-point calibration the calibration consists of a blank, "S1", "S2" and "S3" standards. The concentrations of the calibration standards are defined in *T-MET-WI12065*.

For acceptance criteria and corrective action see Table I and Table II.

Procedure

A. Setting up an ICP-MS run

The procedure is the same for the Agilent 7500 (E03), 7700 (E05), and 7900 (E07) instruments.

1. Determine the batches to be analyzed and determine any special requirements by viewing lab notes and/or project notes that are with the batch paperwork.

2. Open the Sequence Editor program from the IDAT menu in eLIMS.

3. Select "ICP-MS" in the Instrument Method drop down list.

4. Select the appropriate digest type and load the list of batches.

Note: Use the checkbox "Show scheduled batches" if you need a batch that has been written up previously. This will show all batches that have not been written up before and batches previously written up.

5. Select the appropriate batch and then the template. Add the batch to the template using the "Add Batch" button.

6. Review the information uploaded to the Sequence Editor program.

   a. Information automatically included as required by template:

      (1) PBW – Prep blank (water)
      (2) LCSW – Laboratory control sample (water)
      (3) LCSDW – Laboratory control sample duplicate (water)
      (4) PBS – Prep blank (solid)
      (5) LCSS – Laboratory control sample (solid)
      (6) LCSDS – Laboratory control sample duplicate (solid)
      (7) Lancaster Laboratories' sample number
      (8) CCV – Continuing calibration verification
      (9) CCB – Continuing calibration blank
      (10) LLC – Low level check
      (11) ICSA – Interference check standard – A
      (12) ICSAB – Interference check standard - AB
      (13) S0 – Calibration blank
      (14) S1 – Calibration standard 1
      (15) S2 – Calibration standard 2 - Multi-point only
      (16) S3 – Calibration standard 3 - Multi-point only
      (17) CCS – Carryover Control Standard - rinse
      (18) Batch No. – The batch number of the sample.

   b. IV, FV and SDG are not included on the cover sheet but are pulled from LIMS during import.

      Initial volume (IV) – The sample aliquot digested.
      Final volume (FV) – The final sample volume after digestion

      SDG – Sample delivery group number for data package samples.

   c. Dilution factor (DF) – The dilution factor of the sample prepared at the time of analysis, needed to bring the sample into the linear range of the instrument, to negate a matrix effect, or for serial dilutions. If dilutions other than the default dilution are required, the analyst must change the DF for affected tubes prior to saving the sequence. The sample may be added multiple times for multiple dilutions if required.

d. Protocol – The protocol used to review the data for specific method requirements in the IDAT database. Each template in Sequence Editor has a default protocol. If samples require a different protocol it must be changed for the appropriate tubes prior to saving the sequence.

e. Comments – Any description of the sample (from prep logs), status of the sample (i.e., RUSH, Promised) and due date are recorded here. The list of elements needed for the run is automatically inserted on the cover sheet by the Sequence Editor Program. Additional comments may be recorded under the Elements column if additional space is needed.

f. Lot numbers – Lot numbers for filters, test tubes, and standards must be recorded by the analyst at the start of the analytical run.

g. Run Name – The Run Name is recorded by the analyst at the start of the analytical run.

7. When setting up a run using the Sequence Editor Program, Batch QC (i.e., PB, LCS, background, duplicate, matrix spike, matrix spike duplicate, post-digest spike, and serial dilution) are automatically placed in a block of ten or fewer samples. If there is an LCS and LCSD, they are automatically placed one after the other.

a. ICV/ICB must be analyzed immediately after the calibration curve.

b. CCV/CCB must be run after every ten analytical samples.

c. LLC, ICSA, ICSAB, CCV, and CCB immediately follow the ICV/ICB. LLC, ICSA, ICSAB, CCV and CCB conclude each run per client requirement. DOD does not require an ending ICSA/ICSAB

d. Any deviations from protocol must be noted in the Comments Section of the cover page.

e. Verify that all information has been entered correctly.

f. Save the file. This automatically generates the cover sheet and opens the cover sheet in a Word document.

g. Add batch location and any comments to the cover sheet.

h. Print the cover sheet.

B. Pouring an ICP-MS run (Waters only in 50 mL digestion tubes):

The procedure is the same for the Agilent 7500 (E03), 7700 (E05) and 7900 (E07) instruments.

It is important to minimize any chance of contamination, to both yourself and the samples. Keep your hands and the work area clean at all times. Wear appropriate PPE at all times to prevent exposure to chemicals and samples.

NOTE: See Form *T-MET-WI12065* for standards and solutions used during the analytical run.

1. Choose the appropriate run sheet.

NOTE: When retrieving the batch from the shelf for the first time, record the batch location on the cap of the prep blank in black sharpie. This saves time when returning the batch to the proper location after analysis and shows that the batch has been poured before and verified to be in the correct order. To prevent more than one batch from being assigned to the same location, the digestion trays all have the location written on the foam holder.

2. Verify that each digestion tube is in the correct order according to the cover sheet. If anything is missing, correct the cover sheet and notify PREP or the Group Lead to correct LLENS and put the sample back in for digestion. If the order is incorrect, reorder the sample digestion tubes to match the paperwork.

3. For batches prepared in hot blocks in 50 mL digestion tubes:

a. The only tubes that typically need to be poured for the initial run are the post digestion spike (PDS, or UP) and serial dilution (UL) samples. These are prepared using the background sample (U) or the duplicate background sample (D) when limited sample volume is available.

b. All other samples remain in the 50 mL digestion tubes for analysis.

4. Samples that need to be poured into test tubes:

a. Obtain the appropriate number of tubes.

b. Write the last four digits of the sample number and the dilution factor if greater than 1 on each tube. If the PBW/PBS or LCS/LCSW must be in tubes, write PBW/PBS/LCS/LCSW and the batch location on the tubes.

c. Place tubes in test tube racks in the same order as the run on the cover sheet.

d. The analyst must ensure that tubes are labeled correctly, that dilutions are performed accurately, and that the dilutions are recorded on the run cover sheet.

5. Post-digest spike (PDS):

a. A PDS is required for each batch (sample volume permitting).

b. A PDS is prepared by pipetting 0.2 mL of the appropriate PDS solution into a 14 mL graduated test tube, and bringing it to a volume of 10 mL with the background sample, "U". If the PDS must be diluted, pipette 0.2 mL of the PDS solution into a 14 mL graduated test tube, add the appropriate amount of background sample, "U", and dilute to 10 mL using matrix rinse. If there is limited volume for the background sample, "U", then the "D" may be used for dilutions of the PDS or UL.

c. Record the lot number of PDS solution used in the comments column of the ICP-MS run sheet.

6. Serial dilution SD or (UL)

a. Prepare the SD (UL) by diluting the background sample at a dilution that is equal to 5× the dilution factor of the PDS (UP) sample (i.e. if PDS (UP) = DF1, SD (UL) must = DF5; if PDS (UP) = DF5, SD (UL) must = DF25).

7. Filtering samples

a. Samples that are cloudy or have particulate suspended in solution must be filtered prior to analysis to prevent clogging of the sample introduction system, which causes run failures and instrument down time to correct the problem.

b. Samples that are digested using the 50 mL hot block tubes need to be filtered using the FilterMate filtration devices and plunger.

c. Attach a filtration device to the plunger and very carefully insert the filter into the hot block tube until the filter reaches the bottom of the digestion tube.

d. Remove and discard the plunger.

e. An alternative for samples in any type of vessel is to filter using a 10-mL sterile disposable syringe fitted with a 0.45 µm PTFE syringe filter.

f. If any samples are filtered, the PB and LCS must also be filtered. If any QC sample is filtered (U, D, R or M), then all QC including the PB and LCS must be filtered.

g. Document all filtrations on the run cover sheet.

NOTE: It is not necessary to filter all samples (in hot block tubes only) that contain particulate, as long as all of the particulate is settled to the bottom of the tube below the 5 mL mark in 50 mL digestion vessels. The sampling depth of the autosampler probe is set such that the tip of the probe is approximately 1 cm above the bottom of the digestion tube.

8. Verify that all samples in the hot block tray are in the correct position and/or pour each sample (or sample filtrate) into the appropriate tube. Usually, the order of the batch QC is PB, LCS, (LCSD), Bkg, PDS, DUP, MS, (MSD), and SD. Most importantly, the actual positions of the samples in the tray must match the autosampler table used for analysis.

NOTE: Immediately prior to beginning analysis, the analyst must visually verify that each sample is in the position indicated in the autosampler table used for the run.

9. If not being analyzed immediately, cover any poured tubes with plastic wrap to prevent contamination of the samples (hotblock tubes and dilutions prepared in graduated test tubes must be capped tightly except during pouring and/or analysis).

10. Return samples to sample storage, being sure to place the batch back into the location recorded on the batch sheet.

11. Record the following on the first page of the ICP-MS run sheet under "Poured By": initials, employee number, and the date.

12. NOTES:

a. A PDS (UP) and a SD (UL) are performed on one sample in each digestion batch. Typically, the background sample is chosen. If the batch QC is split between two samples, the PDS is performed on the background sample accompanied by a matrix spike; the SD is performed on the background sample accompanied by a matrix duplicate. If sample volume is limited, it is acceptable to use the duplicate for the PDS and SD.

b. Batches with only field blanks or equipment blanks do not need a PDS or a SD.

c. Air filter batches need only a SD on one sample in the batch (a PDS is not required).

d. "As Received" samples are analyzed with a blank and LCS, LCSD (prepared by the analyst). These "batches" are assigned a batch number by the analyst and recorded into the departmental LLENS system and is uploaded to LIMS.

e. Documentation is of utmost importance. Verify all entries.

Calculations

1. Final Result

a. Water sample

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Volume}}$$

b. Solid sample (mg/kg)

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Weight (grams)}}$$

2. Relative percent different (RPD)

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

S = first sample value

D = duplicate sample value

3. Spike recovery

$$\%\ Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = spiked sample result

SR = sample result

SA = spike added

4. Correlation Coefficient

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\left(\sum X^2 - \frac{(\sum X)^2}{N}\right)\left(\sum Y^2 - \frac{(\sum Y)^2}{N}\right)}}$$

Where :

X = the known concentration

Y = the instrument response

N = the total number of data points

5. Serial Dilution

$$\%\ Difference = \frac{(5 \times SDR) - SR}{SR} \times 100$$

Where:

SDR = serial dilution result

SR = sample result

6. Methods of standard additions (MSA)
Take either 4 identical aliquots (for 3 point MSA) or 2 identical aliquots (for one point MSA) of the same sample. Leave one unspiked. Spike the other 3 aliquots with different levels of a standard solution (for 3 point MSA) and spike the other aliquot at approximately the indigenous concentration of the sample (for one point MSA). Add blank solution to sample aliquots so that the final volume is the same for all. Use small volumes of spiking solution to avoid diluting the sample more than 10%. Analyze the 4 aliquots or 2 aliquots and record the instrument readings in absorbance. Use the readings and spike values to find the slope and x- and y- intercepts. The x- intercept is the result.

$$\text{Slope} = m = \frac{\sum x_i y_i - (\sum x_i \sum y_i)/n}{\sum x_i^{\,2} - (\sum x_i)^2/n}$$

$$\text{Y-Intercept} = b = \bar{y} - m\bar{x}$$

$$\text{Result} = -\frac{b}{m}$$

$$\text{Correlation Coefficient} = r = \frac{\sum\{(x_i - \bar{x})(y_i - \bar{y})\}}{\sqrt{\left[\sum (x_i - \bar{x})^2\right]\left[\sum (y_i - \bar{y})^2\right]}}$$

The correlation coefficient (r) for the least squares fit must be ³0.995. If the r value is <0.995, the MSA must be repeated at the same dilution. If the r value is again low, the result with the higher r value is verified and both are flagged with a "+" in the data package. If the r value is <0.990, the sample is run at an interference dilution to overcome matrix effects. This usually requires a raised limit of quantitation. If a client requests a particular limit of quantitation that prohibits further dilution, then the sample is repeated at the same dilution and the best of the two results is verified.

7. Average, Standard Deviation and Relative Standard Deviation

The average result, $\bar{x}$, is calculated by summing the individual results and dividing this sum by the number (n) of individual values:

$$\bar{x} = \frac{x_1 + x_2 + x_3 + x_4 + \ldots x_n}{n}$$

Standard deviation is a measure of how precise the average is or how well the individual numbers agree with each other.

$$\text{Standard deviation, } S = \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + (x_3 - \bar{x})^2 + \ldots + (x_n - \bar{x})^2}{n-1}}$$

Relative standard deviation (RSD) is expressed in percent and is obtained by multiplying the standard deviation by 100 and dividing this product by the average.

$$\text{Relative standard deviation, RSD} = \frac{100 \times S}{\bar{x}}$$

Statistical Information/Method Performance

Generate MDLs and LOQs according to *QA-SOP11892*.

The department supervisor maintains annual study data. The department supervisor requests that a Quality Assurance Specialist update to the LIMS as needed. Update the department database via a download from the LIMS.

Refer to *QA-SOP11896* for statistical information.

Quality Assurance/Quality Control

A. For 6020, 6020A and 6020B, each digestion batch (up to 20 samples) must contain a method blank, LCS, and either an US, D, MS, MSD or an LCS/LCSD.

B. For 200.8, each digestion batch (up to 10 samples) must contain a method blank, LCS, and either an US, D, MS or an LCS/LCSD.

C. QC limits for MS/MSD, and LCS/LCSD are established through statistical analysis of historical data.

1. The limits are maintained in the LIMS for the relevant analysis numbers.

2. The limits are evaluated every 6 months and updated as needed.

3. The limits are subject to change without notification.

D. Batch Quality Control

1. For the preparation and concentrations of Batch Quality Control see *T-MET-WI12065*.

2. For the frequency, acceptance criteria and corrective action see Tables I and II.

E. Raw data quality checks

1. Make sure that the run is correctly labeled, and dated and that the corresponding cover sheet is attached to the run.

2. Verify that the appropriate Tuning Report is with the run.

3. For run and batch QC/Calibration frequency, acceptance criteria and corrective action, see Method Specific Tables I (EPA 200.8), and II (EPA 6020). For information on statistical windows refer to *QA-SOP11896*.

4. Spike levels of batch QC are available in the LIMS and on T-MET-WI9082.

5. LOQs are available to analysts in the LIMS.

6. Check to make sure that all results are not> 90% of the Linear Range. If a sample reading is above 90% of the linear range, then reread the sample at a dilution sufficient to bring the sample concentration to approximately the middle of the calibration range.

7. Check that the **absolute** value of all nondetected analytes is less than the LOQ. A technical decision must be made as to whether a reread is warranted for readings <|-LOQ|.

8. Check for carryover between samples. Sample RSD >20%, with a concentration > the LOQ decreasing progressively over time (i.e., Reading 3<2<1). Flag any suspect samples for reread.

NOTE: Whenever a sample is encountered that exceeds the calibration range, the following sample must be checked for carryover for the over range analyte (s) and any suspect results must be deselected and reanalyzed. During reanalysis the sample order must be modified as needed to avoid carryover from any over range sample(s).

9. For all EW (samples from public drinking water sources), check the results against the MCL (maximum contaminant level). If an analyte **exceeds** the MCL notify a verifier at once. An automated email is sent to the Client Service Representative and the state for the analytes listed below with the exception of Pb and Cu which follow the 90th percentile rule (the CSR tracks the lead and copper and notifies the supplier when necessary). Suppliers must be notified within 24 hours.

10. To avoid the risks associated with polyatomic interferences in wastewater and soil matrices all analytes must be analyzed on the collision cell ICP-MS instruments which include Agilent 7500, Equipment #11332, Agilent 7700x, Equipment #19204 and Agilent 7900, Equipment #27813).

a. Because EPA 200.8 rev. 5.4 does not currently allow the analysis of drinking water samples using collision cell ICP-MS all drinking water samples must be analyzed using a method with no gas mode for all analytes on either the Agilent 7500 or 7700. The following analytes are analyzed in drinking water samples: Be, Cr, Ni, Cu,

As, Se, Ag, Cd, Sb, Tl, and Pb. Drinking water samples have also been historically free of the types of interferences that made alternate mass selection necessary; multiple masses are no longer used in the instrument method and only the masses referenced at the beginning of this procedure are used.

11. Check the internal standard level for the entire run. If the internal standard reading for any sample is out of the acceptance range of the S0 reading, evaluate whether this is a result of the sample matrix or drift from other samples in the run. Only reread the sample at a dilution if the internal standard appears to be out of range due to the sample matrix. For samples where an internal standard is above the acceptance range it is acceptable to reprocess the data using an alternate internal standard. This is the preferred approach in order to avoid raised reporting limits. The acceptance criteria differ based on the method being used. Refer to Table I, and II for the method acceptance criteria.

NOTE: The internal standard is added in equal concentration to all of the samples and standards via a dedicated line on the peristaltic pump. The analytical lines referenced to an internal standard report a corrected concentration value based on the ratio of analyte to internal standard intensities. All the calculations for determining concentration are based on Intensity Ratio (IR). The IR is defined as the background corrected intensity signal of the analyte line (Ia) divided by the internal standard value (Iis). IR= Ia/Iis.

12. For TCLP and SPLP samples, an MSA (method of standard additions) is required if:

a. The sample concentration falls between 80% and 100% of the regulatory limit.

b. If the TCLP or SPLP matrix spike (QA) recovers <20%, all samples in the leachate batch must be reanalyzed using the method of standard additions for that analyte.

13. When items 1 – 12 are complete, check the following:

a. All samples requiring reread/redigestion are listed on the reread/redigestion schedule forms.

b. The data are uploaded to LIMS via IDAT by the reviewer.

F. Verification process

1. Confirm that all required pieces of QC have been uploaded to LIMS and are within specification. If there is partial QC on the current run and the samples have been analyzed more than once, check to see if there are associated runs in the hold bin waiting for additional QC to be verified.

2. Choose method of verification. (Metals verification by run, verify by multiple elements per sample, or verify by individual element).

3. Check lab notes and project notes for each sample group.

4. If a technical decision or a client decision has been made to accept data that is not within specification, a nonconformance form *Q-EQA-FRM6869* must be filled out and signed by the investigator and a verifier. An electronic copy of the nonconformance form must be placed in the nonconformance forms folder located under the dept 22 folder on lldata/env. Quality Assurance reviews these forms on a monthly basis. Notify your supervisor each time that a nonconformance form has been generated.

5. Once all of the elements are verified for a digest, verify the digest number. Suite and tracking numbers will auto verify after all the metals analyses are verified.

Figure I - Daily Performance Acceptance Criteria

In Sensitivity	>300,000 cps
Mg Sensitivity	>40,000 cps
Pb Sensitivity	>100,000 cps
CeO/Ce	=0.03
Ba++/Ba+	=0.03
Background	<30 cps @ Mass 220
Net RSd	=%5.0

Table I - ICP-MS Metals by EPA 200.8 rev 5.4

*NOTE - PA EW SAMPLES ARE NOT ACCEPTED IF QC DOES NOT MEET CRITERIA. Redigest and reanalyze as needed if the acceptance criteria are not met.

Table I - ICP-MS Metals by EPA 200.8 rev 5.4			
QC	**Frequency**	**Acceptance**	**Corrective Action**
Tuning	Daily	No AMU diff. of >0.1 P.W. < 0.9 at 10% height (Agilent 7500 and 7700) %RSD <5 for masses used for tuning	Perform mass calibration for AMU. Adjust mass calibration for P.W.
Daily Performance	Daily	Evaluated for information only	Instrument maintenance and optimization as needed.
Single Point Calibration	Daily	The calibration must contain a blank and 1 standard	
Multi Point Calibration	Daily	r^2 = 0.995 Must contain a blank and 3 standards	Terminate run sequence and recalibrate. Data must not be reported for the analyte unless the correlation coefficient is =0.995
ICV	Immediately after calibration.	±10% of the true value If an element ICV is out high, accept element if the result < LOQ* .	Re-calibrate and re-analyze affected elements.
ICB	Immediately after the ICV.	|ICB| < 3x IDL If the ICB is out high, accept element results > 10x the ICB detection or < LOQ. If ICB is out low, only accept results > 10 x ICB detection*.	Re-calibrate and re-analyze affected elements.
LLC	Analyzed after ICB. Analyzed at the end of the run per client requirement.	± 50% of the true value. NA if samples are >10× the true value of the LLC.	Data for that analyte must not be reported from

Table I - ICP-MS Metals by EPA 200.8 rev 5.4

		For LLC results >the high limit, samples <reporting limit can be accepted*	the sample (reanalyze).
ICSA/ICSAB	ICSA: Analyzed after LLC ICSAB:Analyzed after the ICSA ICSA/ICSAB: Analyed at the end of the run per client requirement	± 20% of the true value for analytes that are spiked. |ICSA| or |ICSAB| must be <2× LOQ for analytes that are not spiked.	Data for that analyte must not be reported from the run (reanalyze).
CCV	Every 10 samples and at the end of the run.	±15% of the true value. If CCV is out, accept ND elements with |result| < LOQ*.	Data for that analyte must not be reported from the run (reanalyze).
Continuing Calibration Blank (CCB)	Every 10 samples and at the end of the run.	|CCB| must be <3x IDL If out high, accept element if the |result| < LOQ or > 10 x the detection in the CCB*. If out low, only accept results > 10 x the detection in the CCB*.	Data bracketed by the CCB for the affected analyte cannot be reported (reanalyze all samples in the bracketing blocks for that element).
PB	1 per analytical batch of 10 samples or less.	|PB| must be < 2.2x MDL. Does not apply to samples > 10x PB value or non-detects*. EW samples are not accepted for any reason if the PB is out of specification.	Redigest all associated samples if the LCS is out of specification low. If the LCS is out of specification high redigest samples that are greater than the LOQ. EW samples must be redigested.
LCS	1 per analytical batch of 10 samples or less. The LCS is spiked at or below the MCL for all primary drinking water metals. See QA -SOP11886 for MCLs.	Use statistical limits or the method limit of ±15%,, as indicated by the client requirement. If the LCS is out high and the sample result < LOQ the data can be taken*. EW samples are not accepted if the LCS is out of specification.	Redigest all associated samples if the LCS is out of specification low. If the LCS is out of specification high redigest samples > LOQ. EW samples must be redigested.
LCSD	If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a	Use statistical limits or the method limit of ±15%, as indicated by the client requirement. RPD < 20%	Redigest all associated samples.

Table I - ICP-MS Metals by EPA 200.8 rev 5.4			
	frequency of 1 per analytical batch of 20 samples or less.	If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken*.	
MS	1 per analytical batch of 10 samples or less.	Use statistical limits or the method limit of ±30%, as indicated by the client requirement.	Data is flagged in the QC Summary and/or in the data package. If sample concentration <4X the spike added a PDS must be performed.
Duplicate (D)	1 per analytical batch of 10 samples or less.	If the samples are >5× the LOQ the RPD must be <20%	'*'-Flag the data package forms.
PDS	Must be prepared with each background sample. Evaluated when MS is out.	±15% of the background value.	Report % rec. on FormVB-IN.
Serial Dilution	Must be prepared with each background sample. Evaluated only when analyte concentrations are >50 MDL.	The percent difference must be <10%	'E'- Flag data on DP Forms
Samples	Samples reading > 90% of the linear range must be reanalyzed. Elements reported as non-detect are accepted if the ICV/CCV is out of specification high and the sample is not < - LOQ.* RSD must be <20% for results >2× LOQ.		Sample is diluted and reanalyzed. EW must be re-analyzed Sample is reanalyzed.
Linear Range (LR)	Verify semi-annually.	±10% of the true value	
Internal Standards	Added to all samples by way of second pump channel.	Must be 60%-125% of the Calibration Blank Internal Standard	Reanalyze @ DF2

Table II - ICP-MS Metals by EPA 6020/6020A/6020B

Table II - ICP-MS Metals by EPA 6020/6020A/6020B			
QC	**Frequency**	**Criteria**	**Corrective Action**

Table II - ICP-MS Metals by EPA 6020/6020A/6020B

		SW-846 6020	SW-846 6020A	SW-846 6020B	
Tuning	Daily	No AMU diff. of >0.1 P.W. < 0.9 at 10% height (Agilent 7500 and 7700) %RSD <5 for masses used for tuning			Perform mass calibration for AMU. Adjust mass calibration for P.W.
Daily Performance	Daily	Evaluated for information only			Instrument maintenance and optimization as needed.
Single Point Calibration	Daily	The calibration must contain a blank and 1 standard.			
Multi Point Calibration	Daily. Must contain a blank and 3 standards.	r = 0.995.	r = 0.998.	r = 0.995.	Terminate run and recalibrate.
ICV	Immediately after Calibration	%Recovery: 90-110%. If an element ICV is out high, accept element if the |result| < LOQ.			Re-calibrate and re-analyze
ICB	Immediately after ICV	|ICB| <3× IDL	|ICB| <3× IDL	|ICB| 1/2 LOQ	Re-calibrate and re-analyze affected elements: If the results are < 10x the ICB detection If the results were <LOQ and ICV was out low Samples <LOQ can be reported if ICV is out high.
LLC	At the beginning of the run before ICSA/ICSAB. At the end of the run per client requirement.	%Recovery: 50 -150% If out of range, accept element results >10× the true value of the LLC.	%Recovery: 70-130% If out of range, accept element results > CCV and CCV is in spec.	%Recovery: 80-120% If out of range, accept element results > CCV and CCV is in spec.	Data for that element cannot be reported from the run for the affected samples. If the LLC is out high, accept results <LOQ
ICSA	After LLC and at the end of the run per client requirement.	%Recovery: 80 -120% |ICSA| < 2× LOQ for unspiked elements.	%Recovery: 80-120% |ICSA| < 2× LOQ for unspiked elements.	%Recovery: 80-120% |ICSA| < LOQ for unspiked elements.	Reanalyze samples that require the element
ICSAB	After LLC and at the end of the run per client requirement.	%Recovery: 80-120% |ICSAB| < 2× LOQ for unspiked elements.	%Recovery: 80-120% |ICSAB| < 2× LOQ for unspiked elements.	ICSAB is not required.	Reanalyze samples that require the element
CCV	After every 10 samples and	%Recovery: 90-110%. If out high, accept element if the |result| < LOQ.			Data bracketed by the CCV: Reanalyze samples with affected element(s) > LOQ .

Table II - ICP-MS Metals by EPA 6020/6020A/6020B

	at the end of the run.				
CCB	After every CCV, every 10 samples and at the end of the run	|CCB| <3× IDL	|CCB| <3× IDL	|CCB| < ½ LOQ	Data bracketed by the CCB: Reanalyze samples < 10x the CCB detection. Reanalyze if CCB was out low and the results were <LOQ Samples < LOQ can be reported if the CCB is out high.
PB	1 per analytical batch of 20 samples or less.	|PB| must be < ½ LOQ. Not applicable if sample is > 10× the PB reading or <LOQ.	|PB| must be < ½ LOQ. Not applicable if sample is > 10× the PB reading or <LOQ.	|PB| must be < ½ LOQ. Not applicable if sample is > 10× the PB reading or <LOQ.	Sample may be re-analyzed once. If still out of specification, redigest all associated samples.
LCS	1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of ±20%, as indicated by the client requirement.			Sample may be re-analyzed once. If still out of specification, redigest all associated samples. If the LCS is out high, only redigest samples > LOQ.
LCSD	If required, 1 per analytical batch of 20 samples or less.	Must meet same criteria as LCS RPD < 20%			Same as LCS corrective action. Redigest samples if RPD is out of specification.
MS/MSD	1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of ±25% as indicated by the client requirement. RPD must be <20%.			Data is flagged in the QC Summary and/or in the data package. If sample concentration <4X the spike added a PDS must be performed.
D	1 per analytical batch of 20 samples or less.	If the samples are >5× the LOQ the RPD must be <20%.			Flagged in data package and in the QC Summary.
PDS	Must be prepared with each background sample. Evaluated when MS is not within specification.	±15% of the true value			The data is flagged in the data package.
Serial Dilution	Must be prepared with each background sample. Evaluated	The percent difference must be <10%.			The data is flagged in the data package.

Table II - ICP-MS Metals by EPA 6020/6020A/6020B

	only when analyte concentrations are >100X MDL.				
Samples		Sample reading must be within the linear range. RSD <20% for results > 2x LOQ. Elements <LOQ are accepted if the ICV/CCV is out of specification high, and the sample is not < - LOQ.			Sample is diluted and reanalyzed. Sample is reanalyzed. Reanalyze for elements that do not meet this criteria.
Linear Range (LR)	Verified semi-annually.	±10% of the true value			Samples reading greater than 90% of the calibration range must be reanalyzed.
Upper Linear Range	Analyzed once per run	NA	NA	±10% of the true value	Samples reading greater than 90% of the calibration range must be reanalyzed.
Mid Range Check (1/2 the Upper Linear Range)	Analyzed once per run.	NA	NA	±10% of the true value	Reanalyze all elements > |CCV|.
Internal Standards	Added to everything through use of second pump channel	30%-120% 80%-120% for ICV, CCVs, ICB, LLC, and CCBs.	70-130%	70-130%	Samples: reanalyze @ DF5. ICV/CCV/ICV/CCB/LLC: Terminate analysis and reanalyze. ICSA/ICSAB: Reanalyze

Q-EQA-FRM6869 Nonconformance Form
QA-SOP11178 Demonstrations of Capability
QA-SOP11880 Balance, Syringe, Pipette, and Labware Verification
QA-SOP11892 Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896 Establishing Control Limits
QA-SOP11901 Instrument Maintenance and Calibration
S-SS-WI10695 Liquid Sample Preservation, Sample Splitting, and Turbidity for metals by EPA Methods 200.7 and 200.8
T-MET-FRM8822 ICPMS Analysis
T-MET-WI11939 Digestion by EPA 200.8 for the Analysis of Total Recoverable Metals in Water by ICPMS
T-MET-WI12065 Working Instructions for Preparation of ICP-MS Solutions and Standards
T-MET-WI18026 Instrument Operations for Agilent 7500
T-MET-WI18027 Instrument Operations for Agilent 7700
T-MET-WI18028 Instrument Maintenance for Agilent 7500
T-MET-WI18029 Instrument Maintenance for Agilent 7700
T-MET-WI21589 Instrument Operations for Agilent 7900
T-MET-WI21590 Instrument Maintenance for Agilent 7900

End of document

eurofins	Always check on-line for validity. **Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A/6020B(aqueous, solid, tissue) and EPA 200.8 (aqueous)**	Level: **Work Instruction**
Document number: **T-MET-WI11933**		
Old Reference: **1-P-QM-WI-9018443**		
Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **12-JUL-2019**	Document users: **6_EUUSLA_Metals_ICP-MS Analysis, 6_EUUSLA_Metals_ICP-MS Analysis Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

Version history

Version	Approval	Revision information
8	11.SEP.2018	
9	21.MAR.2019	
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eurofins	Always check on-line for validity. **Microwave Extraction Method 3546 for Pesticides in a Solid Matrix**	Level: **Work Instruction**
Document number: **T-OE-PEST-WI10926**		
Old Reference: **1-P-QM-WI -9015103**		
Version: **8**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date **01-MAY-2018**	Document users: **5_EUUSLA_Organic Extraction_All, 6_EUUSLA_ Organic Extraction_Pest/PCB Soils, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

LIMS ID

Analysis - 10496, 11141

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Revision Log

Revision 8		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Procedure 1. b. and 1 f.	Reflects current practice	Added weights for tissue matrix and clarified the range.

Revision 8		**Effective Date:** This version
Apparatus and Equipment	Reflects current practice	Removed graduated cylinders
Scope	Reflects current practice	Added tissues to matrix types
Procedure 14	Clarification	Re-organized steps for clarification.

Revision 7	**Effective Date:**	**07-AUG-2017**
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Basic Principles	Reflects current procedure	Added carbon cleanup.
Procedure 3	No longer part of this process	Removed reference to Mirex, MixE, and Kepone.
Procedure 14.c. (1)	Reflects current procedure	Added reference to carbon cleanup.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3546, Revision 0, February 2007.

2. MARS Operation Manual, Revision 2, February 2006.

3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #*1363, 1420, 4225, 10738, 13237*	Pesticides by Method 8081A in Solid Samples using GC-ECD
Analysis #*2487*	Food and Tissue Preparation
Analysis #*10590*	Analysis of Pesticides by 8081B in Solid Samples using GC-ECD
T-OE-PEST-WI11410	Pesticide Extract Cleanup Using Gel Permeation Chromatography
T-OE-PEST-WI10864	Glassware Cleaning for Organic Extractions
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-PEST-WI10871	Pesticide Extract Concentration Using a Zymark TurboVap II Concentration Workstation
T-OE-PEST-WI10876	Organic Extraction Standards Storage and Handling

Scope
This procedure is used for the extraction of organochlorine pesticides from soils, tissues, or solid wastes.

Basic Principles
A portion of sample is placed in an extraction vessel. Surrogate standards are added to each sample to monitor recovery. The vessel is then loaded into the instrument and extracted. The organic compounds present in the soil dissolve in the solvent, which is then removed. The sample is then concentrated and bottled.
Several cleanup procedures are used as needed to eliminate matrix interferences before the sample is analyzed. They include: florisil, copper, carbon cleanup, and gel-permeation cleanup (GPC).

Reference Modifications
The joint of the K-D is not rinsed with fresh solvent when the ampule is removed. Quad and MDL studies have shown that this step is unnecessary.

Definitions
1. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. This is used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

2. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

3. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample

Interferences
Method interferences are caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of sample to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.
The extracts are concentrated on a steam bath. Caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Samples are collected in wide-mouth glass jars with PTFE-lined lids and stored under refrigeration at 0º to 6º C, not frozen, prior to extraction.. Samples must be extracted within 14 days of collection. Extracts are stored in the freezer at -10° to -15°C.

Apparatus and Equipment

1. MARS Xpress – CEM Corp. or equivalent

2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during concentration

3. Steam bath, VWR/LLI Model #1127 or equivalent

4. N-Evap with nitrogen supply

5. Beakers – stainless steel, assorted sizes

6. Pipettes – Class A, assorted sizes

7. Pipettes – disposable

8. Balance – capable of weighing to 0.01 g

9. Teflon®-wash bottles

10. Vials – assorted sizes

11. Teflon®-boiling chips

12. Forceps

13. Scoop

14. TurboVap II concentration workstation w/appropriate concentration tubes – Zymark or equivalent

15. Funnels – stainless steel or Teflon®

16. Extraction vessels

17. Frits – various

18. Sodium Sulfate Columns

19. GPC – J2 Scientific or equivalent

Reagents and Standards

1. Hexane – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt.

2. Acetone – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt.

3. Methylene Chloride (CH_2Cl_2) – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt.

4. Sodium Sulfate (Na_2SO_4) – Reagent grade or equivalent. Bake at 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

5. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical Analysis #*1363, 1420, 4225, 10738, 13237* and #*10590*.

Preparation of Glassware

See
T-OE-PEST-WI10864

Calibration

Not applicable to this procedure.

Procedure

1. Sample aliquot

a. If Sample Registration has pre-weighed the sample into a glass jar, add approximately 5g of sodium sulfate, mix and proceed.

b. If the sample is not pre-weighed, weigh 30.0 - 30.5 g of sample into a labeled stainless steel beaker. (If sample matrix is tissue, weigh 15.0 - 15.5 g.)

(1) Record the initial weight and any comments about the sample in the extraction log.

(2) Alternative sample weights may be used to meet certain reporting limits. However, if sample weight greater than 30.5 is used the sample must be divided among multiple vessels and the extracts combined.

c. Process all tissues by Analysis #*2487* prior to extraction.

d. The background, MS, and MSD are performed on three separate aliquots of a field sample.

e. Add approximately 5 g of sodium sulfate to each sample and mix.

(1) If the sample has a high water content or is a clay-like soil, add additional sodium sulfate until a free-flowing consistency is achieved.

(2) Mix the sodium sulfate and sample until a free-flowing consistency is reached.

f. The Blank, LCS, and LCSD (if applicable) are prepared by filling a Teflon® extraction vessel with 35.0 - 35.5 g of sodium sulfate. (If sample matrix is tissue, use 15.0-15.5 g tilapia and add approximately 5 g sodium sulfate. Then mix.)

(1) For non-tissue samples: Record 30 g on the extraction log. (The sodium sulfate used for the QC samples is measured out as 35 grams to account for the 30 gram "sample" plus the 5 grams of sodium sulfate.)

2. Carefully place each sample into its clearly marked corresponding extraction vessel. A funnel is used to prevent spillage and loss of sample.

3. Use pipettes to add surrogate standards and spiking solutions.

a. Surrogates – 1.0 mL of SW-846 surrogate is added to all samples, blanks, and spikes.

b. Spiking solutions – Spiking solutions are added to the LCS, LCSD (if applicable), MS, and MSD samples. The type of spike is determined by an analysis number. Typically they are as follows:

(1) Spike 1.0 mL SW-846 spike.

Analysis #*1420* has an additional LCS/LCSD spiked with 1.0 mL of Alachlor spike.

(2) These may change to accommodate specific client requirements as appropriate.

(3) See *T-OE-PEST-WI10876* for storage and handling of spikes.

4. Add 30 mL of 50% acetone in methylene chloride to each vessel.

5. Cap each vessel according to manufacturer's guidelines.

6. Invert each vessel to ensure mixing of sample and solvent.

7. Place the vessels into the carousel. When all samples are loaded, place the carousel into the microwave.

8. Run Program "LL Soils". See Table 1 for instrument conditions. Verify that the run reached 100°C and document on the batchlog.

9. Uncap the cooled vessel.

10. Pour the extract and sample into a column filled with approximately 10cm of sodium sulfate on top of a Kuderna-Danish (K-D) assembly containing a Teflon®-boiling chip. Rinse the vessel with approximately 10 mL of methylene chloride from a wash bottle and pour through salt column. Rinse the column with approximately 10 mL of methylene chloride.

11. Place a 3-Ball Snyder column on the K-D set-up and concentrate over a steam bath at 85° to 99°C.

This steam bath temperature ensures concentration in a reasonable length of time.

12. **If the sample requires GPC, skip this Step. Proceed to Procedure step 14 b.**

When the apparent volume in the ampule is 3 to 5 mL, use a bottle-top dispenser to add approximately 50 mL of hexane directly to the KD through the Snyder column.

Do not allow the ampule to go dry since loss of analytes will result.

13. When the apparent volume in the ampule again reaches 3 to 5 mL remove the sample from the bath and allow to cool for approximately 10 minutes until the K-D setup reaches ambient temparture.

14. Remove the ampule and use a wash bottle to adjust the final volume.

a. Samples that do not require GPC: Adjust final volume to exactly 10 mL with hexane in a calibrated ampule. Mix thoroughly with a disposable pipette. Proceed to 14. c.

b. Samples that require GPC: Adjust the final volume to exactly 10 mL with methylene chloride. Mix thoroughly with a disposable pipette.

(1) Perform GPC cleanup following *T-OE-PEST-WI11410*

(2) When GPC cleanup is complete, concentrate the extract to final volume 5 mL using a TurboVap as described in T-OE-GEN-WI10871

(3) Florisil the sample 2 mL to 2 mL as described in the Pesticide Florisil Cleanup section of *T-OE-PEST-WI10281*

NOTE: DO NOT florisil samples that have Kepone as a compound of interest.

(4) Bottle twice in an appropriately labeled crimp-top autosampler vial.
(5) Place the remaining extract in an appropriately labeled screw-cap vial.

(6) Store all extracts in the freezer at -10° to -15°C.

c. Samples that require carbon cleanup: Adjust the final volume to exactly 10ml with hexane in a calibrated ampule. Mix thoroughly with a disposable pipette.

(1) perform carbon cleanup on the sample 2 mL to 2 mL as described in the Carbon Cleanup section of *T-OE-PEST-WI10281*

(2). Perform copper cleanup to remove sulfur interference from extracts. See ***T-OE-PEST-WI10281*** for this procedure

Calculations
See analysis method.

Statistical Information/Method Performance
See analysis method.

Quality Assurance/Quality Control
A batch is defined as the samples to be extracted in any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted, a blank, an LCS, MS, and MSD must be extracted. If insufficient volume of sample is available for MS/MSD, then an LCSD must be prepared instead.

If any client, state, or agency has more stringent QC or batching requirements, these must be followed.

Table I

LL Soils: Instrument Conditions

Power: 1600W
Ramp Temperature: 100°C
Ramp Time: 30 minutes
Hold Time: 10 minutes
Cool Down Time: 20 minutes

T-OE-GEN-WI10864 Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10871 Pesticide Extract Concentration Using a Zymark TurboVap II Concentration Workstation
T-OE-GEN-WI10876 Organic Extraction Standards Storage and Handling
T-OE-GEN-WI7154 Food and Tissue Preparation
T-OE-PEST-WI10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-PEST-WI11410 Pesticide Extract Cleanup Using GPC by Method 3640A
T-PEST-WI9232 Analysis of Pesticides by 8081B in Solid Samples using GC-ECD
T-PEST-WI9992 Pesticides by Method 8081A in Solid Samples using GC-ECD

End of document

Version history

Version	Approval	Revision information
6	03.DEC.2015	
7	04.AUG.2017	
8	17.APR.2018	

An error has happened on file: /D4Doc/formularer/2016/09/Quality Document # 1-P-QM-WI -9015103_6_1049611141.doc
Errortext: The remote server returned an error: (404) Not Found.

eurofins	Always check on-line for validity. **Analysis of Pesticides by 8081B in Solid Samples using GC-ECD**	Level: **Work Instruction**
Document number: **T-PEST-WI9232**		
Old Reference: **1-P-QM-WI-9015108**		
Version: **6**		Organisation level: **5-Sub-BU**
Approved by: **UKA4** Effective Date **29-MAR-2018**	Document users: **6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C**	Responsible: **5_EUUSLA_Pesticide Residue Analysis_Manager**

LIMS ID
Analysis - 10590

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Revision Log

Revision 6	**Effective Date:** This version	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LMS ID	Reflects current scans	Added 13237
Reference	Reflects current 8000 references	Added 8000C and 8000D
Cross Reference	Enhancement	Added QA-SOP11892
Scope	Current reporting limits for tissue	Updated tissue scan 13237 to current LOQs
Calibration	Enhancement	Added the 8000D criteria Added 6 levels for MIXA, MIXE, chlordane, and toxaphene. Changed midlevel to level 4 Added CCV for toxaphene and chlordane Added criteria when 2 consecutive CCVs fail. Added criteria on linear fit for chlordane and toxaphene
Statistical Information/ Method Performance	Reflects 8000D criteria	Added information on LLOQ.

Revision 5	**Effective Date:** Apr 17, 2017	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout document	Reflects current document numbers in D4	Replaced EtQ document numbers with D4 document numbers
Definitions	Basic terms defined in higher level documents	Removed section
Scope	Reflects current analysis	Added information for Pesticide in Tissue.
Scope	Clarification	Revised information in extraction and associated analysis scan table
Cross Reference	Reflects current cross reference Document and Document Titles	Updated document title for analysis #11129, 11131, 11134 Removed 1-P-QM-QMA-9015390 and 1-P-QM-QMA-9017309
Interference	Old reference not needed	Removed reference to SOP-OE-004
Personnel Training And Qualifications	Reference not needed	Removed reference to 1-P-QM-QMA-9015390
Sample Collection, Preservation, and Handling	Clarification	Added the extracts are stored at ≤-10ºC
Apparatus and Equipment	Reflects current columns	Added Phenomenex MR1 30 m × 0.32 mm × 0.5 µm and Phenomenex MR2 30 m × 0.32 mm × 0.25 µm
Reagents and Standards B.4.	Reflects current storage condition	Changed prepared storage conditions to ≤-10ºC
Reagents and Standards B.10.	Reflects current standard	Updated Chlordane standard from Ultra Scientific to Restek
Reagents and Standards B.13.	Reflects current standard	Updated EVAL standard from Restek to Ultra Scientific
Reagents and Standards B.15.	Relects current standard	Updated surrogate stock used for IBLK from Supelco to Restek
Reagents and Standards B.16.c.	Clarification	Added information for CCV, ICV, and MDL concentrations
Reagents and Standards B.16.d.	Clarification	Added detail to preparation of SS standard and MS standard
Calibration	Reflects current order of sequence	Changed the order of when the ICVs are injected
Calibration C.	Reflects current PCB standards	Changed the mixes that are injected for the PCB patterns
Calibration	Reflects current process	Removed statement on changing septum prior to ICAL
Calibration D. - L.	Reflects current process	Reordered steps throughout section.
Calibration J.3.c, e, J.5.d	Reference not needed	Removed references SOP-PP-031 and SOP-PP-013. Removed reference SOP-PP-032
Procedure 3	Reference not needed	Removed reference SOP-PP-011
Procedure 4	Reflects current process	Added information on evaluating data where compounds coellute on one of the columns.
Calculation	Reference not needed	Removed reference SOP-PP-040
Statistical Information/Method Performance	References not needed	Removed reference to 1-P-QM-QMA 9017309. Removed reference SOP-PP-025
Quality Assurance/Quality Control	Reflects current practice	Added kepone to list of compounds not routinely spiked
		Removed SOP-PP-002

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 8081B, February 2007 (Update IV).

2. Determinative Chromotographic Separations, SW-846, Method 8000C, March 2003

3. Determinative Chromotographic Separations, SW-846, Method 8000D, July 2014

4. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #10496, 11141	Microwave Extraction Method 3546 for Pesticides in a Solid Matrix
Analysis #11129, 11131, 11134	Ultrasonic Extraction for Pesticides in a Solid Matrix by Method 3550
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-PEST-WI10011	QC Data Acceptability and Corrective Action
T-PEST-WI9954	Interpretation of Chromatographic Data
T-PEST-WI10007	Preventative and Corrective GC Maintenance
T-PEST-WI9980	Monitoring of QC Data Acceptance Limits
T-PEST-WI10016	Setting Up Single Component Initial Calibrations
T-PEST-WI10022	Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Scope

This method is used for identifying and quantitating the following Pesticides in solid samples by SW846 Method 8081B: Solid matrices other than soil can also be analyzed as long as the sample can be handled through the sonication or microwave technique for extracting. Typically solids are reduced to small pieces for extracting (e.g. concrete, wood, other plant material etc.). Tissue samples are ground and homogenized prior to extracting. Tissue samples may be whole fish, filets, or other miscellaneous species (usually aquatic, but not necessarily). Standards for the PCBs are run during this analysis since some of the PCB peaks may coelute or overlap with the pesticide peaks of interest. The information is used for proper identification and interpretation of the peaks observed for each sample. Quantitation of the same peak as a pesticide and PCB can be avoided.

Compound	LOQ (µg/kg)
alpha-BHC	0.83
beta-BHC	1.0
delta-BHC	0.90
heptachlor	0.83
aldrin	0.83
heptachlor epoxide	0.83
endosulfan I	0.83
endosulfan II	1.7
endosulfan sulfate	1.7
dieldrin	1.7
endrin	1.7
4,4'-DDE (*p,p*)	1.7

Compound	LOQ (µg/kg)
2,4'-DDE (*o,p*)	1.7
4,4'-DDD (*p,p*)	1.7
2,4'-DDD (*o,p*)	1.7
4,4'-DDT (*p,p*)	1.7
2,4'-DDT (*o,p*)	1.7
endrin aldehyde	1.7
endrin ketone	1.8
methoxychlor	6.7
chlordane	17
alpha-chlordane	0.83
gamma-chlordane	0.83
toxaphene	33.
kepone	7
mirex	1.7
telodrin	1.2
hexachlorobenzene(HCB)	0.83
Total Endosulfan (I + II)	0.83
Total DDTs	1.7

The following Pesticides in tissue samples are also identified and quantitated:

(**NOTE**: based on an initial sample volume of 15g to final volume 10mL)

Compound	LOQ (µg/kg)	LIMS Analysis Scan
alpha-BHC	1.7	13237
beta-BHC	3	13237
delta-BHC	5	13237
gamma-BHC (lindane)	7.5	13237
heptachlor	1.7	13237
aldrin	1.7	13237
heptachlor epoxide	1.8	13237
endosulfan I	1.7	13237
endosulfan II	3.4	13237
endosulfan sulfate	3.4	13237
dieldrin	3.4	13237
endrin	3.4	13237
4,4'-DDE (*p,p*)	3.4	13237
2,4'-DDE (*o,p*)	5	13237
4,4'-DDD (*p,p*)	3.6	13237
2,4'-DDD (*o,p*)	5	13237
4,4'-DDT (*p,p*)	3.4	13237
2,4'-DDT (*o,p*)	5	13237
endrin aldehyde	3.4	13237
endrin ketone	3.4	13237
methoxychlor	13	13237
Chlordane	34	13237
alpha-chlordane	1.7	13237
gamma-chlordane	1.7	13237
toxaphene	34	13237
mirex	4	13237
hexachlorobenzene(HCB)	3	13237

Limit of Quantitations (LOQs) are based on annual statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS.

HCB, Telodrin, and Kepone, are additional compounds offered by special request.

The table below lists the extraction scan and the associated analysis scan.

Extraction	Analysis
10496 Microwave	10590
11134 Sonication	1363
10496 Microwave	13237

Basic Principles
The sample is extracted using sonication or microwave with 50% hexane/acetone. The extract is dried, concentrated, and exchanged to hexane. The pesticides are then identified and quantitated using gas chromatography with an electron capture detector (GC-ECD). Florisil, GPC, or copper cleanups may be employed to reduce matrix interferences which introduce large, unresolvable peaks into the chromatogram, specifically elemental sulfur.

Reference Modifications
Gas Chromatography conditions differ from those listed in 8081. However, all quality control (QC) criteria are met.

Interferences
A. Avoid contact with any plastic material during the extraction and analysis procedures to minimize interferences from phthalate esters.

B. Scrupulously clean all glassware to minimize interferences caused by laboratory contaminants.

C. An electron capture detector is very sensitive to compounds that contain halogens and will also respond to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur.

D. Extracts may require further cleanup if interferents are present. Refer to *T-OE-PEST-WI10281* for details on each cleanup procedure. Interfering materials can introduce large, unresolvable peaks into the chromatogram.

1. Use Florisil cleanup to reduce organics that can interfere (polar compounds).
2. Use GPC to remove sulfur and higher molecular weight organics.
3. Use copper cleanup to remove elemental sulfur.

E. For solid samples, a 1:1 mixture of methylene chloride/acetone has been shown to introduce many extraneous interfering peaks due to reactions that occur between the solvents during the heated concentration process. Therefore, hexane/acetone is used for extraction.

Safety Precautions and Waste Handling
See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Gloves, lab coats, and safety glasses must be worn when preparing standards. Lab coats and safety glasses must be worn around the GC where solvents and sample extracts are handled.

All GC vials and vials containing extracts are placed in a hazardous waste container for lab pack disposal. There is a satellite container in the laboratory that is then emptied into the main laboratory waste collection drums. All solvent waste is disposed of in solvent waste containers.

Personnel Training and Qualifications
All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms,

perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples or one blind sample.

Sample Collection, Preservation, and Handling
Samples are collected in wide-mouth glass containers with Teflon-lined caps and kept cool at 0° to 6°C, not frozen. The extraction must be performed within 14 days of collection, and sample analysis must be performed with 40 days of extraction. Extracts are stored at ≤-10ºC.

Apparatus and Equipment
1. HP 6890 gas chromatograph equipped with dual electron capture detectors or equivalent

2. Columns:

a. Phenomenex MR1 30 m × 0.32 mm × 0.5 µm

b. Phenomenex MR2 30 m × 0.32 mm × 0.25 µm

Alternatively, Restek columns can also be used, and are in use for scan 1420 to achieve separation of alachlor

c. RTX– CLPesticides – 30 m × 0.32 mm × 0.5 µm

d. RTX – CLPesticides II – 30 m × 0.32 mm × 0.25 µm

3. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent. Chrom Perfect® is a data system capable of storing and reintegrating chromatographic data and determining peak areas using a forced baseline, area summation, baseline projection, and performing baseline compensation as required.

4. Various sizes of Class A volumetric flasks, pipettes, and syringes

Reagents and Standards
A. Reagents

1. Hexane for autosampler rinse vials. Stored at room temperature for up to 1 year.

2. UPC (ultra pure carrier) helium for carrier gas

3. UPC nitrogen for detector make-up gas

4. UPC hydrogen for carrier, either bottled or from a generator

B. Standards

1. All standards are prepared using Class A volumetric pipettes, syringes, and flasks.

2. All weights are made on an analytical balance.

3. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.

4. All prepared standard solutions are stored at ≤ -10°C, except as noted.

5. See the electronic standards database for the compound list and concentrations contained in the various mixes.

6. PCB standards are identical to those outlined in analysis 0042 (1-P-QM-WI-9015126).

7. Mix A – Restek Catalog #32292. Equivalent to the CLP (SOW OLMO3.2) Mix A and B, contains all single component pesticides and surrogates in the TCL and PPL organochlorine lists.

8. Mix E – Restek Custom Mix #55992. Contains additional organochlorine pesticides such as kepone, the *o,p* isomers of DDT, DDD, DDE, mirex, telodrin and hexachlorobenzene.

9. Toxaphene stock – Restek Catalog #32005 at 1,000,000 ppb. Prepare an intermediate by placing 2 mL into a 25-mL volumetric and bring to volume with hexane.

10. Chlordane stock (CAS # 57-74-9) – Restek 32021(1,000,000 ppb in hexane).

11. Surrogate Stock (SS) – Supelco #861284 containing Decachlorobiphenyl (DCB) and Tetra-chloro-meta-xylene (TCX) at 200,000 ppb each in acetone.

12. Pest MS stock – Supelco Catalog #48796, #48196. All compounds in Mix A (#7 above)

13. EVAL stock – Ultra Scientific CLP-25D. Equivalent to CLP performance evaluation mix (PEM).

14. ICV stocks – These must always be from different lot numbers (or vendors) than the working calibration standards.

Accustandard Cat. #M-8081-SC and Accustandard Cat. #P-064S-10x for Methoxychlor. Prepare an intermediate by diluting 0.1 mL of stock into a 10 mL volumetric flask with hexane using the M-8081-SC stock.

15 Instrument Blank (IBLK) – surrogate stock (SS) – Restek 32000 containing Decachlorobiphenyl (DCB) and Tetrachlorometaxylene (TCX) at 200,000 ppb each in acetone.

16. Prepare working standards using the electronic standard database as a guide.

a. In the database, choose the category (i.e. working spike, surrogate, intermediate, etc) and the required standard.

b. The database contains the following information: solution description (ex. MIXA1), parent solution name, aliquot used, final volume, solvent used, concentration of each compound in the solution, and expiration date. The standards are prepared in hexane. All standards are stored in glass bottles with Teflon lined caps in the freezer at ≤ -10ºC. The working standards have an expiration date of 6 months.

c. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level. The CCV and ICV are at the level 4 concentration of the ICAL. The MDL standard is prepared at 2 to 5 times below the low level standard of the ICAL.

d. The following table is used for the preparation scheme of the matrix spike solution and the surrogate solution used during the extraction. The SS standard is prepared in a volumetric flask and stored in 8 separate 250ml clear glass bottles in the standard refrigerator at 0º to 6°C. The MS standard is prepared in a volumetric flask and stored in 9 separate 12ml amber vials in the standard refrigerator at 0º to 6° C.

Standard Name	Parent Solution	Aliquot (mL)	Final Volume (mL)	Solvent	Description
SW-846 SS	SS Stock	3.0	2000	Acetone or methanol	SW-846 Water Surrogate – identical to that prepared for PCB analyses
SW-846 MS	MS Stock	2.0	100	Acetone or methanol	SW-846 Water spike for single component organochlorines in TCL/PPL list

17. Standards for the PCBs are run during this analysis since some of the PCB peaks may coelute or overlap with the pesticide peaks of interest. The information is used for proper identification and interpretation of the peaks observed for each sample. Quantitiation of the same peak as a pesticide and PCB can be avoided.

Extraction
See Organic Extraction analysis 11131 (sonication) or analysis 10496 (microwave).

Gas Chromatographic Conditions
The conditions listed serve as a guideline only and are typically the optimum operating conditions. The analyst may make changes to the chromatographic conditions to improve the speed of analysis, linearity, sensitivity and/or improve the separation if initial and continuing calibration criteria and quality assurance criteria listed within this analysis document are met.

Detector:	ECD
Detector	*Temp:* 330°C
Oven Temp:	140°C, no hold, 25°C/min to 250°C, then 22C/min to 300 C hold 3 min
Carrier:	Hydrogen at constant flow of 3.4 ml/min
	Helium may also be substituted
Makeup Gas:	N_2 at 55 mL/min
Injection Size:	1 µL, direct injection
Injector Temp:	225°C

Calibration
A. The pesticide analysis is run as a dual column approach. One injection is split onto two analytical columns. All initial and continuing calibration criteria listed below applies to both analytical columns.

B. Fill the autosampler rinse vials with clean solvent or replace vials that appear dirty.

C. Prepare a sequence using the following order of injections:

1. Conditioner
2. IBLK (instrument blank)
3. EVALX
4. MIXA1
5. MIXA2
6. MIXA3
7. MIXA4
8. MIXA5
9. MIXA6
10. ICMAX (ICV STD)
11. MIXE1*
12. MIXE2*
13. MIXE3*
14. MIXE4*
15. MIXE5*
16. MIXE6*
17. ICMEX* (ICV if needed)
18. TOXA1
19. TOXA2
20. TOXA3
21. TOXA4
22. TOXA5
23. TOXA6
24. ICTXX
25. CHLD1
26. CHLD2
27. CHLD3

28. CHLD4
29. CHLD5
30. CHLD6
31. ICCH
32. AR164
33. 2154X
34. AR484
35. MDLA (MDL std for Mix A)
36. MDLE (MDL std for Mix E)
37. MDTX
38. MDCH
23. Blank
40. LCS
41. 1234567
42. 1234567ms
43. 1234567msd
44.– 54. Continue running samples for a 12-hour period from last standard
55. EVALX
56. MIXA4 (CCV)
57. MIXE4* (CCV)
58. TOXA4 (CCV)
59. CHLD4 (CCV)

D. The conditioner injection is usually a standard or sample that has already been injected.

1. The conditioner is used to prime the system
2. It is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.

E. Hexane blanks can also be injected to allow the GC to go through some temperature programs and/or check the cleanliness of the system.

F. Inject initial instrument blank (IBLK) after the conditioners but before the initial calibration. It is used to determine that the instrument is free of background noise or contamination.

G. Run a breakdown evaluation standard (EVAL) at the start of an ICAL to ensure the breakdown of DDT and endrin meets the method acceptance criteria.

1. Sample analysis cannot be performed if the breakdown exceeds 15% for either DDT or endrin.
2. Breakdown check is run ongoing throughout the run after every 12 hours.
3. The sum of the peak heights of DDE, and DDD divided by the total peak heights of DDT/DDD/DDE cannot exceed 15%.
4. The sum of the peak heights endrin aldehyde and endrin ketone divided by the total peak heights of endrin/endrin aldehyde/endrin ketone cannot exceed 15%.

H. *MIX E is only needed when analyzing for additional pesticide including 2,4-DDE, 2,4-DDD, 2,4-DDT, kepone, mirex, HCB and telodrin.

I. The order of injections for the Aroclor multi-components is not critical as long as they are all run before sample analysis.

1. Aroclors are only used to identify possible PCB patterns which may interfere with the pesticide detections.

J. Initial Calibration (ICAL)

1. Calibrate using the 6 levels of the single component pesticides contained in MIX A and E. Run 6 levels for chlordane and toxaphene .
2. An external standard calibration is used with average calibration factor (AVGCF) for all analytes where the %RSD is ≤20%.
3. If the RSD is > 20%, use a calibration curve.

a. Attempt a linear fit first. Use this fit if the correlation coefficient is ≥0.99.

b. If the correlation coefficient is less than 0.99, a quadratic fit will be tried.

(1) A six-point calibration must be run to use quadratic.

(2) Prepare a sixth point somewhere within the established calibration range listed in the standards preparation section.

(3) Typically the pesticides in this method will not require a quadratic fit.

(4) Quadratic fit can not be used to extend the calibration range or bypass instrument maintenance

NOTE: For samples from ***South Carolina***, a quadratic fit may not be used.

c. For either curve type, extrapolate or force to zero is not allowed. Set the zero to ignore. See *T-PEST-WI10016* for more details.

d. If the 0.99 curve coefficient cannot be met:

(1) Inspect the data points to see if one or more calibration levels appear to be off.

(2) Reinject or remake the standard if a specific calibration level has concentrated due to solvent evaporation, or degraded over time.

(3) Perform instrument maintenance as needed. See *T-PEST-WI10007* for troubleshooting linearity problems.

e. Curve types and criteria can be altered to meet client or project specific requirements as well as any regulatory agency requirements that may differ from those listed here.

4. Set up the aroclor data in the custom “datalog” program.

a. The retention times of the peaks used for identifying the aroclors are entered into the calibration file along with the corresponding peak heights and concentrations.

b. This calibration is only used to help identify potential aroclor patterns and peaks that may overlap or interfere with target pesticides.

5. Set up the toxaphene and chlordane calibration data in the custom “datalog” program.

a. The retention times of the peaks used for identifying and quantifying these multi-component pesticides are entered into the calibration file along with the corresponding peak heights and concentrations.

b. An external standard calibration is used with average calibration factor (AVGCF) for each chosen peak of the Chlordane pattern and Toxaphene pattern where the %RSD is ≤20%.

c. If the RSD is > 20%, use a calibration curve.

(a). Attempt a linear fit first. Use this fit if the correlation coefficient is ≥0.99.

(b). If the correlation coefficient is less than 0.99, a quadratic fit will be tried.

(1) A six-point calibration must be run to use quadratic.

(2) Prepare a sixth point somewhere within the established calibration range listed in the standards preparation section.

(3) Typically the pesticides in this method will not require a quadratic fit.

(4) Quadratic fit can not be used to extend the calibration range or bypass instrument maintenance

NOTE: For samples from ***South Carolina***, a quadratic fit may not be used.

(c). For either curve type, extrapolate or force to zero is not allowed. Set the zero to ignore.

d. See **T**-PEST-WI10022 for details on this program.

6. Ensure the peaks in the standards are labeled properly, including the surrogates in all injections that contain them.

7. Set the scaling of chromatograms and peak integration parameters so that the peaks for each compound of interest are detected and integrated at the concentration of the MDL. This ensures that the LOQ and MDL can be met.

8. When 8000D is referenced and curve fits are used in the initial calibration, percent error (%E) must be calculated for each calibration level. Standard levels at or below the LOQ must meet +/- 50%, standards above the LOQ must meet +/-30%. (%error = (true concentration - calculated concentration)/true concentration)*100)

K. Initial Calibration Verification (ICV)

1. Verify the calibration curve using the ICV mixtures injected directly after the corresponding curve.

2. The % difference of the concentrations for these must be within 20% difference of the nominal concentration.

L. Continuing Calibration Verification (CCV)

1. Analyze a set of check standards after each set of injections in a 12-hour period, or 20 samples, whichever comes first (samples, QC, blanks, etc.).

a. Use a mid level single component standard to evaluate the response of single component analytes.

b. Use a mid level standard for toxaphene and chlordane.

c. Run the breakdown evaluation mix (EVAL). Analysis cannot proceed if either compound exceeds 15%.

2. The concentration quantitated for the continuing calibration check standards must be within 20% difference (%D) of the nominal concentration.

3. Samples must be bracketed by compliant standards.

4. When confirmation of target analytes is needed, the initial calibration criteria must be met and the second column should meet the 20% continuing calibration criteria.

5. When a continuing calibration verification standard (CCV) fails to meet the QC criteria, all samples that were injected after the last CCV that passed must be re-injected.

Exception: If the CCV fails high and those targets are not detected in the associated samples, the samples can be reported.

If two consecutive/sequential CCVs fail, corrective action must be taken, which can include performing injection port maintenance, baking the instrument or other types of maintenance. Two consecutive/sequential CCVs must meet the criteria or an initial calibration must be performed before sample analysis can continue.

6. The instrument blank (IBLK) may be injected after each set of continuing calibration verifications.

a. This is optional but frequently requested for projects.

b. It must be evaluated as a water matrix against the water MDL/LOQs.

c. The IBLK must not have any target compounds above the reporting limits.

(1) If a target analyte is detected in the IBLK, any associated samples with a detection for that same target must be evaluated.

(2) Unless the concentration in the sample is more than 10x the IBLK value, the sample must be reinjected

(3) Instrument maintenance, like baking the system or injection port maintenance is usually necessary to clean up the instrument.

7. Retention time (RT) windows

a. Established as 3× the standard deviation determined over 72 hours, or at no less than .02 minutes, applied to the initial calibration standard, usually Level 3.

b. If the RTs for a continuing calibration standard fall outside the RT window, update the midpoint RT using that standard.

(1) Save this under the appropriate name to indicate an update has occurred.

(2) RTs cannot be updated more than once per day. All subsequent standards run within a 24-hour period must be within this window.

(3) If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure

1. Make injections via an auto sampler.

2. Samples are analyzed according to the sequence in the calibration section above.

3. Retention times of peaks in the samples are compared to the standard RT windows. Peaks present on both columns (and that are also in the correct ratios to represent an aroclor) are quantitated and the high value is reported unless there are chromatographic anomalies. See *T-PEST-WI9954*.

4. There are several compounds that coelute on one column and not the other; whether a compound coelutes or not is instrument and column dependent. Compounds known to coelute are contained in different standards. One standard is named MIXA and the other standard is MIXE. Refer back to the ICAL to note which compounds coelute and on which column they coelute before evaluating the sample data. If there is a detection for one of the coeluting compounds on the column where this compound does not coelute and the detection is greater than the MDL, look at the other column and note if the coeluting compound is present. If the coeluting column is present and within the +/-0.02 retention time units of the detected coleluting compound from the other column, calculate the concentration using the appropriate response factor. Calculate the RPD between the two columns and report as per routine protocol.

5. Continue running groups of samples/injections followed by check standards every 12 hours or every 20 injections, whichever comes first.

6. If significant interference is present, schedule florisil cleanup. If elemental sulfur is present, copper cleanup the extract or have it put through GPC cleanup. If these techniques do not reduce the matrix problems, dilute the extract, analyze, and adjust the LOQs accordingly.

7. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

Calculations

A. See *T-PEST-WI9847* for details on all calculations/equations used to evaluate the initial and continuing calibration.

B. Calculation of results is performed according to the following procedures:

1. Single-component compounds

a. Using AVGCF from initial calibration

$$\frac{Sample\ Height}{AVG\ CF\ (CF)} \times \frac{FV}{IW} \times DF = \mu g/kg\ as\ received$$

b. Using linear curve from initial calibration:

$$[(Sample\,Height - Y - intercept)/Slope] \times \frac{FV}{IW} \times DF = \mu g/kg\,as\,received$$

Where:

FV (final volume) = volume in mLs
IW (initial weight) = weight in grams

DF (dilution factor) = as needed

2. Multi-component compounds

The peak heights generated by the integration system are used to calculate the calibration factors (CF) for peaks of interest for each quantitation peak used for toxaphene and chlordane.

Usually the six major peaks are chosen for quantitation. Include alpha chlordane, gamma chlordane, and heptachlor as three of the six major peaks for the calibration of chlordane. Sample concentrations are calculated per peak using Average Calibration Factor (AVG CF).

$$\frac{Sample\ Height}{AVG\ CF\ (CF)} \times \frac{FV}{IW} \times DF = \mu g/kg\ as\ received$$

Where:

FV (final volume) = volume in mLs

IW (initial weight) = weight in grams

AF (additional factor) = based on cleanups
(i.e., 2 mL extract florisiled to 25 mL = 12.5)

DF (dilution factor) = as needed

The final result that is reported is determined as the average of the result for each peak chosen for quantitation:

$$(Result\ 1 + Result\ 2 + \ldots + Result\ n) / n = Average\ Result$$

3. A breakdown mix (EVALX) containing p,p′-DDT and Endrin is run to check for breakdown. The breakdown must not exceed 15% for either compound. Breakdown is calculated as:

$$\%\ Breakdown\ for\ p,p'\text{-}DDT = \frac{pk\ ht\ (area)\ of\ p,p'\text{-}DDE + p,p'\text{-}DDD}{pk\ ht\ (area)\ of\ p,p'\text{-}DDE + p,p'\text{-}DDD + p,p'\text{-}DDT} \times 100$$

$$\%\ Breakdown\ for\ Endrin = \frac{pk\ ht\ (area)\ of\ Endrin\ Aldehyde + Endrin\ Ketone}{pk\ ht\ (area)\ of\ Endrin\ Aldehyde + Endrin\ Ketone + Endrin} \times 100$$

If breakdown fails, injector maintenance must be performed. Analysis cannot proceed until breakdown check passes.

Statistical Information/Method Performance

LCS, MS, and RPD are compared to the limits stored in the LIMS. The limits for LCS and MS are statistically derived. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Acceptance limits are generated according to *T-PEST-WI9980*. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

When 8000D is referenced an annual lower limit of quantification (LLOQ) verification is required annually on at least one instrument. All instruments must have one at least every three years.

Quality Assurance/Quality Control

Each extraction batch (up to 20 samples) must contain a method blank, a laboratory control spike sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD) or an LCS/LCSD.

The TCL single-component pesticides of interest for each analysis are routinely spiked. Mirex, *o,p*-DDE/DDD/DDT, telodrin, kepone, and HCB are not spiked since this would result in co-elution with the other spiked compounds. These can be spiked at a client's request for special projects, within our scope of accreditation.

DCB and TCX are added as surrogates to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the GC run.

QC limits for surrogates, LCS/LCSD, and MS/MSD are established through statistical analysis of historical data. The limits are evaluated every 6 months and updated as needed. The limits are maintained in the LIMS for the relevant analysis numbers.

See *T-PEST-WI10011* for details on QC acceptance criteria and corrective action.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed.

T-OE-PEST-WI10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-PEST-WI10007 Preventative and Corrective GC Maintenance
T-PEST-WI10011 QC Data Acceptability and Corrective Action
T-PEST-WI10016 Setting Up Single Component Initial Calibrations
T-PEST-WI10022 Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs
T-PEST-WI9847 Common Equations Used During Chromatographic Analyses
T-PEST-WI9954 Interpretation of Chromatographic Data
T-PEST-WI9980 Monitoring QC Data Acceptance Limits

End of document

Version history

Version	Approval	Revision information
5	17.FEB.2017	
5.1	17.APR.2017	
6	29.MAR.2018	

eurofins	Always check on-line for validity. **Pesticides in Water by Method 8081B using GC-ECD**	Level: **Work Instruction**
Document number: **T-PEST-WI9999**		
Old Reference: **1-P-QM-WI-9015107**		
Version: **7**		Organisation level: **5-Sub-BU**
Approved by: **UKA4** Effective Date **29-MAR-2018**	Document users: **6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C**	Responsible: **5_EUUSLA_Pesticide Residue Analysis_Manager**

LIMS ID
Analysis - 10589, 10647

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Revision Log

Revision 7		**Effective Date:**	This version
Section	**Justification**	**Changes**	
Revision Log	Formatting requirement	Removed revision logs up to the previous version	

Revision 7	**Effective Date:** This version	
Calibration	Clarification and Enhancement	Added 6 levels for chlordane and toxaphene and renumbered sequence. Added use of each individual peak in calculating response factors for chlordane and toxaphene. Added curve criteria for toxaphene and chlordane.

Revision 6	**Effective Date:** Mar 26, 2018	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Reference	Enhancement	Added 8000C and 8000D
Definitions	Information exists in higher level documents	Removed section
Personnel Training and Qualifications	Reference to higher level documents unnecessary	Removed reference to *QA-SOP11178*
Calibration	Method compliance and reflects current practice	Added 8000D criteria for ICAL. Changed to 6 levels for the ICAL. Changed midlevel to the level 4 standard for the CCV. Added criteria to address when 2 consecutive CCVs fail. Added CCVs for toxaphene and chlordane
Statistical Information/ Method Performance	Method compliance and reflects current practice	Added information on analyzing an LLOQ. Added information on statistically derived parameters.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 8081B, Rev. 2, February 2007.

2. Determinative Chromotographic Separations, SW-846, Method 8000C, March 2003
3. Determinative Chromotographic Separations, SW-846, Method 8000D, July 2014
4. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #6654, 10241, 11112, 11113, 11114, 11116, 11117, 11118, 11119, 11120, 11121, 11123, 11126, 11960, 12026, 12822, 13086, 13093, 13183, 13187	Separatory Funnel Extraction by Method 3510C, 608 or 622 for Pesticides and PCBs in a Wastewater
Analysis #6030,10227	Polychlorinated Biphenyls (PCBs) by Method 608 or 8082 in Waters
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)

Document	Document Title
T-PEST-WI10011	QC Data Acceptability and Corrective Action
T-PEST-WI9954	Interpretation of Chromatographic Data
T-PEST-WI10007	Preventative and Corrective GC Maintenance
T-PEST-WI9980	Monitoring QC Data Acceptance Limits
T-PEST-WI10016	Setting Up Single Component Initial Calibrations
T-PEST-WI10022	Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Scope

This method is used for identifying and quantitating the following Pesticides in aqueous samples:

Compound	LOQ (µg/L)
alpha-BHC	0.01
beta-BHC	0.01
delta-BHC	0.01
gamma-BHC (lindane)	0.01
heptachlor	0.01
Aldrin	0.01
heptachlor epoxide	0.01
endosulfan I	0.01
endosulfan II	0.03
endosulfan sulfate	0.02
Dieldrin	0.02
Endrin	0.02
4,4'-DDE (*p,p*)	0.02
2,4'-DDE (*o,p*)	0.02
4,4'-DDD (*p,p*)	0.02
2,4'-DDD (*o,p*)	0.02
4,4'-DDT (*p,p*)	0.02
2,4'-DDT (*o,p*)	0.02
endrin aldehyde	0.1
endrin ketone	0.02
methoxychlor	0.1
technical chlordane	0.5
alpha-chlordane	0.01
gamma-chlordane	0.02

Compound	LOQ (µg/L)
toxaphene	1
Kepone	0.2
Mirex	0.05
Telodrin	0.01
hexachlorobenzene (HCB)	0.01
Total Endosulfan (I + II)	.01
Total DDTs	0.02

Limit of Quantitations (LOQs) are based on annual statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS.

HCB, Telodrin, and Kepone, are additional compounds offered by special request.

Basic Principles

A portion of sample is extracted serially with methylene chloride. The volume of sample can be adjusted depending on the physical appearance of the sample and the amount sent for analysis. The extract is dried, concentrated, and exchanged to hexane. The pesticides are then identified and quantitated using gas chromatography with electron capture detectors (GC-ECD). Florisil, GPC, or copper cleanups may be employed to reduce matrix interferences that introduce large, unresolvable peaks into the chromatogram.

Reference Modifications

Gas Chromatography conditions differ from those listed in 8081B. However, all quality control (QC) criteria are met.

Interferences

A. Avoid contact with any plastic material during the extraction and analysis procedures to minimize interferences from phthalate esters.

B. Scrupulously clean all glassware to minimize interferences caused by laboratory contaminants.

C. An electron capture detector is very sensitive to compounds that contain halogens and will also respond to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur.

D. Extracts may require further cleanup if interferents are present. Refer to *T-OE-PEST-WI10281* for details on each cleanup procedure. Interfering materials can introduce large, unresolvable peaks into the chromatogram.

1. Use Florisil cleanup to reduce organics that can interfere (polar compounds).
2. Use GPC to remove sulfur and higher molecular weight organics.
3. Use copper cleanup to remove elemental sulfur.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Gloves, lab coats, and safety glasses must be worn when preparing standards. Lab coats and safety glasses must be worn around the GC where solvents and sample extracts are handled.

All GC vials and vials containing extracts are placed in a hazardous waste container for lab pack disposal. There is a satellite container in the laboratory, which is then emptied into the main laboratory waste collection drums. All solvent waste is disposed of in solvent waste containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through

documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, one blind sample, or one ICAL with ICVs and/or CCVs.

Sample Collection, Preservation, and Handling

Samples are collected in amber glass containers with Teflon™-lined caps, preserved with 0.008% sodium thiosulfate in case residual chlorine is present, and stored under refrigeration at 0º to 6°C, not frozen. Sample extraction must be performed within 7 days of collection, and sample analysis must be performed with 40 days of extraction. Extracts are stored frozen at -10º to -15ºC.

Apparatus and Equipment

1. HP 6890 gas chromatograph equipped with dual electron capture detectors, or equivalent

2. Columns:

   a. Phenomenex MR1 30 m × 0.32 mm × 0.5 µm or equivalent

   b. Phenomenex MR2 30 m × 0.32 mm × 0.25 µm or equivalent

3. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent. Chrom Perfect® is a data system capable of storing and reintegrating chromatographic data and determining peak areas using a forced baseline, area summation, baseline projection, and performing baseline compensation as required.

4. Various sizes of Class-A volumetric pipettes, flasks, and syringes

Reagents and Standards

A. Reagents

1. Hexane for autosampler rinse vials, stored at room temperature.

2. UPC (ultra pure carrier) helium for carrier gas

3. UPC nitrogen for detector make-up gas

4. UPC hydrogen for carrier gas, bottled or from a generator

B. Standards

1. All standards are prepared using Class-A volumetric pipettes, flasks, and syringes.

2. All weights are made on an analytical balance.

3. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.

4. All prepared standard solutions are stored at -10º to -15°C in labeled containers.

5. See the electronic standards database for the compound list and concentrations contained in the various mixes.

6. PCB standards are identical to those outlined in the department Analysis #6030, 10227.

7. Mix A – Restek Catalog #32292. Equivalent to the CLP (SOW-OLMO3.2) Mix A and B, contains all single component pesticides and surrogates in the TCL and PPL organochlorine lists.

8. Mix E – Restek Custom Mix #55992. Contains additional organochlorine pesticides such as kepone, the *o,p* isomers of DDT, DDD, DDE, telodrin, mirex, and hexachlorobenzene.

9. Toxaphene stock – Restek Catalog #32005 at 1,000,000 ppb. Prepare an intermediate by placing 2 mL into a 25-mL volumetric and bring to volume with hexane.

10. Chlordane stock (CAS# 57-74-9)– Ultra Scientific PP-150 (100,000 ppb in methanol).

11. Surrogate stock (SS) – Supelco #861284 containing Decachlorobiphenyl (DCB) and Tetra-chloro-meta-xylene (TCX) at 200,000 ppb each in acetone.

12. Pest MS stock – Supelco Cat. #48796 and #48196. Contains all single component pesticides and surrogates in the TCL and PPL organochlorine lists.

13. EVAL stock – Restek Cat. #32074-510. Equivalent to CLP performance evaluation mix (PEM).

14. ICV stocks – These must be from a second source different than those used for working calibration standards.

Restek #32297 and #32298 for Mix A; Accustandard Cat. # S-5833 for Mix E; Supelco Cat #4-8103 for Toxaphene; Accustandard #P017S-10x for Chlordane.

15. Instrument Blank (IBLK) – surrogate stock (SS) – Supelco #861284 containing Decachlorobiphenyl (DCB) and Tetrachlorometaxylene (TCX) at 200,000 ppb each in acetone.

16. Prepare working standards using the electronic standard database as a guide.

a. In the database, choose the category (ie working spike, surrogate, intermediate, etc) and the required standard.

b. The database contains the following information: solution description (ex. MIXA1), parent solution name, aliquot used, final volume, solvent used, concentration or each compound in the solution, and the expiration date. The working standards have an expiration date of 6 months.

c. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level.

d. See below for the preparation of the matrix spike and the surrogate spike solution used during the extraction process.

Standard Name	Parent Solution	Aliquot (mL)	Final Vol. (mL)	Solvent	Description	Expiration Date
SW-846 SS	SS Stock	1.5	1000	acetone or methanol	SW-846 Water Surrogate - identical to that prepared for PCB analyses	6 months
SW-846 MS	MS Stock	1.0	500	acetone or methanol	SW-846 Water Spike for single component organochlorines in the TCL/PPL list	6 months

17. Standards for the PCBs are run during this analysis since some of the PCB peaks may coelute or overlap with the pesticide peaks of interest. The information is used for proper identification and interpretation of the peaks observed for each sample. Quantitation of the same peak as a pesticide and PCB can be avoided.

Extraction Procedure

See *Analysis #6654, 10241, 11112*, 11113, 11114, 11116, 11117, 11118, 11119, 11120, 11121, 11123, 11126, 11960, 12026, 12822, 13086, 13093, 13183, 13187.

Gas Chromatographic Conditions

Detector: ECD

Detector Temp: 330°C

Oven Temp: 140°C, no hold, 25°C/min to 250°C, then 22C/min to 300 C. hold 3 min

Carrier: Hydrogen at constant flow of 3.4 ml/min

Helium may also be substituted

Makeup Gas: N_2 at 55 mL/min

Injection Size: 1 µL, direct injection

Injector Temp: 225°C

The conditions listed serve as a guideline only and are typically the optimum operating conditions. The analyst may make changes to the chromatographic conditions to improve the speed of analysis, linearity, sensitivity, and/or improve the separation if initial and continuing calibration criteria and quality assurance criteria listed within this analysis document are met.

Calibration

A. The pesticide analysis is run as a dual column approach. One injection is split onto two analytical columns. All initial and continuing calibration criteria listed below applies to both analytical columns.

B. Fill the autosampler rinse vials with clean solvent or replace vials that appear dirty.

C. Prepare a sequence using the following order of injections:

1. Conditioner
2. IBLK (instrument blank)
3. EVALX
4. MIXA1
5. MIXA2
6. MIXA3
7. MIXA4

8. MIX A5
9. MIXA6
10. MIXE1*
11. MIXE2*
12. MIXE3*
13. MIXE4*
14. MIXE5*
15. MIXE6*
16. TOXA1
17. TOXA2
18. TOXA3
19. TOXA4
20. TOXA5
21. TOXA6
22. CHLD1
23. CHLD2
24. CHLD3
25. CHLD4
26. CHLD5
27. CHLD6
28. AR164
29. AR2154
30. AR484
31. MDLA (MDL std for Mix A)
32. MDLE (MDL std for Mix E)
33. MDTX (MDL std for toxaphene)
34. MDCH (MDL std for chlordane)
35. ICMAX (ICV)
36. ICMEX (ICV)
37. ICTX (ICV toxaphene)
38. ICCH (ICV chlordane)
39. Blank
30. LCS
41. 1234567
42. 1234567ms
43. 1234567msd
44.– 54 Continue running samples for a 12-hour period from last standard
55. EVALX
56. MIXA4 (CCV)
57. MIXE4* (CCV)
58. TOXA4 (CCV)
59. CHLD4 (CCV)

D. Run a breakdown evaluation standard (EVAL) at the start of an ICAL to ensure the breakdown of DDT and endrin meets the method acceptance criteria.

1. Evaluates the system for the breakdown of DDT and Endrin before sample analysis can begin.

2. Breakdown check is run ongoing throughout the run after every 12 hours.

3. Sample analysis cannot be performed if the breakdown exceeds 15% for either compound.

E. *MIX E is only needed when analyzing for additional pesticides including 2,4-DDD, 2,4-DDE, 2,4-DDT, kepone, mirex, HCB, and telodrin.

F. The order of injections for the multi-components is not critical as long as they are all run before sample analysis.

1. Aroclors are only used to identify possible PCB patterns which may interfere with the pesticide detections.

G. The conditioner injection is usually a standard or sample that has already been injected.

1. The conditioner is used to prime the system.

2. It is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.

H. Hexane blanks may also be run to allow the GC to go through some temperature programs and/or to check the cleanliness of the system.

I. Instrument blanks (IBLK) may also be run with the continuing check standards - this is optional but frequently requested for projects.

1. The instrument blank (IBLK) is injected after the conditioners but before the initial calibration.

2. It is used to determine that the instrument is free of background noise or contamination.

J. Initial Calibration (ICAL)

1. Calibrate using the 6 levels of the single component pesticides contained in MIX A and E. Calibrate using 6 levels for chlordane and toxaphene .

2. An external standard calibration is used with average response factor (AVGRF) for all analytes where the % RSD is ≤20%.

3. If the RSD is > 20%, use a calibration curve.

a. Attempt a linear fit first. Use this fit if the correlation coefficient is ≥0.99.

b. If the correlation coefficient is less than 0.99, a quadratic fit will be tried.

(1) A six-point calibration must be run to use quadratic.

(2) Prepare a sixth point somewhere within the established calibration range listed in the standards preparation section.

(3) Typically the pesticides in this method will not require a quadratic fit.

(4) Quadratic fit cannot be used to extend the calibration range or bypass instrument maintenance

NOTE: For samples from South Carolina, a quadratic fit may not be used.

c. For either curve type, extrapolate or force to zero is not allowed. Set the zero to ignore. See *T-PEST-WI10016* for more details.

d. If the 0.99 curve coefficient cannot be met:

(1) Inspect the data points to see if one or more calibration levels appear to be off.

(2) Reinject or remake the standard if a specific calibration level has concentrated due to solvent evaporation, or degraded over time.

(3) Perform instrument maintenance as needed. See *T-PEST-WI10007* for troubleshooting linearity problems.

e. Curve types and criteria can be altered to meet client or project specific requirements as well as any regulatory agency requirements that may differ from those listed here.

4. Set up the aroclor data in the custom “datalog” program.

a. The retention times of the peaks used for identifying the aroclors are entered into the calibration file along with the corresponding peak heights and concentrations.

b. This calibration is only used to help identify potential aroclor patterns and peaks that may overlap or interfere with target pesticides.

5. Set up the toxaphene and chlordane calibration data in the custom “datalog” program.

a. The retention times of the peaks used for identifying and quantifying these multi-component pesticides are entered into the calibration file along with the corresponding peak heights and concentrations.

b. An external standard calibration is used with average response factor (AVGRF) for each individual peaks for the chlordane and the toxaphene pattern where the % RSD is ≤20%.

c. See *T-PEST-WI10022* for details on this program.

d. If the RSD is > 20%, use a calibration curve.

(a). Attempt a linear fit first. Use this fit if the correlation coefficient is ≥0.99.

(b.) If the correlation coefficient is less than 0.99, a quadratic fit will be tried.

(1) A six-point calibration must be run to use quadratic.

(2) Prepare a sixth point somewhere within the established calibration range listed in the standards preparation section.

(3) Typically the pesticides in this method will not require a quadratic fit.

(4) Quadratic fit cannot be used to extend the calibration range or bypass instrument maintenance

NOTE: For samples from South Carolina, a quadratic fit may not be used.

(c). For either curve type, extrapolate or force to zero is not allowed. Set the zero to ignore. See *T-PEST-WI10016* for more details.

(d). If the 0.99 curve coefficient cannot be met:

(1) Inspect the data points to see if one or more calibration levels appear to be off.

(2) Reinject or remake the standard if a specific calibration level has concentrated due to solvent evaporation, or degraded over time.

(3) Perform instrument maintenance as needed. See *T-PEST-WI10007* for troubleshooting linearity problems.

e. Curve types and criteria can be altered to meet client or project specific requirements as well as any regulatory agency requirements that may differ from those listed here.

6. Ensure the peaks in the standards are labeled properly, including the surrogates in all injections that contain them.

7. Set the scaling of chromatograms and peak integration parameters so that the peaks for each compound of interest are detected and integrated at the concentration of the MDL. This ensures that the LOQ and MDL can be met.

8. When 8000D is referenced and curve fits are used in the initial calibration, percent error (%E) must be calculated for each calibration level. Standard levels at or below the LOQ must meet +/- 50%, standards above the LOQ must meet +/-30%. (%error = (true concentration - calculated concentration)/true concentration)*100)

L. Initial Calibration Verification (ICV)

1. Verify the calibration curve using the ICV mixtures injected directly after the full ICAL.

2. The % difference of the concentrations for these must be within 20% difference of the nominal concentration.

M. Continuing Calibration Verification (CCV)

1. Analyze a set of check standards after each set of injections in a 12-hour period, or 20 samples, whichever comes first (samples, QC, blanks, etc.).

a. Use a mid level single component standard (Level 4) to evaluate the response of single component analytes.

b. Use a mid level for toxaphene and chlordane (Level 4).

c. Run the breakdown evaluation mix (EVAL). Analysis cannot proceed if either compound exceeds 15%.

2. The concentration quantitated for the continuing calibration check standards must be within 20% difference (%D) of the nominal concentration.

3. Samples must be bracketed by compliant standards.

4. When confirmation of target analytes is needed, the initial calibration criteria must be met and the second column must meet the 20% continuing calibration criteria.

5. When a CCV fails to meet the QC criteria, all samples that were injected after the last CCV that passed must be re-injected.

Exception: If the CCV fails high and those targets are not detected in the associated samples, the samples can be reported.

If two consecutive/sequential CCVs fail, corrective action must be taken, which can include performing injection port maintenance, baking the instrument or other types of maintenance. Two consecutive/sequential CCVs must meet the criteria or an initial calibration must be performed before sample analysis can continue.

6. The instrument blank (IBLK) may be injected after each set of continuing calibration verifications.

a. This is optional but frequently requested for projects.

b. It must be evaluated as a water matrix against the water MDL/LOQs.

c. The IBLK must not have any target compounds above the reporting limits.

(1) If a target analyte is detected in the IBLK, any associated samples with a detection for that same target must be evaluated.

(2) Unless the concentration in the sample is more than 10x the IBLK value, the sample must be reinjected after another compliant IBLK.

(3) Instrument maintenance, like baking the system or injection port maintenance is usually necessary to clean up the instrument.

7. Retention time (RT) windows

a. Established as 3× the standard deviation determined over 72 hours, or at no less than .02 minutes, applied to the initial calibration standard, usually Level 3.

b. If the RTs for a continuing calibration standard fall outside the RT window, update the midpoint RT using that standard.

(1) Save this under the appropriate name to indicate an update has occurred.

(2) RTs cannot be updated more than once per day. All subsequent standards run within a 24-hour period must be within this window.

(3) If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure

1. Make injections via an auto sampler.

2. Samples are analyzed according to the sequence in the calibration section above.

3. Retention times of peaks in the samples are compared to the standard RT windows. Peaks present on both columns (and that are also in the correct ratios to represent an aroclor) are quantitated and the high value is reported unless there are chromatographic anomalies. See *T-PEST-WI9954*.

4. Continue running groups of samples/injections followed by check standards every 12 hours or every 20 injections, whichever comes first.

5. If significant interference is present, schedule florisil cleanup. If elemental sulfur is present, copper cleanup the extract or have it put through GPC cleanup. If these techniques do not reduce the matrix problems, dilute the extract, analyze, and adjust the LOQs accordingly.

6. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

Calculations

A. See *T-PEST-WI9847* for details on all calculations/equations used to evaluate the initial and continuing calibration.

B. Calculation of results is performed according to the following procedures:

1. Single-component compounds

   a. Using AVGCF from initial calibration

$$\frac{Sample\ Height}{AVGCF} \times \frac{FV}{IV} \times DF = \mu g/L \quad as\ received$$

   b. Using linear curve from initial calibration:

$$[(Sample\ Height - Y - intercept)/Slope] \times \frac{FV}{IV} \times DF = \mu g/L\ as\ received$$

Where:

FV (final volume) = volume in mLs

IV (initial volume) = volume in mLs

DF (dilution factor) = as needed

2. Multi-component compounds

The peak heights generated by the integration system are used to calculate the Calibration Factors (CF) for peaks of interest for each quantitation peak used for toxaphene and chlordane.

Usually the six major peaks that are unique toxaphene and chlordane (include alph chlordane, gamma chlordane and heptachlor) are chosen for quantitation. Sample concentrations are calculated per peak using Average Calibration Factor (AVGCF).

$$\frac{Sample\ Height}{AVG\ CF\ (CF)} \times \frac{FV}{IV} \times DF = \mu g/L\ as\ received$$

Where:

FV (final volume) = volume in mLs

IV (initial volume) = volume in mLs

DF (dilution factor) = as needed

The final result that is reported is determined as the average of the result for each peak chosen for quantitation:

$$(Result\ 1 + Result\ 2 + \ldots + Result\ n) / n = Average\ Result$$

3. A breakdown mix (EVALX) containing p,p′-DDT and Endrin is run to check for breakdown. The breakdown must not exceed 15% for either compound. Breakdown is calculated as:

$$\%\ Breakdown\ for\ p,p'\text{-}DDT = \frac{pk\ ht\ (area)\ of\ p,p'\text{-}DDE + p,p'\text{-}DDD}{pk\ ht\ (area)\ of\ p,p'\text{-}DDE + p,p'\text{-}DDD + p,p'\text{-}DDT} \times 100$$

$$\%\ Breakdown\ for\ Endrin = \frac{pk\ ht\ (area)\ of\ Endrin\ Aldehyde + Endrin\ Ketone}{pk\ ht\ (area)\ of\ Endrin\ Aldehyde + Endrin\ Ketone + Endrin} \times 100$$

If breakdown fails, injector maintenance must be performed. Analysis cannot proceed until breakdown check passes.

Statistical Information/Method Performance

LCS, MS, and RPD are compared to the limits stored in the LIMS. The limits for LCS and MS are statistically derived. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Acceptance limits are generated according to *T-PEST-WI9980*. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

When 8000D is referenced an annual lower limit of quantification (LLOQ) verification is required annually on at least one instrument. All instruments must have one at least every three years.

Quality Assurance/Quality Control

Each extraction batch (up to 20 samples) must contain a method blank, a laboratory control spike sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD) or an LCS/LCSD.

The TCL single-component pesticides of interest for each analysis are routinely spiked. Mirex, o,p-DDE/DDD/DDT, telodrin, and HCB are not spiked since this would result in co-elution with the other spiked compounds. These can be spiked at a client's request for special projects, within our scope of accreditation.

DCB and TCX are added as surrogates to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the GC run.

See *T-PEST-WI10011* for details on QC acceptance criteria and corrective action.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed.

QA-SOP11178 Demonstrations of Capability
QA-SOP11892 Determining Method Detection Limits and Limits of Quantitation
T-OE-PEST-WI10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-PEST-WI10920 Separatory Funnel Extraction by Method 3510C, 608, 608.3 or 622 for Pesticides and PCBs in a Wastewater
T-PEST-WI10007 Preventative and Corrective GC Maintenance
T-PEST-WI10011 QC Data Acceptability and Corrective Action
T-PEST-WI10016 Setting Up Single Component Initial Calibrations
T-PEST-WI10022 Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs
T-PEST-WI11971 Polychlorinated Biphenyls (PCBs) by Method 608 or 8082 in Waters
T-PEST-WI9847 Common Equations Used During Chromatographic Analyses
T-PEST-WI9954 Interpretation of Chromatographic Data
T-PEST-WI9980 Monitoring QC Data Acceptance Limits

End of document

eurofins	Always check on-line for validity. **Pesticides in Water by Method 8081B using GC-ECD**	Level: **Work Instruction**
Document number: **T-PEST-WI9999**		
Old Reference: **1-P-QM-WI-9015107**		
Version: **7**		Organisation level: **5-Sub-BU**
Approved by: **UKA4** Effective Date **29-MAR-2018**	Document users: **6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C**	Responsible: **5_EUUSLA_Pesticide Residue Analysis_Manager**

Version history

Version	Approval	Revision information
5	20.OCT.2015	
6	25.MAR.2018	
7	29.MAR.2018	

eurofins	Always check on-line for validity. **Microwave Extraction Method 3546 for PCBs in a Solid Matrix**	Level: **Work Instruction**
Document number: **T-OE-PEST-WI10927**		
Old Reference: **1-P-QM-WI -9015104**		
Version: **9**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **31-OCT-2019**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Pest/PCB Soils, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

LIMS ID

Analysis - 10497, 11140, 13100, 13998, 14114, 14652

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Table I

Revision Log

Revision 09	**Effective Date:** This version	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Reflects current practice	Added preps 13998, 14114, and 14652

eurofins	Always check on-line for validity.	Level:
Document number: **T-OE-PEST-WI10927**	**Microwave Extraction Method 3546 for PCBs in a Solid Matrix**	**Work Instruction**
Old Reference: **1-P-QM-WI -9015104**		
Version: **9**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **31-OCT-2019**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Pest/PCB Soils, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

Revision 09	**Effective Date:** This version	
Throughout procedure	Reflects current practice	Clarified weights to use for each prep number
Procedure 3	Reflects current practice	Added spiking procedure for prep 14652

Revision 8	**Effective Date:** 01-MAY-2018	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Purpose	Removed section	Not required
Scope	Reflects current practice	Added tissues to matrix types
Apparatus and equipment	Reflects current practice	Removed graduated cylinder. Added glass vial inserts
Throughout Procedure	Clarification	Updated wording to clarify steps
Procedure 1	Reflects current practice	Added weights for tissue matrix and clarified the range
Procedure 15	Reflects current practice	Combined the copper and florisil steps as they are done together now.
Procedure 16	Reflects current practice	Updated the bottling requirements

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3546, Revision 0, February 2007.
2. *Chemical Hygiene Plan*, current version.
3. MARS Operation Manual, Revision 2, February 2006.

Cross Reference

Document	Document Title
Analysis #*0042, 1030, 6011, 7512, 10225, 10736, 10906, 12800, 13236*	Polychlorinated Biphenyls (PCBs) by Method 8082 in Solids and Wipes
Analysis #*2487*	Food and Tissue Preparation
T-OE-PEST-WI11410	Pesticide Extract Cleanup Using GPC by method 3640A
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)

Document	Document Title
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Scope
This procedure is applicable for the extraction of PCBs from soils, tissues, or solid wastes.

Basic Principles
A portion of sample to be analyzed is placed in an extraction vessel. Surrogate standards are added to each sample to monitor recovery. The vessel is then loaded into the microwave and extracted. The organic compounds present in the sample dissolve in the solvent, which is then removed. The sample is then concentrated and bottled.

Several cleanup procedures may be required to eliminate matrix interferences before the sample can be analyzed. They include: sulfuric acid treatment, florisil, copper, and gel-permeation cleanup (GPC).

Reference Modifications
The KD is not removed from the steam bath and cooled before adding hexane. The Snyder column is not removed for the solvent addition; therefore, the KD does not have to be cool.

Double volumes of surrogates and matrix spiking solutions are not added when a sample requires gel-permeation cleanup. Instead, the extract is concentrated to one-half the normal final volume after GPC to make up for the loss on GPC and maintain the limit of quantitation.

The Joint of the K-D is not rinsed with fresh solvent when the ampule is removed. Quad and MDL studies have shown that this step is unnecessary.

Definitions
1. GPC – Gel Permeation Cleanup

2. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

3. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide

information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

4. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample

Interferences

Method interferences may be caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. All glassware is rinsed with solvent before use and a method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.
Since the extracts are concentrated on a steam bath, caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or must be disposed of in the designated containers. These will then be transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) may be disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the technicians training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Samples are collected in wide-mouth glass jars with PTFE-lined lids and stored under refrigeration at 0º to 6º C, not frozen, prior to extraction. Samples must be extracted within 14 days of collection. Extracts are stored in the freezer at -10° to -15°C.

Apparatus and Equipment

1. MARS Xpress – CEM Corp. or equivalent

2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during concentration

3. Steam bath, VWR/LLI Model #1127 or equivalent

4. N-Evap with nitrogen supply

5. Beakers – Stainless steel, assorted sizes

6. Pipettes – Class A, assorted sizes
7. Pipettes – Disposable

8. Balance – Capable of weighing to 0.01 g

9. Teflon®-wash bottles

10. Vials – Assorted sizes

11. Teflon®-boiling chips

12. Forceps

13. Scoop

14. TurboVap II concentration workstation w/appropriate concentration tubes – Zymark or equivalent

15. Funnels – stainless steel or Teflon®

16. Extraction vessels

17. Frits – Various

18. Sodium Sulfate Columns

19. glass vial inserts

Reagents and Standards

1. Hexane – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt

2. Acetone – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt

3. Methylene Chloride (CH_2Cl_2) – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt

4. Sodium Sulfate (Na_2SO_4) – Reagent grade or equivalent. Bake at 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

5. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding Analysis #*0042, 1030, 6011, 7512, 10225, 10736, 10906, 12800, 13236*.

Preparation of Glassware

See ***T-OE-GEN-WI10864***

Calibration

Not applicable to this procedure

Procedure

1. Sample aliquot

a. If Sample Registration has pre-weighed the sample into a glass jar, add 5g of sodium sulfate, mix and proceed to step 2.

b. If the sample is not pre-weighed:

(1) For preps 10497, 11140, 13100, 14652: weigh 30.0 - 30.5 g of sample into a labeled stainless steel beaker. (If matrix is tissue, weigh 15.0 - 15.5 g)

(2) For prep 13998: weigh 10.0 - 10.5 g of sample into a labeled stainless steel beaker.

(3) For prep 14114: weigh 3.0 - 3.5 g of sample into a labeled stainless steel beaker

(4) Record the initial weight and any comments about the sample in the extraction log.

(5) Alternative sample weights may be used to meet certain reporting limits. However, if sample weight greater than 30.5 is used, the sample must be divided among multiple vessels and the extracts combined.

c. If sample is a wipe: record “wipe” in the matrix type section of the extraction log and enter the amount as 1 g in both the extraction log and the extractables database.

(1) Remove wipe from the vial with clean forceps and place in a stainless steel beaker along with any solvent in the vial.

(2) Use a wash bottle to rinse the vial with a few mL of acetone/methylene chloride and add the rinseate to the beaker.

(3) Record any comments about the sample in the extraction log.

(4) Enter the final volume and surrogate/spike volumes in liters in the extractables database.

d. Process all tissues by Analysis #*2487* prior to extraction.

e. Add approximately 5 g of sodium sulfate to each sample and mix.

(1) If the sample has high water content or is a clay-like soil, add additional sodium sulfate until a free-flowing consistency is reached.

(2) Mix the sodium sulfate and sample until a free-flowing consistency is reached.

e. The Blank, LCS, and LCSD (if applicable) are prepared by:

(1) For preps 10497, 11140, 13100: filling a Teflon® extraction vessel with 30.0 - 30.5 g sodium sulfate. Record 30 g on the extraction log. (The sodium sulfate used for the QC samples is measured out as 35.0 grams to account for the 30 gram “sample” plus the 5 grams of sodium sulfate.) (If sample matrix is tissue, use 15.0-15.5 g tilapia and add approximately 5 g sodium sulfate. Then mix.)

(2) For prep 13998: filling a Teflon® extraction vessel with 10.0 - 10.5 g sodium sulfate. Record 10 g on the extraction log. (The sodium sulfate used for the QC samples is measured out as 15.0 grams to account for the 10 gram “sample” plus the 5 grams of sodium sulfate.)

(3) For prep 14114: filling a Teflon® extraction vessel with 3.0 - 3.5 g sodium sulfate. Record 3 g on the extraction log. (The sodium sulfate used for the QC samples is measured out as 8.0 grams to account for the 3 gram "sample" plus the 5 grams of sodium sulfate.)

2. Carefully place each sample into its clearly marked corresponding extraction vessel. A funnel is used to prevent spillage and loss of sample.

3. Use pipettes to add surrogate standards and spiking solutions.

   a. Surrogates – 1.0 mL of SW846 surrogate is added to all samples (including QC).

   b. Spiking solutions:

      (1) For all analyses (except 14634): 1.0 mL of PCB spiking solution is added to the LCS, LCSD if applicable, MS, and MSD.

      (2) For prep 14652, analysis 14634: 1.0 mL of 1242 spike is added to the LCS, LCSD if applicable, MS, MSD.

   c. This may change to accommodate specific client requirements.

   d. See ***T-OE-GEN-WI10876*** for storage and handling of spikes.

4. Add 30 mL of 50% acetone in methylene chloride to each vessel.

5. Cap each vessel according to manufacturer's guidelines.

6. Invert each vessel to ensure mixing of sample and solvent.

7. Place the vessels into the carousel. When all samples are loaded, place the carousel into the microwave.

8. Run Program "LL1". See Table I for Instrument conditions. Verify that the run reached 100°C and document on the batchlog.

9. Uncap the cooled vessel. Pour the extract and sample into a column filled with approximately 10cm of sodium sulfate on top of a Kuderna-Danish (K-D) assembly containing a Teflon®-boiling chip. Rinse the vessel with approximately 10 mL of methylene chloride from a wash bottle and pour through salt column. Rinse the column with approximately 10 mL of methylene chloride.

10. Place a 3-ball Snyder column on the K-D set-up and concentrate over a steam bath which is at 85° to 99°C.

This steam bath temperature ensures concentration in a reasonable length of time.

If the sample requires GPC, skip step 11.

11. When the apparent volume is 3 to 5 mL, using a bottle-top dispenser, add approximately 50 mL of hexane directly to the KD through the Snyder column.

Do not allow the ampule to go dry since loss of analytes will result.

12. When the apparent volume again reaches 3 to 5 mL, remove from the steam bath and allow to cool for approximately 10 minutes until the K-D setup reaches ambient temperature. Remove the ampule and, using a wash bottle, adjust the final volume to exactly 10 mL with hexane in a calibrated ampule.

NOTE: If the sample requires GPC, N-Evap to approximately 1 mL, then adjust the final volume to exactly 10 mL with methylene chloride instead of hexane. N-Evap if necessary.

Mix thoroughly with a disposable pipette.

13. If the sample requires GPC, perform GPC cleanup following ***T-OE-PEST-WI11410***. When GPC cleanup is complete, concentrate the extract as described above including Step 11. However, in Step 12, adjust the final volume to exactly 5 mL with hexane instead of 10 mL.

14. Treat the 10 mL extract with sulfuric acid as described in ***T-OE-PEST-WI10281***.

15. Perform the copper and florisil cleanup on the extract as described in ***T-OE-PEST-WI10281***.

16. Bottle in three appropriately labeled crimp-top autosampler vials (one with an insert), and place the remaining extract in an appropriately labeled screw-cap vial.

17. All extracts are stored in the freezer.

Calculations

See analysis method.

Statistical Information/Method Performance

See analysis method.

Quality Assurance/Quality Control

A batch is defined as the samples to be extracted in any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted, a blank, LCS, MS, and MSD must be extracted. If insufficient volume of sample is available for MS/MSD, then an LCSD must be prepared instead.

If any client, state, or agency has more stringent QC or batching requirements, these must be followed.

Table I

Power:	1600W

Ramp Temperature:	100°C
Ramp Time:	30 minutes
Hold Time:	10 minutes
Cool Down Time:	20 minutes

T-OE-GEN-WI10864 Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876 Organic Extraction Standards Storage and Handling
T-OE-GEN-WI7154 Food and Tissue Preparation
T-OE-PEST-WI10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-PEST-WI11410 Pesticide Extract Cleanup Using GPC by Method 3640A
T-PEST-WI11972 Polychlorinated Biphenyls (PCBs) by Method 8082 in Solids and Wipes

End of document

Version history

Version	Approval	Revision information
7	03.DEC.2015	
8	17.APR.2018	
9	24.OCT.2019	

An error has happened on file: /D4Doc/formularer/2016/09/Quality Document # 1-P-QM-WI -9015104_7_1049711140.doc
Errortext: The remote server returned an error: (404) Not Found.

eurofins	Always check on-line for validity. **Polychlorinated Biphenyls (PCBs) in Solid Samples by 8082A Using GC-ECD**	Level: **Work Instruction**
Document number: **T-PEST-WI10004**		
Old Reference: **1-P-QM-WI-9015110**		
Version: **9**		Organisation level: **5-Sub-BU**
Approved by: **UKA4** Effective Date **29-MAR-2018**	Document users: **6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Pesticide Residue Analysis_Manager**

LIMS ID
Analysis - 10592, 10885, 12718, 13099, 13219, 13713

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Appendix I

Revision Log

Revision 9	**Effective Date:** This version	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Reference	Reflects current references	Added 8000D

Revision 9	**Effective Date:** This version	
Cross Reference	Updated references to D4	Changed from ETQ reference to D4 throughout document
Interferences	Enhancement	Added information on DDD,DDT, and DDE interference
Sample Collection, Preservation, and Handling	Reflects method hold time	Changed hold time to none recommended
Reagents and Standards 5.	Clarification	Removed sentence on 2 different sources for ICAL and matrix spike
Reagents and standards	Correction	Updated surrogate stock used for IBLK.
Calibration	Reflects current sequence	Added AR166, AR486, and AR546 Changed CCVs from level 3 to level 4.
Calibration 2.a.(4)	Clarification	Added 1248
Calibration 5.	Clarification	Added wording on using each individual peak choosen in the pattern for calculating ave CF.
Statistical Information/Method Performance	Reflects current process	Changed wording to similar verbiage as other department SOPs. added LLOQ requirement
Appendix I	Reflects current sequence	Added AR166, R486 and AR546

Revision: 8	**Effective Date:** Aug 26, 2016	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Cross Reference	References not needed	Removed 1-P-QM-QMA-9015390 and 1-P-QM-QMA-9017309
Scope	Reflects current Aroclors	Updated table to include Aroclor 1262 and 1268 Added 1262 and 1268 to analysis scan 13099 in the table
Basic Principles	Old reference not needed	Removed old reference number SOP-OE-004
Reference Modification	Reflects the current reference method	Updated reference to 8082A
Definition	Common laboratory terms defined in higher level documents	Removed definitions
Interferences	Old reference not needed.	Removed old reference number SOP-OE-004
Personnel Training and Qualifications	Reference not needed	Removed reference 1-P-QM-QMA-9015390.
Sample Collection, Preservation, and Handling	Reflects current storage condition for extracts	Added temperature storage condition for extracts.
Apparatus and Equipment	Reflects current instrumentation in use	Updated to HP7890

Revision: 8	**Effective Date:** Aug 26, 2016	
Reagents and Standards	Reflects current standard solution storage condition	Updated standard solution temperature storage condition from -10 to -15°C to ≤-10°C
Reagents and Standards 18.d	Reflects current MS and SS spike solutions	Updated to the current spike solution names.
Extraction	Reflects current scans	Added Analysis #13100
Calibration	Reflects current process Reflects current analysis sequence Reflects current naming convention	Removed changing the septa prior to calibrating. Updated sequence to include running the EVAL. Renumbered the sequence. Updated name from AR32X to AR323
Calibration 2.a	Reflects current standard code	Updated name from AR32X to AR323 and renumbered section.
Calibration 5.e.	Reflects current process Old references not needed	Added North Carolina criteria for linear fit. Removed old reference numbers SOP-PP-031, SOP-PP-013, and SOP-PP-032
Procedure 2.a	Old reference not needed	Removed old reference number SOP-PP-011
Procedure 4	Reflects current practice	Added hexane as the solvent used for dilutions
Calculation	Old reference not needed	Removed old reference number SOP-PP-040
Statistical Information/Method Performance	Reference not needed	Removed reference 1-P-QM-QMA-9017309
Quality Assurance/Quality Control	Clarification Old reference not needed	Moved QC acceptance limits statement from Statistical Information/Method Performance section to this section. Removed old reference number SOP-PP-002
Appendix I C.	Reflects current sequence Reflects current MS and SS spikes	Added EVAL and renumbered sequence Updated names of parent solution and solvent used for each spike preparation

Reference

1. *Test Methods for Evaluating Solid Waste*, SW-846, Method 8082A, February 2007.

2. Determinative Chromotographic Separations, SW-846, Method 8000D, July 2014

3 *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #0819, 11128, 11132, 11135	Ultrasonic Extraction for PCBs in a Solid Matrix by Method 3550C
Analysis #10497, 11140, 13100	Microwave Extraction Method 3546 for PCBs in a Solid Matrix
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-PEST-WI10011	QC Data Acceptability and Corrective Action
T-PEST-WI9954	Interpretation of Chromatographic Data
T-PEST-WI10007	Preventative and Corrective GC Maintenance
T-PEST-WI9980	Monitoring QC Data Acceptance Limits
T-PEST-WI10016	Setting Up Single Component Initial Calibrations
T-PEST-WI10022	Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses

Scope

This method is used for identifying and quantitating the following PCBs in solid samples and wipes using SW846 8082A:

Compound	Soil LOQ (µg/kg)	Wipes LOQ (µg)	Tissue LOQ (µg/kg)
Aroclor 1016	17	0.5	34
Aroclor 1221	17	0.5	34
Aroclor 1232	17	0.5	34
Aroclor 1242	17	0.5	34
Aroclor 1248	17	0.5	34
Aroclor 1254	17	0.5	34
Aroclor 1260	17	0.5	34
Aroclor 1262	17	0.5	34
Aroclor 1268	17	0.5	34

Aroclors 5422, 5432, and 5460 can be analyzed upon request of the client. See Appendix I for GC operating conditions and calibration information.

Compound	Soil LOQ (µg/kg)
Aroclor 5422	33
Aroclor 5432	33
Aroclor 5460	33

Limits of Quantitiation (LOQs) are based on statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS.

Analysis LIMS scan	Extraction LIMS scan	Description (targets)
10592	11132 sonication	Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260 Aroclor 1262, 1268
10885	10497 microwave	Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260 Aroclor 1262, 1268
13099	13100 microwave	Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, 1268 Aroclor 5432, 5442, 5460
12718 wipes	10497 microwave	Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260 Aroclor 1262,1268
13219 tissue	11128 sonication	Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260 Aroclor 1262,1268
13713 tissue	10497 microwave	Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260 Aroclor 1262,1268

Basic Principles

A solid sample or entire wipe is extracted using sonic probe with 1:1 methylene chloride:acetone, or microwave extraction with hexane. The extract is dried, concentrated, and exchanged to hexane. A florisil and sulfuric acid cleanup is utilized to reduce any matrix interferences. The PCBs are then identified and quantitated using gas chromatography (GC) with electron capture detector (ECD). Copper cleanup may also be employed to reduce elemental sulfur or other matrix interferences which introduce large, unresolvable peaks into the chromatogram. Refer to *T-OE-PEST-WI10281* for details on each cleanup procedure.

Solid matrices other than soil can also be analyzed as long as the sample can be handled through the extraction technique. Typically solids are reduced to small pieces for extracting (concrete, wood, other plant material etc). Tissue samples are ground and homogenized prior to extracting. Tissue samples may be whole fish, filets, or other miscellaneous species (usually aquatic but not necessarily). Wipe samples are analyzed by taking the entire wipe sample and any solvent in the sample container.

Reference Modifications

Gas Chromatography conditions are different than those listed in Method 8082A however, all QC criteria are met.

Interferences

Avoid contact with any plastic material during the extraction and analysis procedures to minimize interferences from phthalate esters.

Scrupulously clean all glassware to minimize interferences caused by laboratory contaminants.

An electron capture detector (ECD) is very sensitive to compounds that contain halogens and will also respond to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur.

Extracts may require further cleanup by sulfuric acid, florisil, or copper if interferents such as oxygenated organics, unsaturated organics, and elemental sulfur are present. Refer to *T-OE-PEST-WI10281* for details on each cleanup procedure.

Common single component pesicides such as DDT, DDD, and DDE may cause interference with the aroclor pattern. To ensure that the analyst is aware of this, a standard containing DDE/DDD/DDT will be run with each initial calibration.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Gloves, lab coats, and safety glasses must be worn when preparing standards. Safety glasses must be worn around the GC where solvents and sample extracts are handled.

GC vials are disposed of in the designated lab container and subsequently lab packed for final disposal. All solvent waste is placed in designated containers in the laboratory then taken to the lab-wide facility by personnel trained in hazardous waste disposal.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, one blind sample, or one ICAL with ICVs and/or CCVs.

Sample Collection, Preservation, and Handling

Samples are collected in wide-mouth glass containers with Teflon™-lined caps and kept cool at 0° to 6°C, not frozen.

PCBs have no maximum recommended holding time for the extraction. Some agencies or projects may require a specific hold time for the extraction. If the hold time is specified in the project, this hold time must be followed. Sample analysis must be performed with 40 days of extraction. Extracts are stored in the freezer at ≤-10°C

Apparatus and Equipment

1. HP 7890 gas chromatograph equipped with an electron capture detector or equivalent

2. Columns:

   a. Phenomonex MultiRes I – 30 m × 0.32 mm × 0.5 µm or equivalent

b. Phenomonex MultiRes II – 30 m × 0.32 mm × .25 µm or equivalent

c. Alternatively, Restek columns can be used.

3. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent. Chrom Perfect® is a data system capable of storing and reintegrating chromatographic data and determining peak areas using a forced baseline, area summation, baseline projection, and performing baseline compensation as required.

4. Various sizes of Class A volumetric flasks, pipettes, and syringes

Reagents and Standards

A. Reagents

1. Hexane for autosampler rinse vials. Stored at room temperature.

2. UPC (Ultra pure carrier) helium for carrier gas

3. UPC nitrogen for detector make-up gas

4. UPC hydrogen for carrier, either bottled or from a generator

B. Standards

1. All standards are prepared using Class A volumetric pipettes, syringes, and flasks.

2. An analytical balance is used to measure all weights.

3. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.

4. All prepared standard solutions are stored at ≤-10°C in labeled containers or vessels.

5. Aroclor 1016 & 1260 stock – Restek #32039 at 1,000,000 ppb in isooctane or equivalent.

   Prepare a ten-fold dilution for an intermediate.

6. Aroclor 1016 ICV Stock – Accustandard Cat# C-2165-H-10X at 1,000,000 ppb in Hexane.

7. Aroclor 1260 ICV Stock - Accustandard Cat# C-2605-H-10X at 1,000,000 ppb in Hexane.

8. Aroclor 1221 stock – Restek #32007 at 100,000 ppb in isooctane or equivalent. Two lots are kept on hand to provide a second source.

9. Aroclor 1232 stock – Restek #32008 at 100,000 ppb in isooctane or equivalent. Two lots are kept on hand to provide a second source.

10. Aroclor 1242 stock – Restek #32009 at 100,000 ppb in isooctane or equivalent. Two lots are kept on hand to provide a second source.

11. Aroclor 1248 stock – Restek #362010 at 1,000,000 ppb in isooctane or equivalent. Two lots are kept on hand to provide a second source

Prepare an intermediate by diluting 1 mL to 10 mL of hexane. .

12. Aroclor 1254 stock – Restek #32011 at 1,000,000 ppb in isooctane or equivalent. Two lots are kept on hand to provide a second source.

Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

13. Surrogate stock (SS) – Supelco #861284 containing DCB/TCX at 200,000 ppb in acetone or equivalent.

Prepare an intermediate by diluting 1.0 mL to 25 mL of hexane for AR1016/1260, AR1254, AR1248.

14. 1016/1260 Matrix spike (MS) stock – Restek #32039 at 1,000,000 ppb in hexane or equivalent.

15. Aroclor 1262 stock – Restek #32409 at 1,000,000 ppb in hexane or equivalent.

Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

16. Aroclor 1268 stock – Restek #32410 at 1,000,000 ppb in hexane or equivalent.

Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

17. Instrument Blank (IBLK) – Surrogate Stock (SS) – Restek #32000 containing Decachlorobiphenyl (DCB) and Tetrachlorometaxylene (TCX) at 2000,000 ppb in acetone or equivalent.

18. Prepare working standards using the electronic standard database as a guide.

a. In the database, choose the category (i.e. working spike, surrogate, intermediate, etc) and the required standard.

b. The database contains the following information: solution description (ex. AR161), parent solution name, aliquot used, final volume, solvent used, concentration of each compound in the solution, and expiration date. The working standards have an expiration date of 6 months.

c. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level.

d. The scheme for preparing the matrix and surrogate spiking solutions used in the extraction process are listed below.

Standard Name	Parent Solution	Aliquot (mL)	Final Volume (mL)	Solvent	Description
PCB Spike	Aroclor 1016/1260 MS Stock	1.25	250	Acetone	PCB Spike
SS	Pest Surr Stock	1.5	1000	methanol	SW-846 Water surrogate – identical to that prepared for Pest/PCB analyses

19. An initial calibration verification standard must also be prepared at a concentration at the mid-point of the calibration for 1016, 1260,1248 and1254 using a stock solution purchased from a different source other than that used for the calibration standards.

20. Additional standards and preparations are listed in Appendix I for Aroclor 5442, 5432, and 5460 (PCT analysis).

Extraction

See Organic Extraction Analysis #0819, 11128, 11132, 11135 or *Analysis #10497, 11140, 13100*

Gas Chromatographic Conditions

The conditions listed are usually the optimum operating conditions but can vary to improve the sensitivity, linearity, and overall chromatography or shorten run times on each GC system.

Detector	ECD
Detector Temperature	330°C
Oven Temperature	110°C 40°C/min to 250°C 20°C/min to 280°C 30°C/min. to 330°C Hold until DCB elutes ~ 2 min.
Carrier	Hydrogen at 12 psi, 5ml/min constant flow (Can be substituted with Helium)
Makeup gas	N2 at 30 mL/min. for Varian GCs N2 at 55 mL/min. for HP GCs
Injection size	1 µL, direct injection
Injection Temperature	225°C

A Merlin microseal may be used in place of a traditional septum.

Calibration

1. Fill the autosampler rinse vials with clean solvent or replace vials which appear dirty.

2. Prepare a sequence using the following suggested order of injections:
    1. Conditioner
    2. IBLK
    3. EVAL
    4. AR161
    5. AR162
    6. AR163
    7. AR164
    8. AR165
    9. AR166
    10. AR481
    11. AR482
    12. AR483
    13 AR484
    14. AR485
    15. AR486
    16. AR541
    17. AR542
    18. AR543
    19. AR544
    20. AR545
    21. AR546

22. AR214
23. AR324
24. AR424
25. AR624
26. AR684
27 AR16xx
28. MD16 (MDL)
29. IC16x (ICV)
30. IC48x (ICV)
31. IC54x (ICV)
32. Blank
33. LCS
34. 1234567
35. 1234567ms
36. 1234567msd

37 – 47. Continue running samples

48. AR164 (CCV)
49. IBLK

a. For routine PCBs:

(1) The AR21, AR32, and AR42 are level 4's in the cal and are entered at AR214, AR324, and AR424 in the cal.

(2) AR62 and AR68 are both level 4s and are listed as AR624 and AR684 in the sequences.

(3) A single point of Aroclor 1016 is analyzed with the calibration to aid in better pattern recognition in the samples. Aroclor 1016 and 1242 have similar patterns with the exception of the smaller trailing peaks at the end of the Aroclor 1242 pattern. This is identified in the sequence as AR16xx.

(4) A DDT/Endrin breakdown standard is run with each ICAL in order to provide the retention times for p,p-DDE, p,p-DDD, and p,p-DDT which may interfere with the pattern for aroclor 1248, 1254 and 1260.

b. See Appendix I for a sequence example when the analysis of PCTs (Aroclors 5442, 5432, and 5460) is requested.

3. Inject conditioner to prime the system.

a. The conditioner injection is usually a standard or sample which has already been injected.

b. It is used to prime the system and is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.

c. Hexane blanks may also be run to allow the GC to go through some temperature programs and/or to check the cleanliness of the system.

4. An instrument blank (IBLK) is always run prior to a new calibration to confirm that the instrument is free of background noise or contamination.

IBLK may also be run with the continuing check standards - this is optional but frequently requested for projects.

5. Initial Calibration (ICAL)

a. Calibrate for the aroclors using the six levels of 1016, 1260, 1248, and 1254 (calibration range of 50 µg/L through 1000 µg/L) and using the single point for 1221, 1232, 1242, and 1262 and 1268 when needed (200 µg/L standard used).

b. As an option, 1248 and 1254 may use a single point calibration.

c. An external standard calibration based on the average calibration factor (AVG CF)for each individual peak chosen in the pattern is used for quantitation where the %RSD is ≤20%.

d. The surrogate standards are calibrated using the AR16 levels and the calibration is also performed using AVG CF unless the %RSD is >20%.

e. When the % RSD criteria is not met (i.e.> 20%), a linear calibration curve is used.

(1) The curve must meet a correlation coefficient of 0.99 to be a valid fit.

(2) Extrapolate or force to zero is not allowed. Set the zero to ignore.

(3) See *T-PEST-WI10016* for more details.

(4) North Carolina and 8000D requires calculation of % error for any linear fits. The criteria for % error of standard levels at or below the LOQ is +/- 50% . The criteria for % error of all other standard levels is +/-30%.

%error = ((true – calc)/true) x 100

f. If the %RSD criteria or 0.99 curve coefficient cannot be met:

(1) Inspect the data points to see if one or more calibration levels may have concentrated due to solvent evaporation or degraded over time.

(2) Reinject or remake the standard if this is the cause.

(3) Perform instrument maintenance as needed.

(4) See *T-PEST-WI10007* for troubleshooting linearity problems.

A quadratic fit may not be used for South Carolina samples.

g. Set up the aroclor calibration data in a custom program under Datalog.

(1) The retention times of the peaks to use for identifying and quantifying the aroclors are entered into the calibration file along with the corresponding peak heights and concentrations (in µg/L).

(2) See *T-PEST-WI10022* for details.

h. Ensure the surrogate peaks in the standards are labeled properly.

i. Set the scaling of chromatograms so that the size of the peaks of interest for each aroclor are approximately 2 to 3 mm in height at the concentration of the method detection limit (MDL).

(1) Ensure all peaks in the MDL standard are integrated.

(2) By running the1016/1260 MDL standard, the majority of peaks for all aroclors should be represented.

6. Initial Calibration Verification (ICV)

a. Verify the calibration curves using the ICV mixtures injected directly after the full ICAL.

b. The % difference of the concentrations of each individual peak used to calculate the Aroclor must be within 20% difference of the nominal concentration.

7. Continuing Calibration Verification (CCV)

a. Calibration verification is performed after each set of twenty injections (samples, QC, blanks, etc.) or 12 hours, whichever comes first.

b. Use AR16 to evaluate the calibration of the aroclors (or other aroclors as requested for particular clients or projects).

c. The concentration quantitated for each individual peak used to calculate the Aroclor in the continuing calibration verification standards must be within 20% difference (%D) of the nominal concentration for each peak/surrogate.

d. Samples must be bracketed by compliant standards.

(1) Exception: If standard following a sample is outside the ±20% but exhibits increasing response, the samples before it do not have to be reinjected if the target analytes are not detected. A comment must be added to the analytical report.

(2) If two consecutive/sequential CCVs fail, corrective action must be taken, which can include performing injection port maintenance, baking the instrument or other types of maintenance. Two consecutive/sequential CCVs must meet the criteria or an initial calibration must be performed before sample analysis can continue.

e. If confirmation of target analytes is needed, then the second column should meet the 20% continuing calibration criteria, as well as all initial calibration criteria. if either of these are not met, a comment must be added to the analytical report.

8. The instrument blank (IBLK) is injected after each set of continuing calibration verification when requested.

a. It must be evaluated as a water matrix against the water MDL/LOQs.

b. The IBLK must not have any target compounds above the reporting limits.

(1) If a target analyte is detected in the IBLK, any associated samples with a detection for that same target must be evaluated.

(2) Unless the concentration in the sample is more than 10x the IBLK value, the sample must be injected after another compliant IBLK.

(3) Instrument maintenance, i.e., baking the system or injection port maintenance is usually necessary to clean up the instrument.

9. Retention time (RT) windows

a. Established as 3× the standard deviation determined over 72 hours, or at no less than ±0.02 min, applied to the midpoint initial calibration standard.

b. If the RTs for a continuing calibration verification standard fall outside the RT window, update the midpoint RT using that standard.

(1) Save this under the appropriate name to indicate an update has occurred.

(2) RTs cannot be updated more than once per day. All subsequent standards run within a 24-hour period must be within this window.

(3) If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure

1. Prepare a sequence of injections as suggested in the Calibration Section, along with the appropriate check standards.

2. Retention times of peaks in the samples are compared to the standard RT windows

a. Peaks present on both columns that are also in the correct ratios to represent an aroclor are quantitated, and the high value is reported unless chromatographic anomalies are observed. See *T-PEST-WI9954*.

b. Use a minimum of three to six peaks for quantitation, with the exception of certain mixes where it may be more accurate to use less peaks to avoid excessive overlap of patterns.

3. Continue running groups of samples/injections followed by check standards every 12 hours or 20 injections, whichever comes first.

a. For projects where a known aroclor is present and at the request of clients, other aroclors can be run for the continuing check standard. For instance, a set of continuing standards may be AR484, AR164, IBLK.

b. Aroclor 1262 and 1268 can be analyzed when requested. A full six point curve can also be run, depending on the project requirements.

4. If significant interference is present, schedule florisil and/or sulfuric acid cleanup. If elemental sulfur is present, TBA or copper the extract or have it put through GPC cleanup. If these techniques do not reduce the matrix problems, dilute the extract with hexane and adjust LOQs accordingly.

5. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

Calculations

1. The peak heights generated by the integration system are used to calculate the calibration factors (CF) for peaks of interest for each aroclor.

Usually, the six major peaks that are unique to each aroclor are chosen for quantitation, with the exception of 1221 where only three peaks are available.

2. Sample concentrations are calculated per peak using average calibration factor (AVG CF) from the initial calibration.

$$\frac{Sample\ Height}{AVG\ CF\ (CF)} \times \frac{FV}{IW} \times DF = \mu g/kg\ as\ received\ per\ peak$$

Where:

FV = Final volume (mL)

IW = Initial weight (g)

DF = Dilution factor, as needed

The final result that is reported is determined as the average of the result for each peak chosen for quantitation:

$$(Result\ 1 + Result\ 2 + \ldots + Result\ n) / n = Average\ Result$$

3. The surrogate results are determined using either AVGRF or linear curve:

Using AVGCF from the initial calibration:

$$\frac{Sample\ Height}{AVCRF\ (CF)} \times \frac{FV}{IW} \times DF = \mu g/kg\ \ as\ received$$

b. Using linear curve from the initial calibration:

$$[(Sample\,Height - Y - intercept)/Slope] \times \frac{FV}{IW} \times DF = \mu g/kg\,as\,received$$

Where:

FV = Final volume

IW = Initial weight

DF = Dilution factor, as needed

4. See *T-PEST-WI9847* for all other equations related to the analysis.

Statistical Information/Method Performance

LCS, MS, and RPD are compared to the limits stored in the LIMS. The limits for LCS and MS are statistically derived. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Acceptance limits are generated according to *T-PEST-WI9980*. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

When 8000D is referenced an annual lower limit of quantification (LLOQ) verification is required annually on at least one instrument. All instruments must have one at least every three years. LLOQV is required by 8000D.

Quality Assurance/Quality Control

QC Acceptance limits are established as statistical limits. See *T-PEST-WI9980* further information on monitoring and establishing limits.

A sodium sulfate blank and a sodium sulfate spike (LCS) are analyzed with every group of samples up to a maximum of 20. An MS/MSD is performed per batch. For wipes and when an MS/MSD cannot be performed, an LCSD will be extracted.

Aroclor 1016 and 1260 are routinely spiked; however, other aroclors can be spiked as requested by clients.

DCB and TCX are added as surrogates to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the GC run.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed.

See *T-PEST-WI10011* for details on QC acceptance criteria and corrective action.

Appendix I

PCT Analysis (Aroclor 5422, 5432, and 5460)

A. Standards:

1. PCT-Stocks- Aroclor 5432, 5442, and 5460 purchased as individually ampulated solutions from Accustandard at 35,000ug/L.

2. Surrogate Stock- Ultra ISM-320 containing TCX/DCB at 200,000ppb in acetone. Prepare an intermediate by diluting 0.25mL to 25mL of hexane.

3. MS stock of Aroclor 5442 - Absolute cat# 71791, 1000ug/L in Methanol.

4. Prepare working standards using the electronic standard database as a guide.

a. In the database, choose the category (i.e. working spike, surrogate, intermediate, etc) and the required standard.

b. The database contains the following information: solution description (ex. AR161), parent solution name, aliquot used, final volume, solvent used, concentration of each compound in the solution, and expiration date. The working standards have an expiration date of 6 months.

c. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level.

d. The scheme for preparing the matrix and surrogate spiking solutions used in the extraction process are listed below.

Standard Name	Parent Solution	Aliquot (mL)	Final Volume (mL)	Solvent	Description
MS	Aroclor 5422 Stock	0.75	100	Acetone	Aroclor 5442 PCT Spike
SS	Pest Surr mix	1.5	1000	methanol	SW 846 surrogate

B. GC Chromatographic Analysis

The conditions listed serve as a guideline only and are typically the optimum operating conditions. The analyst may make any changes to the chromatographic conditions to improve the speed of analysis, linearity, sensitivity, and/or improve separation if initial and continuing calibration criteria and quality assurance criteria listed within this analysis document are met.

Detector: ECD

Detector temp: 330°C

Oven Temp: 110°C to 250° at 40°C/min, to 280°C at 20°C/min, to 330°C at 30°C/min, hold 9 min.

Carrier: Hydrogen at 3.6 mL/min

Makeup gas: N_2 at 60mL/min or equivalent

Injection size: 1-uL, direct injection

Injection temp: 225°C

C. Example of a Sequence:

1. Conditioner
2. IBLK
3. EVAL
4. AR161
5. AR162

6. AR163
7. AR164
8. AR165
9. AR166
10. AR481
11. AR482
12. AR483
13. AR484
14. AR485
15 AR486
16. AR541
17. AR542
18. AR543
19. AR544
20. AR545
21. AR546
22. PCT1
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29. A4423
30. A4424
31. A4425
32. AR213
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38. MDPCTX
39. MD16
40. IC16
41. IC48
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43. Blank
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47. 1234567MSD
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63. AR163
64. PCT3
65. A4423
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T-OE-PEST-WI10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-PEST-WI10922 Ultrasonic Extraction for PCBs in a Solid Matrix by Method 3550C
T-OE-PEST-WI10927 Microwave Extraction Method 3546 for PCBs in a Solid Matrix
T-PEST-WI10007 Preventative and Corrective GC Maintenance
T-PEST-WI10011 QC Data Acceptability and Corrective Action
T-PEST-WI10016 Setting Up Single Component Initial Calibrations
T-PEST-WI10022 Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs
T-PEST-WI9847 Common Equations Used During Chromatographic Analyses
T-PEST-WI9954 Interpretation of Chromatographic Data
T-PEST-WI9980 Monitoring QC Data Acceptance Limits

End of document

Version history

Version	Approval	Revision information
8	26.AUG.2016	
9	29.MAR.2018	

eurofins	Always check on-line for validity. **Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD**	Level: **Work Instruction**
Document number: **T-PEST-WI9238**		
Old Reference: **1-P-QM-WI-9015109**		
Version: **6**		Organisation level: **5-Sub-BU**
Approved by: **UKA4** Effective Date **29-MAR-2018**	Document users: **6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Pesticide Residue Analysis_Manager**

LIMS ID
Analysis - 10591, 13092

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Revision Log

Revision 6		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Reference	Reflects current references	Added reference for 8000C and 8000D

Revision 6	**Effective Date:**	This version
Cross Reference	References to higher level documents not necessary	Removed references 1-P-QM-QMA-9015390 and 1-P-QM-QMA-9017309
Interference	Enhancement	Added interference from DDD, DDE, and DDT.
Scope	Reflects current LOQs	Updated PCTs from 0.5 ug/L to 1.0 ug/L
Definitions	Common terms defined in higher level documents	Removed section
Personnel Training and Qualifications	Reference to higher level documents unnecessary	Removed reference to 1-P-QM-QMA-9015390
Sample Collection, Preservation, and Handling	Reflects current extract storage conditions and preservation	Added extract storage condition. Removed information on preservation. Changed sample extraction hold date to none recommended.
Apparatus and Equipment	Enhancement	Reformatted section
Reagents and Standards	Reflects current standards	Removed individual 1260 standard. Updated Bottle Code 43 table Added the MS and SS working solutions are stored at ≤-10° C.
Extraction	Reflects current prep LIMS scans	Removed all prep LIMS scans except 11121 and 13093
Calibration	Reflects current practice	Removed wording on changing the septa prior to starting calibration Added AR16X to the sequence. Added step when new ICV does not meet criteria. Changed from using 5 levels to using 6 levels for the calibration. Changed from using level 3 for CCV to using level 4.
Calibration	Reflects 8000D	Added information on 8000D criteria. Added information that all individual peaks must meet the criteria.
Procedure	Reflects current practice	Removed GPC cleanup. Added information on raising reporting limits.
Calculations	Reflects current final and initial volumes	Added 2 ml and 250ml for final volume and initial volume, respectively
Statistical Information/ Method Performance	Reflects current process	Removed reference to 1-P-QM-QMA-9017309. Added wording similar to the SOP for SW 846 8082.
Statistical Information/ Method Performance	Reflects current method requirement	Added similar verbiage as the other department SOPS using 8000D.
Appendix 1	Reflects current PCT standards	Added manufacturer for individual standards. Updated table for MS Spike and surrogate spike. Added text

Revision 6	**Effective Date:** This version	
		indicating that the MS and SS working solutions are stored at <-10° C. Added 6 levels of PCBs.

Revision: 5		**Effective Date:** Nov 04, 2015
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Historical/ Local Document Number	LIMS scan relevant to this procedure	Add 13092 for PCTs
Sample Collection, Preservation, and Handling	Reflects current industry standard for refrigeration storage.	Changed to 0° to 6° C, not frozen.
Apparatus and Equipment	Reflects current instrumentation	Updated 7890 GC
Calibration	Reflects method criteria Enhancement Reflects current procedure	Changed wording to second column should meet 20% continuing calibration criteria. Added information on analyzing an EVAL to aid in identifying possible DDD, DDE, and DDT in the aroclor pattern. Added information on analyzing a single PCB 1016 standard to help with pattern recognition. Changed the RT window from 0.03 to 0.02 min.
Gas Chromatographic Conditions	Reflects current operating conditions	Updated GC conditions.
Calculation	Clarification	Added information on not using individual peaks where the value is <MDL in calculating the PCB concentration.
Appendix I	Clarification for PCTs	Removed table for calibration standard preparation and added information referencing the standard database. Updated GC conditions for analyzing PCTs.

Reference

1. T*est Methods for Evaluating Solid Waste*, SW-846, Method 8082A, February 2007.

2. Determinative Chromatographic Separations, SW-846, Method 8000D, July 2014

3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #6654, 10241, 11112, 11113, 11114, 11116, 11117, 11118, 11119, 11120, 11121, 11123, 11126, 11960, 12026, 12822, 13086, 13093, 13183, 13187	Separatory Funnel Extraction by Method 3510C, 608 or 622 for Pesticides and PCBs in a Wastewater
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-PEST-WI10011	QC Data Acceptability and Corrective Action
T-PEST-WI9954	Interpretation of Chromatographic Data
T-PEST-WI10007	Preventative and Corrective GC Maintenance
T-PEST-WI9980	Monitoring QC Data Acceptance Limits
T-PEST-WI10016	Setting Up Single Component Initial Calibrations
T-PEST-WI10022	Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses

Scope

This method is useful for identifying and quantitating the following polychlorinated biphenyls (PCBs) as Aroclors in aqueous matrices:

Compound	LOQ (µg/L)
Aroclor 1016	0.5
Aroclor 1221	0.5
Aroclor 1232	0.5
Aroclor 1242	0.5
Aroclor 1248	0.5
Aroclor 1254	0.5
Aroclor 1260	0.5

The following aroclors can also be analyzed for upon request by the client, usually on a project basis. Since aroclors 1262 and 1268 contain peaks that elute much later than 1260, the GC run time needs to be extended to ensure the entire pattern has eluted.

Compound	LOQ (µg/L)
Aroclor 1262	0.5

Aroclor 1268	0.5
Aroclor 5422	1.0
Aroclor 5432	1.0
Aroclor 5460	1.0

See Appendix I for GC operating conditions and calibration information when analyzing for Aroclor 5422, 5432, and/or 5460.

Limits of Quantitiation (LOQs) are based on annual statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS.

Basic Principles

A portion of an aqueous sample is extracted serially with methylene chloride. The volume of sample extracted can be adjusted depending on the physical appearance of the sample and the amount sent for analysis. The extract is dried, concentrated, and exchanged into hexane. The PCBs are then identified and quantitated using gas chromatography (GC) with an electron capture detector (ECD). The extract may require further cleanup (by florisil, sulfuric acid, or copper) to reduce matrix interferences that introduce large, unresolvable peaks in the chromatogram (due to interferents such as phthalates, oxygenated organics, unsaturated organics, or elemental sulfur).

Reference Modifications

Gas Chromatography conditions are different than those listed in Method 8082A however, all QC criteria are met.

Interferences

A. Avoid contact with any plastic material during the extraction and analysis procedures to minimize interferences from phthalate esters.

B. Scrupulously clean all glassware to minimize interferences caused by laboratory contaminants.

C. An electron capture detector (ECD) is very sensitive to compounds that contain halogens and will also respond to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur.

D. Extracts may require further cleanup if interferents are present. Refer to *T-OE-PEST-WI10281* for details on each cleanup procedure. Interfering materials can introduce large, unresolvable peaks into the chromatogram.

1. Use Florisil cleanup to reduce organics that can interfere (polar compounds).
2. Use GPC to remove sulfur and higher molecular weight organics.
3. Use copper or TBA cleanup to remove elemental sulfur.

E. Common single component pesicides such as DDT, DDD, and DDE may cause interference with the aroclor pattern. To ensure that the analyst is aware of this, a standard containing DDE/DDD/DDT will be run with each initial calibration.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Gloves, lab coats, and safety glasses must be worn when preparing standards. Safety glasses must be worn around the GC where solvents and sample extracts are handled.

GC vials are disposed of in the designated lab container and subsequently lab packed for final disposal. All solvent waste is placed in designated containers in the laboratory then taken to the lab-wide facility by personnel trained in hazardous waste disposal.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform

instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, one blind sample, or one ICAL with ICVs and/or CCVs. .

Sample Collection, Preservation, and Handling

Samples are collected in amber glass containers with Teflon-lined caps and kept cool at 0° to 6°C, not frozen.

PCBs have no maximum recommended holding time for the extraction. Some agencies or projects may require a specific hold time for the extraction. If the hold time is specified in the project, this hold time must be followed. Sample analysis must be performed with 40 days of extraction. Extracts are stored in the freezer at ≤-10°C.

Apparatus and Equipment

1. HP 7890 gas chromatograph equipped with an electron capture detector, or equivalent

2. Columns:

   a. Phenomonex MultiRes I – 30 m × 0.32 mm × 0.5 µm, or equivalent

   b. Phenomonex MultiRes II – 30 m × 0.32 mm × 0.25 µm, or equivalent

3. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent. Chrom Perfect® is a data system capable of storing and reintegrating chromatographic data and determining peak areas using a forced baseline, area summation, baseline projection, and performing baseline compensation as required.

4. Various sizes of Class A volumetric flasks, pipettes, and syringes

Reagents and Standards

A. Reagents

1. Follow manufacturer's guidelines for storage conditions.

2. Hexane for autosampler rinse vials. Stored at room temperature up to 1 year.

3. UPC (Ultra Pure Carrier) helium for carrier gas.

4. UPC nitrogen for detector make-up gas.

5. UPC hydrogen carrier gas, either bottled or from a generator.

B. Standards

1. All standards are prepared using Class A volumetric pipettes, syringes, and flasks.

2. All weights are made on an analytical balance.

3. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.

4. All prepared standard solutions are stored at ≤-10° C in labeled containers for up to 6 months.

If comparison with check standards indicates a problem prior to expiration date, the standards must be replaced.

5. Aroclor 1016 stock – Restek 32006 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 to 10 mL of hexane.

6. Aroclor 1016/1260 stock – Restek 32039 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 to 10 mL of hexane.

7. Aroclor 1221 stock – Restek 32007 at 100,000 ppb in hexane. Two separate lots are kept on hand to provide a second source.

8. Aroclor 1232 stock – Restek 32008 at 100,000 ppb in hexane. Two separate lots are kept on hand to provide a second source.

9. Aroclor 1242 stock – Restek 32009 at 100,000 ppb in hexane. Two separate lots are kept on hand to provide a second source.

10. Aroclor 1248 stock – Restek 32010 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 to 10 mL of hexane. Two separate lots are kept on hand to provide a second source.

11. Aroclor 1254 stock – Restek 32011 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 to 10 mL of hexane. Two separate lots are kept on hand to provide a second source.

12. Initial calibration Verification standard (ICV) Stocks:

a. Aroclor 1016 - Accustandard cat # C-216S-H-10X at 1,000,000 ppb

Aroclor 1260 Accustandard Cat# C-260S-H-10x at 1,000,000 ppb

Prepare an intermediate by diluting 1mL of each to 10 mL of hexane.

b. Aroclor 1248 - Accustandard cat# C-248S-H-10X at 1,000,000 ppb.

Prepare an intermediate by diluting 0.5 mL to 5 mL of hexane

c. Aroclor 1254 – Accustandard cat#C-254S-H-10X at 1,000,000 ppb.

Prepare an intermediate by diluting 0.5 mL to 5mL of hexane.

13. Surrogate stock (SS) – Supelco 861284 containing DCB/TCX at 200,000 ppb in acetone.

14. 1016/1260 Matrix spike (MS) stock: Restek 32039. Each at 1,000,000 ppb in hexane. Also used as a second source stock. Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

15. Aroclor 1262 stock – Restek #32409 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

16. Aroclor 1268 stock – Restek #32410 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

17. Instrument Blank (IBLK) – Surrogate Stock (SS) – Supelco #861284 containing Decachlorobiphenyl (DCB) and Tetrachlorometaxylene (TCX) at 200,000 ppb each in acetone.

18. Prepare working standards using the electronic standard database as a guide.

a. In the database, choose the category (i.e. working spike, surrogate, intermediate, etc) and the required standard.

b. The database contains the following information: solution description (ex. AR161), parent solution name, aliquot used, final volume, solvent used, concentration of each compound in the solution, and expiration date. The working standards have an expiration date of 6 months.

c. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level.

d. For Bottle Code 43's

Standard Name	Parent Solution	Aliquot (mL)	Final Volume (mL)	Solvent	Description
PCB Spike	1016/1260 MS Stock	1.25	250	Acetone or methanol	Water Spike
SS	SS Stock	3	2000	Acetone or methanol	SW-846 Water surrogate – identical to that prepared for Pest/PCB analyses

e. For Bottle Code 153's

Standard Name	Parent Solution	Aliquot (mL)	Final Volume (mL)	Solvent	Description
Mini Sep. PCB Spike	PCB Spike	12.5	50	Acetone or methanol	Water Spike
SS	SS Stock	0.375	1000	Acetone or methanol	SW-846 Water surrogate – identical to that prepared for Pest/PCB analyses

The MS and SS working solutions are stored $\leq$-10° C

19. An initial calibration verification standard must also be prepared at a concentration at the mid-point of the calibration for 1016, 1260, 1248, 1254 using a stock solution purchased from a different vendor or different lot than that used for the calibration standards.

20. Additional standards and preparations are listed in Appendix I for Aroclor 5442, 5432, and 5460 (PCT analysis).

Extraction

See organic extraction Analysis # 11121 and 13093.

Gas Chromatographic Conditions

The conditions listed are usually the optimum operating conditions but can vary to improve the sensitivity, linearity, and overall chromatography or shorten run times on each GC system.

Detector	ECD
Detector Temperature	330°C
Oven Temperature	110°C 40°C/min. to 250°C 20°C/min. to 280°C 30°C/min to 330°C Hold until DCB elutes ~ 2 min.
Column A	MR I
Column B	MR II
Carrier	Hydrogen at 12 psi, 5ml/min constant flow. (Can be substituted with Helium)
Makeup gas	N_2 at 80 mL/min. for Agilent GCs
Injection size	1 µL, direct injection
Injection Temperature	225°C

A Merlin microseal can be used in place of traditional septum.

Calibration

A. Fill the autosampler rinse vials with clean solvent or replace vials that appear dirty.

B. Prepare a sequence using the following order of injections:

1. Conditioner
2. IBLK

3. EVAL
4. AR161
5. AR162
6. AR163
7. AR164
8. AR165
9. AR166
10. AR481
11. AR482
12. AR483
13. AR484
14. AR485
15. AR486
16. AR541
17. AR542
18. AR543
19. AR544
20. AR545
21. AR546
22. AR214
23. AR324
24. AR424
25. AR624
26. AR684
27 AR16X
28. MD16 (MDL)
29. IC16X (ICV)
30. IC48X (ICV)
31. IC54X (ICV)
32. Blank
33. LCS
34. 1234567
35. 1234567ms
36. 1234567msd
37.- 47. Continue running samples
48. AR164 (CCV)
49. IBLK

1. Note for our routine PCBs: The AR21, AR32, and AR42 are level 4s in the ICAL and are entered as AR214 and AR424 in the ICAL. Also the AR62 and AR68 are both level 4s and are listed as AR624 and AR684 in the sequences.

2. A single point of Aroclor 1016 is analyzed with the calibration to aid in better pattern recognition in the samples. Aroclor 1016 and 1242 have similar patterns with the exception of the smaller trailing peaks at the end of the Aroclor 1242 pattern. This is identified in the sequence as AR16X.

3. A DDT/Endrin breakdown standard is run with each ICAL in order to provide the retention times of p,p-DDE, p,p-DDD, and p,p-DDT which may interfere with the pattern for aroclor 1254, 1248, and 1260.

4. See Appendix I for a sequence example when the analysis of PCTs (Aroclors 5442, 5432, and 5460) is requested.

D. Continue running groups of samples/injections. Each bracket must contain no more than 20 samples/injections and last no more than 12 hours for Method 8082A. Each bracket is followed by the continuing calibration check standard and an instrument blank (IBLK).

E. The conditioner injection is usually a standard or sample that has already been injected.

1. The conditioner is used to prime the system.

2. It is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.

F. Hexane blanks can also be run to allow the GC to go through some temperature programs and/or to check the cleanliness of the system.

G. Instrument blanks (IBLK) may also be run with the continuing calibration standards. This is optional but frequently requested for projects.

1. The instrument blank (IBLK) is injected after the conditioners but before the initial calibration.

2. It is used to determine that the instrument is free of background noise or contamination.

H. For projects where a known aroclor is present and at the request of clients other aroclors can be run for the continuing check standard. For instance, a set of continuing standards can be AR484, AR164, and IBLK.

I. Aroclor 1262 and 1268 can be analyzed when requested. A full six point curve can also be run, depending on the project requirements.

J. Initial Calibration (ICAL)

1. Calibrate for the aroclors using the six levels of 1016, 1260, 1248, and 1254. Use the single point for 1221, 1232, 1242, 1262, and 1268 when needed. As an option, 1248 and 1254 can use a single point calibration.

2 An external standard calibration based on the average calibration factor (AVG CF) for all analytes is used for quantitation where the %RSD is ≤20%.

3. The surrogate standards are calibrated using the AR16 levels using AVGCF unless the % RSD is >20%.

4. If the RSD is > 20%, use a calibration curve.

a. Use a linear fit.

b. The correlation coefficient must be >0.99 to be a valid fit.

c. Extrapolate or force to zero is not allowed. Set the zero to ignore. See *T-PEST-WI10016* for more details.

When 8000D is referenced and curve fits are used in the initial calibration, percent error (%E) must be calculated for each calibration level. Standard levels at or below the LOQ must meet +/- 50%, standards above the LOQ must meet +/-30%. (%error = (true concentration - calculated concentration)/true concentration)*100). All individual peaks used to calculate the aroclor pattern must meet the %E criteria.

5. If the 0.99 curve coefficient cannot be met:

a. Inspect the data points to see if one or more calibration level became concentrated due to solvent evaporation or degraded over time.

b. Reinject or remake the standard if a specific calibration level has concentrated due to solvent evaporation, or degraded over time..

c. Perform instrument maintenance as needed. See *T-PEST-WI10007* for troubleshooting linearity problems.

6. The calibration range for the aroclors is 50ug/L to 1000 µg/L. Level 1 is equivalent to the Limit of Quantitation.

7 Set up the aroclor calibration data in a custom program under Datalog.

The retention times of the peaks to use for identifying and quantifying the aroclors are entered into the calibration file along with the corresponding peak heights and concentrations. See *T-PEST-WI10022* for details.

8. Ensure the peaks in the standards are labeled properly, including the surrogates in all injections that contain them.

9. Set the scaling of chromatograms and peak integration parameters so that the size of the peaks for each compound of interest are approximately 2 to 3 mm in height at the concentration of the method detection limit (MDL).

a. Ensure all peaks in the MDL standard are integrated.

b. By running the 1016/1260 MDL standard, the majority of peaks of all aroclors are represented.

K. Initial Calibration Verification (ICV)

1. Verify the calibration curves using the ICV mixtures injected directly after the full ICAL.

2. The % difference of the concentrations for these must be within 20% difference of the nominal concentration. All the individual peaks used in the ICAL for the PCB pattern must meet this criteria.

a. If this criteria is not met, reinject the ICV.

b. If the criteria is not met again, then prepare a new standard.

c. If the criteria is not met after analyzing the new ICV standard, then a recalibration is performed.

L. Continuing Calibration Verification (CCV)

1. Calibration verification is performed after each set of twenty injections (samples, QC, blanks, etc.) or 12 hours, whichever comes first.

2. Use AR16 to evaluate the calibration of the aroclors (or other aroclors as requested for particular clients or projects).

3. Other aroclors can also be used along with AR16. This must be done if a site has prior history of containing a specific aroclor, or as requested for client projects or to meet other regulatory requirements.

4. The concentration quantitated for the continuing calibration check standards must be within 20% difference (%D) of the nominal concentration for each compound. All the individual peaks used in the ICAL for the PCB pattern must meet this criteria.

5. Samples must be bracketed with compliant standards.

a. Exception: If the standard following a sample is outside the ±20% but exhibits increasing response, the samples before it do not have to be reinjected if the target analytes are not detected. A comment must be added to the analytical report.

b. If two consecutive/sequential CCVs fail, corrective action must be taken, which can include performing injection port maintenance, baking the instrument or other types of maintenance. Two consecutive/sequential CCVs must meet the criteria or an initial calibration must be performed before sample analysis can continue.

c. If confirmation of target analytes is needed, then the second column should meet the 20% continuing calibration criteria, as well as all initial calibration criteria. if either of these are not met, a comment must be added to the analytical report.

6. The instrument blank (IBLK) is injected after each set of continuing calibration verifications when requested.

a. It must be evaluated as a water matrix against the water MDL/LOQs.

b. The IBLK must not have any target compounds above the reporting limits.

(1) If a target analyte is detected in the IBLK, any associated samples with a detection for that same target must be evaluated.

(2) Unless the concentration in the sample is more than 10x the IBLK value, the sample must be reinjected after another compliant IBLK.

(3) Instrument maintenance, like baking the system or injection port maintenance is usually necessary to clean up instrument.

7. Retention time (RT) windows

a. Established as 3× the standard deviation determined over 72 hours or at no less than ±0.02 min, applied to the mid-point initial calibration standard.

b. If the RTs for a CCV fall outside the RT window, update the mid-point RT using that standard.

(1) Save this under the appropriate name to indicate an update has occurred.

(2) RTs cannot be updated more than once per day. All subsequent standards run within a 24-hour period must be within this window.

(3) If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure

1. Make injections via an auto sampler.

2. Samples are analyzed according to the sequence in the calibration section above, along with the appropriate check standards.

3. Retention times of peaks in the samples are compared to the standard RT windows.

Peaks present on both columns that are also in the correct ratios to represent an aroclor are quantitated and the high value is reported unless chromatographic anomalies are observed. See *T-PEST-WI9954*.

4. Use a minimum of three to six peaks for quantitation, with the exception of certain mixes where it can be more accurate to use less peaks to avoid excessive overlap of patterns.

5. If significant interference is present, schedule florisil and/or sulfuric acid cleanup. If elemental sulfur is present, copper treat the extract. If these techniques do not reduce the matrix problems, dilute the extract with hexane, analyze, and adjust the LOQs accordingly. Also, the reporting limit for individual aroclors may be raised in instances where matrix interference hinders the recognition of an aroclor pattern in the specified retention time window. The reporting limit is calculated by averaging the concentration of at least 3 peaks in the pattern.

6. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

Calculations

A. See *T-PEST-WI9847* for details on all calculations/equations used to evaluate the initial and continuing calibration.

B. Calculation of results is performed according to the following procedures:

1. The peak heights generated by the integration system are used to calculate the calibration factors (CF) for peaks of interest for each aroclor. Usually, the six major peaks that are unique to

each aroclor are chosen for quantitation with the exception of 1221 where only three peaks are available.

2. Sample concentrations are calculated per peak using average calibration factor (AVG CF) from the initial calibration for 1016, 1260, 1248, and 1254 where a multi-point calibration is run, single point CF for 1221, 1232, 1242, (a multi-point calibration can also be run for these as requested or necessary to meet client or regulatory agency requirements). Do not use individual peaks that have values <MDL in quantitation.

3.

$$\frac{\text{Sample Height}}{\text{AVG CF (CF)}} \times \frac{FV}{IV} \times DF = \mu g/L \text{ as received}$$

Where:

FV = Final volume – 2 or 10 mL

IV = Initial volume – 250 or 1000 mL

DF = Dilution factor, as needed

The final result that is reported is determined as the average of the result for each peak chosen for quantitation:

4. The surrogate results are determined using either AVGRF or linear curve:

$$(\text{Result 1} + \text{Result 2} + \ldots + \text{Result n}) / n = \text{Average Result}$$

a. Using AVGCF from the initial calibration:

$$\frac{\text{Sample Height}}{\text{AVG CF (CF)}} \times \frac{FV}{IV} \times DF = \mu g/L \text{ as received}$$

b. Using linear curve from the initial calibration:

$$[(Sample\ Height - Y - intercept)/Slope] \times \frac{FV}{IV} \times DF = \mu g/L\ as\ received$$

Where:

FV = Final volume – 2 or 10 mL

IV = Initial volume – 250 or 1000 mL

DF = Dilution factor, as needed

Statistical Information/Method Performance

LCS, MS, and RPD are compared to the limits stored in the LIMS. The limits for LCS and MS are statistically derived. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Acceptance limits are generated according to *T-PEST-WI9980*. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

When 8000D is referenced an annual lower limit of quantification (LLOQ) verification is required annually on at least one instrument. All instruments must have one at least every three years.

Quality Assurance/Quality Control

A reagent water blank and a reagent water spike (LCS) are analyzed each day with every batch of samples (batch size is 20). An MS/MSD is performed per batch as long as there is ample volume of a sample in the batch. If an MS/MSD cannot be performed, an LCSD must be extracted.

Aroclor 1016 and 1260 are routinely spiked, however, other aroclors can be spiked as requested by clients.

DCB and TCX are added as surrogates to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the GC run.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed.

See *T-PEST-WI10011* for details on QC acceptance criteria and corrective action.

Appendix I

PCT Analysis (Aroclor 5442, 5432, and 5460)

A. Standards:

PCT-Stocks - Aroclor 5432 (Accustandard T-4325), 5442, and 5460(Accustandard T-460S) purchased as individually ampulated solutions from Accustandard at 35,000ug/L.

MS stock of Aroclor 5442 - Absolute Cat. #71791. 1000ug/mL in Methanol.

Prepare working standards using the electronic standard database as a guide.

1. In the database, choose the category (i.e. working spike, surrogate, intermediate, etc) and the required standard.

2. The database contains the following information: solution description (ex. AR161), parent solution name, aliquot used, final volume, solvent used, concentration of each compound in the solution, and expiration date. The working standards have an expiration date of 6 months.

3. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level.

4. The scheme for preparing the matrix and surrogate spiking solutions used in the extraction process are listed below. The MS and SS working solutions are stored at ≤-10° C.

Standard Name	Parent Solution	Aliquot (mL)	Final Volume (mL)	Solvent	Description
MS	5422 MS Stock	0.625	125	Acetone or methanol	PCT Water Spike

SS	SS Stock	3	2000	Acetone or methanol	PCB surrogate

B. GC Chromatographic Conditions

Detector: ECD
Detector temp: 300°C
Oven Temp: 110°C to 250° at 40°C/min, 280 to 330°C at 30°C/min, hold 9 min.
Carrier: Hydrogen at 5.0 mL/min
Makeup gas: N_2 at 80mL/min or equivalent
Injection size: 1-uL, direct injection
Injection temp: 225°C

The conditions listed serve as a guideline only and are typically the optimum operating conditions. The analyst may make any changes to the chromatographic conditions to improve the speed of analysis, linearity, sensitivity, and/or improve separation if initial and continuing calibration criteria and quality assurance criteria listed within this analysis document are met.

C. Sequence

1. Conditioner
2. IBLK
3. EVAL
4. AR161
5. AR162
6. AR163
7. AR164
8. AR165
9. AR166
10. AR481
11. AR482
12. AR483
13. AR484
14. AR485
15. AR486
16. AR541
17. AR542
18. AR543
19. AR544
20. AR545
21. AR546
22. PCT1
23. PCT2
24. PCT3
25. PCT4
26. PCT5

27. A4421
28. A4422
29. A4423
30. A4424
31. A4425
32. AR214
33. AR324
34. AR423
35. AR624
36. AR684
37. MD16
38 MDPCTX
39. IC16
40. IC48
41. IC54
42. Blank
43. LCS
44. 1234567
45. 1234567MS
46. 1234567MSD
47-61. Continue running samples
62. AR164
63. PCT3
64. A4424
65. IBLK

T-OE-PEST-WI10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-PEST-WI10920 Separatory Funnel Extraction by Method 3510C, 608, 608.3 or 622 for Pesticides and PCBs in a Wastewater
T-PEST-WI10007 Preventative and Corrective GC Maintenance
T-PEST-WI10011 QC Data Acceptability and Corrective Action
T-PEST-WI10016 Setting Up Single Component Initial Calibrations
T-PEST-WI10022 Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs
T-PEST-WI9847 Common Equations Used During Chromatographic Analyses
T-PEST-WI9954 Interpretation of Chromatographic Data
T-PEST-WI9980 Monitoring QC Data Acceptance Limits

End of document

Version history

Version	Approval	Revision information
5	04.NOV.2015	
6	29.MAR.2018	

eurofins	Always check on-line for validity. **Extraction of Chlorinated Herbicides in Water by SW-846 8151A**	Level: **Work Instruction**
Document number: **T-OE-PEST-WI10919**		
Old Reference: **1-P-QM-WI -9015078**		
Version: **18**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **07-NOV-2019**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Herbicide Waters and , 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_Herbicide Chem**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

LIMS ID
0816, 11110

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Revision Log

Revision:	18	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Basic Principles	Method requirement		Reordered steps for NaCl addition
Basic Principles	Reflects current practice		Added N-evap as concentration method
Basic Principles	Update		Alteration in esterification process
	Clarification		Collect in unpreserved bottles

Revision:	18	**Effective Date:**	This version
Sample Collection, Preservation, and Handling			
Apparatus and Equipment	Update		Added volumetric pesticide ampule to K-D apparatus and removed Diazomethane generator
Apparatus and Equipment	Reflects current practice		Added vacuum manifold
Reagents and Standards	Update		Added Trimethylsilyldiazomethane (TMSD) and Silicic Acid
Reagents and Standards	Clarification		Added the use of wide range pH paper to check acidity of Sodium sulfate, acidified
Reagents and Standards 13	Update		Removed storage of up to a year. This varies upon the re-evaluation dates of the two solvents.
Reagents and Standards 11b	Reflects current practice		Added the checking of pH with wide range pH paper
Procedure 20	Clarification		Made this process a numbered step
Procedure 23	Reflects current practice		Added remaining sample disposal
Procedure 25	Reflects current practice		Changed concentration volume to between 3-5mL
Procedure 27-29	Update		Altered the esterification processes to use TMSD instead of the diazomethane generator
Procedure 30	Clarification		Procedural clarification of florisil process
Procedure 31-35	Clarification		Procedural clarification and formatting alterations of process
Procedure 36	Clarification		Removed "=" in -10° C sample storage temperature

Revision:	17	**Effective Date:**	June 11, 2019
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Procedure	Method requirement		reordered steps for spiking, additions of NaCl and pH adjustment

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 8151A, December 1996.

2. Test Methods for Evaluating Solid Wastes, SW-3620C, July 2014.

3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #*0952*, *10407*	Analysis of Chlorinated Herbicides by 8151A in Water

T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Scope

This method is for the extraction of chlorinated herbicides in water and wastewater using SW-846 8151A.

Basic Principles

An aliquot of the sample is placed into a separatory funnel. Sodium chloride and a surrogate standard are added to reduce gaseousness and monitor recovery. The pH is adjusted to greater than or equal to 12 and the sample is allowed to sit for 1 hour. The sample is cleaned with a methylene chloride shake that is discarded. The pH is adjusted to less than or equal to 2 and the sample is serially extracted with ethyl ether. The ether extractions are combined and placed in a flask containing acidified sodium sulfate. The mixture is allowed to sit for at least 2 hours. The solvent is transferred to a K-D apparatus and concentrated to 2mL using a steam bath and N-evap. Methanol is added to the sample and undergoes esterification. Silicic acid is added to stop the esterification process. Hexane is added to adjust the final volume and the extract is florisiled.

Procedural changes to use a reduced sample aliquot while maintaining the default reporting limits are permitted as long as the reagent aliquots are reduced proportionally and a quad study is performed and on file.

Reference Modifications

1. Surrogate and matrix spiking solutions are not added before the transfer to the separatory funnel for several reasons:

a. Samples must be poured from the amber bottles to determine the matrix and volume of sample to use for each extraction.

b. Many sample bottles have no headspace and there is no room to add surrogate to the sample in the bottle.

c. Due to the volume of samples extracted, a separate graduated cylinder for each sample is unrealistic.

d. To maintain consistency with all extractions, no samples are spiked in the bottle or graduated cylinders.

2. The extraction as explained in the Procedure through Step 13 is sufficient to force the herbicide salts into the aqueous solution. Additional extraction with methylene chloride has been found to be unnecessary.

3. The sulfuric acid is not chilled prior to addition in the Procedure Step 14. Since the acid is added using a reagent pump, there is minimal chance of contact.

4 30 g of sodium sulfate is used to ensure **all** H2O is absorbed in the Procedure Step 19.

5. Nitrogen gas is not used to bubble the diazomethane through the sample in Procedure Step 27.b. (4). Instead, the diazald solution is gently heated using a beaker of hot water.

6. Florisil cleanup is performed in the Procedure Step 30 to remove interferences that inhibit or negatively impact the determination of herbicide compounds.

Interferences

Impurities in solvents, reagents, glassware, or other hardware used in sample processing lead to interferences with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Always add acid to water to reduce fuming. The sulfuric acid and sodium hydroxide solutions get hot when prepared. Always wear gloves when handling these solutions.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Always wear gloves when handling the diazald and avoid inhaling diazomethane gas. Both are extremely toxic, severely irritating, and have been cited as carcinogens. See specific safety instructions for this procedure listed in the esterification section.

Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus due to the high temperatures.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers. All waste generated from esterification must be placed in a beaker in the hood and must be added to the solvent waste stream in the lab-wide disposal facility.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the technicians training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the extraction and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, or one blind sample.

Sample Collection, Preservation, and Handling

Samples must be collected in unpreserved 1 liter amber glass bottles and stored at 0° to 6°C, not frozen, prior to extraction. Extraction must be started within 7 days of collection. The extract is stored in the freezer at less than or equal to -10 °C. Leachate samples scheduled for prep 11110 must be extracted within 7 days of the completion of the leachate procedure.

Apparatus and Equipment

1. Separatory funnels, 2-L
2. Kuderna-Danish (K-D) assembly with volumetric pesticide ampule
3. Beakers – Assorted
4. Water bath
5. Filter paper – Whatman #3 or equivalent
6. N-Evap with nitrogen supply
7. pH meter or paper – Assorted ranges

8. Balance – Capable of weighing to 0.01 g

9. Wash bottles

10. Scriber

11. Graduated cylinders – Assorted sizes – Class A

12. Automatic shaker – Capable of holding 2000mL separatory funnels

13. Pipettes – Class A, assorted sizes

14. Syringes – Assorted sizes

15. Micropipetter

16. Reagent pump

17. Erlenmeyer flasks – 500mL

18. Boiling beads – glass

19. Pipettes – Disposable

20. Test tubes

21. TCLP extraction fluid – delivered weekly by the leachate department

22. Vacuum system for eluting multiple cleanup cartridges

a. Vac elute manifold – Analytichem international, J.T. Baker or Supelco (or equivalent). The manifold design must ensure that there is no contact between plastics containing phthalates and sample extracts.

b. Vacuum trap made from a 500-mL sidearm flask fitted with one-hole stopper and glass tubing

c. Vacuum pressure gauge

d. Rack for holding 10-mL volumetric flasks in the manifold

e. Teflon florisil parts

Reagents and Standards

Note: All reagents ACS grade or equivalent unless otherwise indicated.

1. Methylene chloride (CH2Cl2) – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

2. Acetone – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

3. Hexane – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

4. Ethyl ether, high purity, nonpreserved – Use peroxide test strips to ensure it is free of peroxides. Store at room temperature. Follow manufacturer's expiration information.

5. Sulfuric acid (H2SO4) – Baker Instra-analyzed or equivalent. Store at room temperature for up to 1 year.

To prepare 12N solution: Add 588.1 ± 1.0 g H2SO4 to a 1000 mL volumetric flask containing approximately 400 mL of reagent water. Dilute to 1000 mL with reagent water.

6. 6N sodium hydroxide (NaOH) – Lab Chem or equivalent. Store at room temperature for up to 1 year.

7. Trimethylsilyldiazomethane (TMSD) - Follow manufacturer's storage and expiration information.

8. Reagent water – water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.

9. Sodium chloride (NaCl) – Bake at approximately 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

10. Sodium Sulfate (Na2SO4) – Sodium sulfate (Na2SO4) – Granular anhydrous reagent grade or equivalent. Bake at approximately 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

11. Sodium sulfate, acidified – Up to 300 g per sample is needed.

a. Use a pipette to add 1 mL of concentrated sulfuric acid to a beaker containing 1000 g of baked sodium sulfate and slurry with ethyl ether. Remove ethyl ether by placing the mixture on a steam bath.

b. Confirm the mixture is below pH of 4 by adding 1g of the resulting solid to a vial containing 5 mL of reagent water and check pH with wide range pH paper.

c. Store at 130°C or in a dessicator for up to one year.

12. Potassium Hydroxide (KOH) – ACS Certified, Fisher Chemical or equivalent. Store at room temperature for up to 5 years.

13. 50% Ethyl Ether in Hexane – Make desired amount by mixing equal parts of Hexane and Ethyl Ether.

14. Silicic Acid

15. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical Analysis #*0952*, *10407*

Preparation of Glassware

See ***T-OE-GEN-WI10864***

Calibration

Not applicable to this procedure.

Procedure

1. Use a wash bottle to rinse all glassware with acetone.

a. This rinse reduces the amount of alkaline substances present that react with the organic acids being extracted.

b. Be certain all acetone is completely evaporated before the glassware comes in contact with the samples to avoid low recoveries of Dinoseb.

2. Determine the volume of sample to be used for each extraction.

a. Analysis *10407*

(1) Use one bottle (1 liter) unless the matrix contains approximately 1/3 or more sediment or has a very thick consistency.

(2) If using reduced volume of sample due to matrix problems, reduced volume aliquots are 500, 200, or 100mL.

b. Analysis *0952*

(1) If at least 100mL of sample is available, use 50mL of sample.

(2) If the sample also requires a matrix spike, use 50mL for the spike sample.

(3) If <100mL is available, use ½ of the volume in the bottle.

(4) If the sample is not water soluble, use 1mL.

c. If uncertain of the volume to extract for any sample, ask your supervisor.

3. Once the volume of sample is determined, measure each sample.

a. For samples that use one full bottle.

(1) Etch the outside of the bottle with a scriber at the meniscus of the sample volume.

(2) Shake the bottle vigorously and then pour the contents into a 2-L separatory funnel.

(3) Record any comments about the samples in the extraction log.

b. For all samples that use a specified volume.

(1) Shake each bottle vigorously, and then use a clean graduated cylinder to measure the volume.

(2) Transfer the sample to a graduated cylinder.

(3) Record the sample volume and any comments about the samples in the extraction sheet and transfer to the 2-L separatory funnel.

(4) Use a wash bottle to rinse the graduated cylinder with methylene chloride. After the 1 hour in Procedure 8: Step b, add the rinseate to the separatory funnel. If <1000mL of sample is used, add enough reagent water to bring the volume in the separatory funnel to 1L.

c. The blank, laboratory control sample (LCS), and laboratory control sample duplicate (LCSD) (if applicable)

(1) For analysis *0952*: Prepared by measuring 50mL of extraction fluid into the separatory funnel.

(2) For Analysis *10407*: Prepared by using 1L of reagent water measured into the separatory funnel.

d. The background, matrix spike (MS), and matrix spike duplicate (MSD) are prepared using three separate aliquots of a field sample.

4. Use pipettes to add surrogate standards and spiking solutions to the aqueous sample in the separatory funnel.

a. The standard must drip directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

b. Surrogates – For *0952* &*10407* - Add 1.0mL herb surrogate to all samples, blanks, and spikes.

c. Spiking solutions

(1) For analysis *0952* – Add 1.0mL TCLP herb spike to the LCS, LCSD, MS and MSD (if applicable).

(2) Analysis *10407*– 1.0mL herb spike and 1.0mL MCPA fortification mix.

(3) Spikes are changed to accommodate client-specific requirements as appropriate.

d. If a sample requires any special compounds in addition to the standard list, an appropriate spike containing the compounds is added at this time.

e. See ***T-OE-GEN-WI10876*** for storage and handling of spikes.

5. Weigh approximately 250 g of NaCl and add to each separatory funnel.

6. Shake the sample on an automatic shaker for approximately one minute to dissolve the NaCl.

7. Use a reagent pump to add 17 to 25mL of 6N NaOH to each separatory funnel and shake.

8. Check the pH using pH paper to ensure it is greater than or equal to 12.

a. If the pH is less than 12, add additional 6N NaOH until the pH is greater than or equal to 12. Document on batch-log if additional NaOH is needed.

b. Allow sample to sit for 1 hour. Samples are periodically shaken during this one hour period.

9. If the original sample bottle is empty.

a. Use a reagent pump to measure 60mL of methylene chloride and rinse the sample bottle by capping and inverting bottle several times.

b. Add the solvent to the separatory funnel.

c. After the bottle is rinsed with methylene chloride, fill the bottle to the marked level with water and transfer the water to a graduated cylinder to determine the initial volume. Alternatively, weigh the empty bottle and tare the balance.

d. Fill the bottle to the marked level with water and place the bottle onto the tared balance. This weight rounded to a whole number is the initial sample volume.

e. Record the initial volume on the extraction sheet.

10. If the sample container is not empty, use a reagent pump to measure 60 mL of methylene chloride and add the solvent directly to the separatory funnel.

11. Cap the funnel, invert it, and vent immediately.

12. Place the sample on the automatic shaker and shake at the designated speed for 2 minutes with the stopcocks closed.

NOTE: Shaker speeds vary greatly between instruments; the proper setting is marked on each.

13. Allow the phases to separate for approximately 10 minutes. The time required for extracts to set undisturbed is based upon visual confirmation that the layers are adequately separated. Additional time may be necessary for samples with unusual high density (i.e. high salt content). Open the stopcock and drain the methylene chloride (bottom layer) into a waste beaker and discard.

14. Use a reagent pump to carefully add 15 to 20mL of 12N H2SO4 to each funnel.

a. Swirl to mix.

b. Check the pH using pH paper to ensure it is less than or equal to 2. Document on batch-log if additional H2SO4 is needed.

c. If the pH is greater than 2, add additional 12N H2SO4 until the pH is less than or equal to 2.

15. Use a reagent pump to add 120mL ethyl ether to the separatory funnel.

16. Cap the funnel, invert it, and vent immediately.

17. Place the sample on the automatic shaker and shake at the designated speed for 2 minutes with the stopcocks closed.

18. Allow the phases to separate for approximately 10 minutes. The time required for extracts to set undisturbed is based upon visual confirmation that the layers are adequately separated. Additional time may be necessary for samples with unusual high density (i.e. high salt content).

19. Open the stopcock and drain the aqueous layer (bottom layer) into 1-L beaker.

20. Drain the ethyl ether layer into a 500mL Erlenmeyer flask that contains approximately 30g of acidified sodium sulfate.

21. Pour the aqueous layer back into the separatory funnel.

22. Use a reagent pump to add 60mL of ethyl ether into the separatory funnel. Extract the sample as listed in Procedure Steps 17 through 20 venting only if necessary.

23. Perform a third extraction using 60mL of ethyl ether and follow Procedure Steps 17 through 20. Dispose of remaining sample in appropriate waste containers.

24. Allow the extract to remain in contact with the acidified sodium sulfate for a minimum of 2 hours while covered. Residual water hinders the methylation and results in low recoveries. Periodically swirl the Erlenmeyer flask containing the extract and acidified sodium sulfate to ensure the sodium sulfate is free flowing and that residual water is being absorbed.

NOTE: If the sodium sulfate is not free-flowing, add additional acidified sodium sulfate until all the water is removed.

25. Pour the extract into a K-D apparatus.

a. Swirl the flask to break up the sodium sulfate.

b. Use a wash bottle to rinse the flask and funnel with two approximately 30-mL aliquots of ethyl ether to complete the transfer.

26. Add a glass-boiling bead to the K-D apparatus and attach a Snyder column. Wet the column with ethyl ether and concentrate over a steam bath at 80° to 85°C until the apparent volume is between 3-5mL. Adjust the vertical position of the apparatus and the water temperature, as required, to complete the concentration in 5-10 minutes. At the proper rate of distillation the balls of the column will actively chatter, but the chambers will not flood.

NOTE: For samples from **North Carolina** use a temperature of 60° to 65°C.

27. After the extract has cooled, break down the K-D apparatus. N-evap the concentrate in the pesticide ampule to 2.0mL.

28. Add approximately 300µL of methanol.

29. Esterification with trimethylsilyldiazomethane (TMSD) solution:

a. Safety precautions

(1) **TMSD is flammable, and acutely toxic. Only open container in a drawn hood.**

(2) If solution is spilled, **leave area immediately and contact safety.**

(3) Wear gloves at all times during this procedure. Additional protection, such as a safety shield, is recommended.

(4) All glassware used in this procedure must be taken directly to wash room personnel, not placed on cart of dirty glassware.

(5) This must be set up in a hood containing no electrical appliances or steam baths. Additional heat and electrical hazard must be avoided.

b. Methylation Procedure

(1) Add 300µL of TMSD to the extract. The extract should turn yellow and remain yellow. If this does not occur, add additional 100µL portions of TMSD until the yellow color persists.

(2) Allow the extract to sit for 1 hour at room temperature.

(3) Adjust final volume to 10mL with hexane and mix thoroughly.

(4) Add approximately 0.1g of silicic acid to stop the reaction. No more than 0.5g should be used. Allow to stand for 20 minutes.

Note: Yellow color does not need to dissipate entirely to indicate esterification is complete.

Note: Silicic acid does not dissolve in solution. Adding too much will cause sample to thicken and require manual separation by centrifuge.

(5) If manual separation is required, transfer to a 24mL vial. Do not rinse as this will alter FV. Centrifuge at 1000RPM for 3 minutes. Continue to step 30.

30. Florisil the sample using a vac elute manifold:

a. Prepare the vac elute manifold and elution solvent:

(1) Thoroughly rinse the vacuum manifold lid with reagent water, methylene chloride and acetone - in that order - prior to assembling the chamber. The drip-tips and stopcocks must also be rinsed prior to use.

(2) Volumetrically prepare the elution solution of 50% ether in hexane. Allow the solution to equilibrate to room temperature before bringing to final volume. Document this preparation in the reagent preparation logbook.

(3) Screw the drip tips into the top of the manifold. Place the valves into the top of the drip tips. Place the florisil cartridges, labeled with the sample numbers, on top of the valve. Be certain the valves are closed.

b. Prepare a 1-gram florisil cartridge by rinsing with approximately 6mL of hexane.

c. Repeat step b with 50% ethyl ether in hexane. Make sure to keep a meniscus of solvent above the florisil bed. Do not allow the column to go dry from this point forward.
d. Remove the top of the manifold and dispose solvent in the appropriate waste container.
e. Place labeled pest ampules (numbered to match florisil cartridges) into the tube holder. Place the assembled tube holder into the vacuum manifold, being sure the drip tips go into the top of the ampules.

f. Mix sample with a 2mL glass pipette and add 2 mL of extract to the cartridge. Elute the sample at a flow rate of 5mL per minute, making sure the column does not go dry.

g. Pour 5 to 6 mL of 50% ethyl ether in hexane into the cartridge. Allow solvent to flow through cartridge at a rate of 5mL per minute. Just prior to the elution solvent reaching the florisil be, fill the cartridge approximately half full (approximately 3mL) with 50% ethyl ether in hexane. Allow the cartridge to drip dry.
31. Remove the ampule containing the eluate from step 27 from the manifold.

32. Add 100 µL of Herb Internal Standard to the extract.

33. Concentrate the eluate to just below 2mL on the N-evap - using the same process described in step 24.

34. Remove the ampule from the N-evap and bring to final volume 2.0mL with hexane - mix thoroughly.

35. Use a disposable pipette to bottle the extract into two clear autosampler vials. The remainder of the unflorisiled extract should be bottled in a labeled 12-mL vial.

36. The extracts are stored in a freezer at -10° C and must be analyzed within 40 days of extraction.

Calculations
See analysis method.

Statistical Information/Method Performance
See analysis method.

Quality Assurance/Quality Control
A batch is defined as the samples to be extracted on a given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted, a blank, LCS (extraction fluid blank spiked with compounds to be determined carried through the entire procedure), MS, and MSD must be extracted. If there is limited sample preventing the preparation of the MS/MSD, an LCSD must be prepared instead. Also, if the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing must be used.

See the GC analysis methods for specifics on compounds in the matrix spikes and surrogates.

T-OE-GEN-WI10864 Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876 Organic Extraction Standards Storage and Handling
T-PEST-WI9202 Analysis of Chlorinated Herbicides by 8151A in Water

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End of document

Version history

Version	Approval	Revision information
16	16.APR.2018	
17	28.MAY.2019	
18	24.OCT.2019	

An error has happened on file: /D4Doc/formularer/2016/09/Quality Document # 1-P-QM-WI -9015078_15_0816.doc
Errortext: The remote server returned an error: (404) Not Found.

eurofins	Always check on-line for validity. **Analysis of Chlorinated Herbicides by 8151A in Water**	Level: **Work Instruction**
Document number: **T-PEST-WI9202**		
Old Reference: **1-P-QM-WI-9015088**		
Version: **17**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date **28-JUN-2019**	Document users: **6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_Herbicide Chem**	Responsible: **5_EUUSLA_Pesticide Residue Analysis_Manager**

LIMS ID
Analysis - 0952, 10407

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Revision Log

Revision	17	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Calibration 5.	Correction		Changed from r to r2
Quality Assurance/ Quality Control	Current process		Changed IS evaluation to compare to mid point initial calibration standards instead of the CCV. Change IS criteria to 50 - 200%

Revision	16	**Effective Date:**	March 20, 2019

Revision	16	**Effective Date:**	March 20, 2019
Section	**Justification**	**Changes**	
Revision Log	Formatting requirement	Removed revision logs up to the previous version	
References	Reflect current criteria	Removed 8000B reference	
Calibration	Reflects current criteria	Added ICV and CCV criteria for 8000D.	

Reference

1. *Test Methods for Evaluating Solid Waste*, SW-846 Method 8151A, December 1996.

2. State of Connecticut Department of Environmental Protection, Recommended Reasonable Confidence Protocols for Chlorinated Herbicides by SW-846 8151, version 2.0 July 2006.

3. Determinative Chromotographic Separations, SW-846, Method 8000D, July 2014

4. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #0816, 11110, 11111	Extraction of Chlorinated Herbicides in a Water Matrix by SW -846 8151A
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-PEST-WI10011	QC Data Acceptability and Corrective Action
T-PEST-WI9954	Interpretation of Chromatographic Data
T-PEST-WI9980	Monitoring of QC Data Acceptance Limits
T-PEST-WI10016	Setting Up Single Component Initial Calibrations
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses
QA-SOP11892	Determining Method Detection Limits

Scope

This method is applicable to the measurement of the following chlorinated herbicides in water and wastewater:

Compound	Limit of Quantitation (µg/L)	Notes
2,4,5-T	0.05	
2,4,5-TP (Silvex)	0.05	
2,4-D	0.5	
2,4-DB	1.0	
2,4-DP (dichlorprop)	0.5	

Dalapon	1.25	
Dicamba	0.3	
Dinoseb	0.5	
Hexachlorophene	0.2	Special request required
MCPA	200	
MCPP (mecoprop)	200	
PCP	0.05	
Picloram	1.0	Special request required

LOQs are based on annual statistical evaluation of laboratory data and are subject to change. The current LOQs are maintained in the LIMS.

See Table I for a list of the compounds in each scan. See T-OE-PEST-WI10919 (*Analysis #0816, 11110, 11111*) for the extraction procedure.

Basic Principles

Samples are hydrolyzed to convert methyl esters to the acid state. Extraneous material is removed using a methylene chloride solvent wash. The chlorinated phenoxy acids are extracted from an acidified sample of water or wastewater with ethyl ether. Acids are then converted to their methyl esters using diazomethane as the derivatizing agent. The methyl esters are determined by gas chromatography using an electron capture detector (GC-ECD). A florisil cleanup and/or dilution can be performed to eliminate matrix interferences that introduce large unresolvable peaks in the chromatogram. A dilution is required if interferences such as chlorinated acids and phenols are present. Refer to *T-OE-PEST-WI10281* for more details on this cleanup procedure.

Interferences

An electron capture detector is very sensitive to compounds that contain halogens and also responds to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur. Plastic must not be used during the extraction or analysis to prevent phthalate contamination. Glassware must be scrupulously cleaned.

This analysis can be particularly affected by matrix interferences or coextractives that include chlorinated hydrocarbons, phthalates, organic acids, and phenols. A florisil cleanup is used to reduce these types of interferents. The extraction procedure also includes a cleanup using methylene chloride after alkaline hydrolysis of the analytes of interest.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Gloves, lab coats, and safety glasses must be worn when preparing standards and handling sample extracts and solvents. Lab coats and glasses are required while working in the laboratory areas.

All GC vials and extract vials are placed in a hazardous waste container for lab pack disposal. There is a satellite container in the laboratory that is then emptied into the main laboratory waste collection drums. All solvent waste is disposed of in designated solvent waste containers in the laboratory which are then combined with the main laboratory designated waste collection drum.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, one blind sample, or one ICAL with ICVs and/or CCVs.

Sample Collection, Preservation, and Handling

Samples are collected in amber glass bottles and preserved with sodium thiosulfate. Samples must be kept cool at 0° to 6°C, not frozen. They must be extracted within 7 days of the date collected, and extracts must be analyzed within 40 days.

Apparatus and Equipment

1. HP7890 gas chromatograph fitted with electron capture detector or equivalent

2. Columns:

   a. Phenomenex ZB-35 30 m × 0.32 mm × 0.5 µm

   b. Phenomenex ZB-XLB 30 m × 0.32 mm × 0.25 µm

3. Integrating system such as Chrom Perfect by Justice Innovations or equivalent

4. Various sizes of Class A volumetric flasks, pipettes, and syringes

Reagents and Standards

A. Reagents:

1. Hexane, pesticide grade for autosampler rinse vials. Stored at room temperature.

2. UPC (ultra pure carrier) nitrogen for detector make-up

3. UPC hydrogen carrier, bottled or from a generator

4. Ethyl ether, high purity, nonpreserved – Store at room temperature.

B. Standards:

1. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.

2. All standards are prepared using Class-A volumetric flasks, pipettes, and syringes.

3. All standards are stored in labeled vials or flasks in a freezer at ≤-10°C.

4. DBOFB stock – 4,4'-dibromooctafluorobiphenyl Ultra PPS-170 at 1000 µg/mL ppb, or equivalent. This is used as the internal standard.

5. DBOFB Intermediate – Dilute 1.0 mL of DBOFB stock into 50 mL of acetone. This solution is stable for 6 months.

6. Working DBOFB IS diluting solution – Dilute 5.0 mL of the DBOFB intermediate into 100 mL of hexane. This solution is used to make sample dilutions. This solution is stable for 6 months.

7. DCAA SS stock – 2,4 dichlorophenylacetic acid (DCAA) non-methylated stock. Ultra PPS-162 at 5,000 µg/mL, or equivalent.

8. Acid herb stock – Acid herbicide stock for calibration standards: Accustandard catalog #S-12214-R5 in methanol (concentrations vary per compound), or equivalent.

9. Hexachlorophene stock – Restek cat #31811 at 2,000 µg/ml in methylene chloride, or equivalent.

10. Picloram stock – Restek cat #32265 at 1,000 µg/ml in methanol, or equivalent.

11. Herbicide intermediate – Dilute 1.0 mL of acid herbicide stock, 0.02 mL of hexachlorophene stock, 0.05 mL of picloram stock, and 0.02 mL of DCAA SS stock into 10 mL of ethyl ether. This solution is methylated following procedure outlined in Analysis #4181 prior to making the calibration standards. This solution is stable for 6 months.

12. MS Herbicide stock:

a. Herbicide mix in the acid form for the matrix spiking solution: Ultra cat #HBM-8150A in methanol (concentrations vary per compound), or equivalent.

b. PCP stock – Accustandard cat #APP-9-176-D-20X at 2000 µg/mL in methylene chloride, or equivalent.

c. Dinoseb fortification stock – Restek cat #32251 at 1,000 µg/ml in methanol, or equivalent.

d. Picloram stock – Restek cat #32265 at 1,000 µg/ml in methanol, or equivalent.

e. Hexachlorophene stock – Restek cat #EPA-1125 at 1,000 µg/ml in acetone, or equivalent.

13. MS MCPA stock – Neat compound from ChemService cat #PS-40, or equivalent. Dilute approximately 0.25g into 5 mL of methanol. Stable for 1 year.

14. ICV Stocks:

a. Acid herbicide mix – Supelco cat # 46861-U in methanol (concentrations vary per compound), or equivalent.

b. Hexachlorophene – Accustandard cat #APP-9-116 at 100 µg/l in methanol, or equivalent.

15. ICV Intermediate – Dilute 1 mL of acid herbicide stock, 0.5 mL of hexachlorophene stock, and 0.02 mL of DCAA SS stock into 10 mL of ethyl ether. This solution is methylated following procedure outlined in Analysis #4181 prior to making the working standard.

16. Surrogate Stock (SS) – Ultra Scientific cat #PPS-161 containing 2,4-Dichlorophenylacetic acid (DCAA) in MTBE, or equivalent.

17. Prepare working standards using the electronic standard database as a guide.

a. In the database, choose the category (i.e. working spike, surrogate, intermediate, etc) and the required standard.

b. The database contains the following information: solution description (ex. HERB 1), parent solution name, aliquot used, final volume, solvent used, concentration of each compound in the solution, and expiration date. The working standards have an expiration date of 6 months.

c. The calibration scheme begins at or near the reporting limit through a 40 fold of the initial calibration level.

18. Prepare the spiking solutions using the prep scheme in the table below:

Standard Name	Parent Solution	Aliquot (mL)	Final Vol (mL)	Solvent	Description	Expiration Date
MS (herb)	Chlorinated Herb Stock	2.5	100	Methanol	Herb Spike	6 months
	PCP Stock	0.05				
	Dinoseb Fortification Stock	0.3				
	Picloram Stock	0.25				
	Hexachlorophene Stock	0.12				
MS (MCPA)	MCPA Stock	0.5	100	Acetone	MCPA fortification mix	6 months
IS	4,4 DBOFB Stock solution	1	50	Hexane	Internal Std	6 months
SS	SS DCAA Stock	1.0	1000	Hexane	Herb surrogate standard	6 months
IBLK	SS (DCAA methyl ester)	0.80	200	Hexane	Instrument Blank	6 months

GC Conditions

The conditions listed are optimum however, they can be changed to improve the linearity, sensitivity, or overall chromatography on each GC system as needed.

Instrument setup (primary and confirmation)

Detector – ECD
Detector temperature – 325°C
Carrier – Hydrogen at 10 psi (Helium is a substitute)
Makeup gas – N_2 at 80 mL/min
Injection size – 2-µL, direct injection
Injector temperature – 250°C
Oven temperature – 50°C, hold 0.5 min, 25°C/min to 100°C, 12C/min to 310°C Hold 2 min
Carrier – Hydrogen at 12 PSI (helium is a substitute)

Calibration

1. Prior to starting a new calibration, fill the autosampler rinse vials with clean solvent or replace vials themselves if they appear to be dirty.

2. Prepare a sequence as follows:

1. Conditioner
2. IBLK
3. Herb Level 1
4. Herb Level 2
5. Herb Level 3
6. Herb Level 4
7. Herb Level 5
8. Herb level 6 (optional)
9. MDHEX
10. ICHBX
11. Blank
12. LCS
13. 1234567
14. 1234567ms
15. 1234567msd

16. – 20. Continue with samples

21. Herb Level 3

22. – 31. Ten samples

32. Herb Level 3

Continue running groups of 10 samples followed by an Herb level 3 standard between sample groups.

3. The conditioner injection is usually a standard or sample that has already been injected.

a. Any number of conditioners can be used prior to the start of the run – one is shown here as an example.

b. It is used to prime the system and is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.

c. Hexane blanks are run to allow the GC to go through some temperature program runs and/or to check the cleanliness of the system.

4. The instrument blank (IBLK) is injected after the conditioners but before the initial calibration.

a. It is used to determine that the instrument is free of background noise or contamination.

b. IBLK may also be run with the continuing calibration standards – this is optional, but is frequently requested for projects.

5. Initial Calibration (ICAL)

a. The system is calibrated using a minimum of five concentration levels.

b. An internal standard calibration is used with average response factor (AVGRF) for all analytes where the %RSD is ≤20%.

c. Alternatively, when these criteria are not met, a calibration curve must be used.

d. When using a calibration curve, a linear fit must be tried first.

(1) Use the linear fit if the coefficient of determination (r^2) is $\geq$0.99.

(2) However, if the coefficient of determination (r^2) is $<$0.99, a quadratic fit must be tried. A 6-point calibration must be run to use quadratic, and the coefficient of determination (r^2) must be $\geq$ 0.99.

e. For either curve type, extrapolate or force zero is not allowed.

f. See *T-PEST-WI10016* for details on using Chrom Perfect for setting up single component calibration files.

g. Ensure all peaks in the standards are labeled properly and that the scaling is such that concentrations at the MDL exhibit a peak about 2 to 3 mm in height.

h. Be sure all peaks in the MDLH standard are integrated by the data system.

When curve fits are used in the initial calibration, percent error (%E) must be calculated for each calibration level. Standard levels at or below the LOQ must meet +/- 50%, standards above the LOQ must meet +/-30%. (%error = (true concentration - calculated concentration)/true concentration)*100)

6. Initial Calibration Verification (ICV)

a. Verification of the calibration curves is performed using the ICV mixtures injected directly after the full ICAL.

b. The % difference of the concentrations for each analyte must be within ±20% difference of the nominal concentration for the curve to be used for sample analysis under 8000D.

7. Continuing Calibration Verification (CCV)

a. A CCV standard is analyzed after every ten injections (samples, QC, blanks etc) using the level 3 calibration standard.

b. The CCV between samples must exhibit a response at ±20% difference (%D) for each compound under 8000D

c. The concentration calculated for the continuing injection is compared to the nominal concentration.

d. Samples must be bracketed with compliant standards.

. e. Exception: If the standard following a sample is outside the 20% for 8000D but exhibits increasing response, the samples before it do not have to be reinected if the target analytes are not detected. A comment must be added to the analytical report.

f. If two consecutive/sequential CCVs fail, corrective action must be taken, which can include performing injection port maintenance, baking the instrument or other types of maintenance. Two consecutive/sequential CCVs must meet the criteria or an initial calibration must be performed before sample analysis can continue.

g. If confirmation of target analytes is needed, then the second column should meet the 20% continuing calibration criteria for 8000D, as well as all initial calibration criteria. If either of these are not met, a comment must be added to the analytical report.

8. If an instrument blank (IBLK) is injected after the CCV, it must be evaluated as a water matrix against the water MDL/LOQs.

a. The IBLK must not have any target compounds above the reporting limits.

b. If a target analyte is detected in the IBLK, any associated samples with detection for that same target must be evaluated.

(1) Unless the concentration in the sample is more than 10× the IBLK value, the sample must be reinjected after another compliant IBLK

(2) Instrument maintenance, like baking the system or injection port maintenance is usually necessary to clean up the instrument.

9. Retention Time (RT)

a. RT windows are established as 3× the standard deviation determined over a 72-hour period, or at no less than ±0.03 min, applied to the midpoint initial calibration standard.

b. If the RTs for a CCV fall outside the windows, update the midpoint RT using that standard.

(1) Save this under an appropriate name to indicate an update has occurred.

(2) All subsequent continuing standards run within a 24-hour period must fall within this window.

(3) Retention times cannot be updated more than once per day.

(4) If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure

1. Retention times of peaks in the samples are compared to the standard RT windows.

a. Peaks that are present on both columns are quantitated and the high value is reported unless there are chromatographic anomalies.

b. See *T-PEST-WI9954* for more information on the interpretation of chromatographic data.

2. Samples that contain levels of analytes above the highest level calibration standards must be diluted and reanalyzed. Use Working DBOFB IS diluting solution to prepare dilutions. See standard section.

When preparing dilutions, add sufficient internal standard to maintain the same 100-µg/L concentration.

Calculations

1. Sample Concentration

$$Sample\ Concentration,\ \mu g/L = Extract\ Conc\ (\mu g/L) \times \frac{DF \times FV}{IV} \times Conc\ Int\ Std$$

Where:

IV = Initial volume in mL

DF = Dilution factor

FV = Final volume in mL

2. Linear Curve

$$Extract\ Conc\ (\mu g/L) = \frac{(pk\ ht\ /\ int\ std\ ht) - Y - intercept}{slope}$$

3. Average response factor (AVGRF)

The calculation is the same as above except the extract concentration is calculated as follows:

$$Extract\ Conc.\ (\mu g/L) = \frac{pk\ ht\ in\ sample}{internal\ pk\ ht\ (of\ std)\ in\ sample} / AVG\ RF$$

Where:

$$AVG\ RF = \frac{RF\ Calib\ 1 + RF\ Calib\ 2 + \ldots + RF\ Calib\ 5}{5}$$

$$RF = \frac{Standard\ Peak\ Height\ /\ Internal\ Peak\ Height}{Standard\ Concentration\ (\mu g/L)\ /\ Conc\ Internal\ Std}$$

4. Usually, the internal standard concentration is normalized to 1. It can be changed for injections that have a concentration different than the normal due to dilution or alternate amount added during extraction.

5. See *T-PEST-WI9847* for more details on the calculations related to the calibration.

Statistical Information/Method Performance

LCS, MS, and RPD are compared to the limits stored in the LIMS. The limits for LCS and MS are statistically derived. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Acceptance limits are generated according to *T-PEST-WI9980*. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

An annual lower limit of quantification (LLOQ) verification is required annually on at least one instrument. All instruments must have one at least every three years.

Quality Assurance/Quality Control

At least one blank and LCS is analyzed with each batch of 20 samples. An MS andMSD is analyzed with each batch of 20 samples as long as there is ample volume. An LCSD is performed if an MS/MSD cannot be done.

The spiking solutions contain all analytes of interest. A surrogate standard of 2,4-dichlorophenyl acetic acid (DCAA) is added to each sample, blank, and spike to monitor the efficiency of the extraction and the operation of the autoinjector.

An internal standard is added to each sample, blank, and spike. The internal standard (DBOFB) response for each calibration verification (initial and continuing), QC sample, and field sample is evaluated by comparing the response in the sample to the response of the mid-point initial calibration standard with criteria of 50 -200%.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed instead.

T-PEST-WI10011 outlines the QC acceptability and corrective action.

Table I

Compound	0952 (TCLP)	10407 master
2,4-D	X	X
2,4,5-TP (Silvex)	X	X
2,4,5-T		X
Dinoseb		X
Dalapon		X
MCPP		X
MCPA		X
2,4-DP		X
2,4-DB		X
PCP		X
Hexachlorophene *		X
Dicamba		X
Picloram *		X

* Denotes Special Permission required to add these compounds since they are not routine analytes

Appendix I

CT RCP Requirements

No use of grand mean for initial and continuing calibration evaluation.

If any sample needs a comment about out of spec data, comment 2510 must be put on the sample first, followed by our comment, so that the RCP form generates properly from the LIMS.

Comment about any raised limits (does not need precursor comment)

Need instrument blanks after every CCV set.

If there is >40% difference between column A and B, a comment must be placed on the analytical report. There are two comments for this: 1570 says the higher result was reported, 1569 says the lower result was reported. Use these on the analytical report as they apply.

The LCS recoveries must be between 40 -140%.

The MS/MSD recoveries must be between 40-140%. The maximum allowable RPD is 30%.

The surrogate recovery must fall between 30 – 150%.

QA-SOP11892 Determining Method Detection Limits and Limits of Quantitation
T-OE-PEST-WI10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-PEST-WI10919 Extraction of Chlorinated Herbicides in Water by SW-846 8151A
T-PEST-WI10011 QC Data Acceptability and Corrective Action
T-PEST-WI10016 Setting Up Single Component Initial Calibrations
T-PEST-WI9847 Common Equations Used During Chromatographic Analyses
T-PEST-WI9954 Interpretation of Chromatographic Data
T-PEST-WI9980 Monitoring QC Data Acceptance Limits

End of document

Version history

Version	Approval	Revision information
15	23.APR.2018	
16	20.MAR.2019	
17	19.JUN.2019	

eurofins	Always check on-line for validity. **VOCs and GRO by GC/MS in Soils and Solids by EPA 8260C/D**	Level: **Work Instruction**
Document number: **T-VOA-WI8236**		
Old Reference: **1-P-QM-WI-9013077**		
Version: **6**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date **12-APR-2019**	Document users: **6_EUUSLA_GC/MS Volatiles_GC/MS Auditors/Verifiers, 6_EUUSLA_GC/MS Volatiles_Management, 6_EUUSLA_GC/MS Volatiles_SW846 8260B/C Soil**	Responsible: **5_EUUSLA_GC/MS Volatiles_Manager**

LIMS ID
Analysis 11995

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Revision Log

	Revision: 6	**Effective Date:** This version
Section	**Justification**	**Changes**
Title	Current practice	Updated title to reflect new methods
Revision Log	Formatting requirement per G-DC-SOP16244	Removed revision logs up to the previous version
Reference	Current practice	Added 8260D reference

Revision: 5		**Effective Date:** 21.MAR.2019
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Title		Shortened title for clarity

Revision: 5	**Effective Date:** 21.MAR.2019	
Reference	Update	Added 8000D
Cross Reference	Redundancy	Removed Level II procedures and updated to D4 numbers
Personnel Training and Qualifications	Requirement	Added reference to IDOC
Reagents and Standards	Current practice	Updated freezer temperature and clarified IS/SS concentrations. Updated secondary dilution standard expiration throughout section.
Calibration	Clarification	Updated verbiage concerning MDL detection. Added 8000D criteria. Quantified "scoop" amount for sodium bisulfate. Added "prepared daily" to CCV description. Clarified acceptance criteria by stating "No more than 20%"...
Procedure	Clarification	Added use of reagent water for method blank and reference to QA/QC section for specific requirements. Added statement that method blank must be analyzed before samples.
Statistical Information/ Method Performance	Current requirement	Added statement concerning MDL evaluation
Quality Assurance/ Quality Control	Current practice	Added LLOQ information Added sand requirement for low level method blank
Entire Document	Update	Removed references to Level II procedures and updated to D4 numbers
Entire Document	Formatting requirement	Added GRO information contained in Appendix A
Appendix A	Formatting requirement	Deleted entire section, information redistributed to appropriate sections

Reference

1. Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS), SW-846 Method 8260C, August 2006.

2. Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS), SW-846 Method 8260D, June 2018.

3. Determinative Chromatographic Separations, SW-846 Method 8000D, March 2018.

4. Test Methods for Evaluating Solid Wastes, SW-846 Method 5030B, December 1996.

5. Test Methods for Evaluating Solid Wastes, SW-846 Method 5030C, May 2003.

6. Test Methods for Evaluating Solid Wastes, SW-846 Method 5035, Revision 0, December 1996.

7. Test Methods for Evaluating Solid Waste, SW-846, Method 5035A, July 2002.

8. *Total Petroleum Hydrocarbons Analysis-Gasoline Method*, California Department of Health Services, LUFT Task Force.

9. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
S-SS-WI10682	GC/MS - Bulk Solid Matrix Sample Preparation
S-SS-WI11170	Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035
T-VOA-WI7619	GC and GC/MS Instrumentation Maintenance
T-VOA-WI7629	GC/MS Volatile Standards Traceability
T-VOA-WI7692	Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
T-VOA-WI8373	GC/MS Volatiles Audit Process

Scope

This method is suitable for the determination of target compounds listed and maintained in the Laboratory Information Management System (LIMS) for soil and solid matrices. Samples consist of soils/solids collected or submitted in bulk in glass containers with Teflon-lined screw-caps or in field core sampling/storage containers (i.e., EnCore or equivalent). Associated MDLs/LOQs are listed in the LIMS under the analysis numbers and/or Project Information lists. Theoretical Standard Calibration (TSC) Sheets are included in the Appendix (Figures 1-6). These TSC sheets are to serve as examples only and may not reflect most current version in use. Non-target volatile compounds in the sample can be tentatively identified (TIC) using a mass spectral reference library comparison. This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by purge and trap GC/MS methodologies and skilled in mass spectral interpretation. Using this method, the TICs are quantitated with an estimated concentration.

Compounds other than those listed in the LIMS for this group of master scans may be analyzed using USEPA SW-846 Method 8260C. Selected Ion Monitoring (SIM) parameters can be used to detect, identify and quantitate volatile organic compounds in methanol extracts of soils/solids, if lower quantitation limits are required (project- or client-specified) and/or matrix interferences are anticipated. Attachment I describes the proper analysis procedure for Gasoline Range Organics in soils and solids. Due to poor purging efficiency or poor chromatography, some analytes require calibration at higher levels and/or higher practical quantitation limits (PQLs). Any additional compounds must be added to the theoretical standard concentrations (TSC) sheet. Standards containing additional analytes must be prepared as described in the Standards section of this document. Both secondary stock solutions and matrix spike solutions must be prepared for use in analyzing additional compounds.

Basic Principles

The soil sample is prepared according to analysis *S-SS-WI10682* and *S-SS-WI11170* for 8260C. The sample is purged with an inert gas and the effluent gas passed through a sorbent trap where the volatile organics are trapped. After purging, the sorbent trap is rapidly heated and backflushed onto the head of a gas chromatographic column held at the appropriate initial temperature for the column in use. The gas chromatographic column is temperature programmed to separate the volatile compounds, which are subsequently detected and identified using mass spectrometric techniques.

When a compound reaches the MS, it is bombarded by high energy electrons (70 eV). This causes the compound to fragment and form ions. The positive ions are focused into a quadrupole mass analyzer, where the ions are separated

according to their mass/charge ratios during rapid repetitive scans. These ions are then amplified and detected with an electron multiplier.

The resulting time/intensity/mass spectra data are stored and processed by a computer. Target compounds are identified on the basis of relative retention times and mass spectral matches to standards, which are injected every 12 hours on the same system. The internal standard method is used for quantitation.

The GRO analysis is typically performed in conjunction with the analysis of other volatile target compounds by SW-846 Method 8260C. The GRO quantitation range is 0.1 minutes before the peak apex of C6 (hexane) to 0.2 minutes after the peak apex of C12 (dodecane); however, other ranges can be established. By establishing a (C12) GRO window to 0.2 minutes following the elution of dodecane, the areas from a trio of unresolved peaks eluting near to the upper limit of the range must consistently be included in the total GRO area. In addition, the range remains tight enough to ensure that no C13 or greater compounds can be included in the total GRO area. The C4 range retention time is determined by selecting the first peak after the air and/or artifact peak minus 0.1 minutes in the first level of standard analyzed with the ICAL. The C5 range retention time is 0.1 minutes before the peak apex of pentane.This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by GC/MS purge and trap methodologies. The area of the total ion chromatogram for the GRO range is determined. The area of the internal standards and surrogate standards are found and subtracted from the total area of the chromatogram within the desired time range. The resulting area is then quantitated versus the internal standard, fluorobenzene.

Interferences

Contaminant sources are volatile compounds in the laboratory environment, impurities in the inert purging gas, carryover from samples containing high concentrations of volatile organic compounds and dirty glassware. The analyst must demonstrate that the system is free from interferences (by producing acceptable method blank data) before analyzing a batch of samples. Matrix effects from heavily contaminated soils and solids can interfere with the internal standard responses, target analytes and surrogate recoveries, thereby hindering accurate quantitation. See Section 4.0 of SW-846 Method 8260C for further discussion.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity of each reagent used has not been precisely determined. However, each reagent must be treated as a potential health hazard. Safety measures would include the use of fume hoods, safety glasses, lab coats, and gloves when working directly with reagents. Refer to the *Chemical Hygiene Plan* for specific details.

Personnel Training and Qualifications

Education Requirement: A 4–year Baccalaureate Degree from an accredited College or University in one of the physical sciences and/or 1 – 3 years of relevant gas chromatography experience.

Analysts must be trained in the proper method of volatile organic sample preparation and analysis as determined by the supervisor(s). All training and education relating to volatile organic sample preparation and analysis must be documented by each analyst in their training record. Specifically, each new chemist must train with an experienced

chemist for the first 12 weeks depending on the individual and their previous experience. The first 12 weeks are spent working one-on-one with the trainer. This time may be less if the new chemist has prior relevant experience in GC/MS and analytical chemistry background.

During the training period, the new chemist must learn daily maintenance, calibration techniques, data and library search review, and forms generation. They are also required to read all relevant SOPs and EPA methods. All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP. Each analyst must perform an Initial Demonstration of Capability to measure proficiency. Thereafter, an annual Demonstration of Capability is performed and maintained in the analyst's training records.

NOTE: A separate Demonstration of Capability for GRO is required.

Sample Collection, Preservation, and Handling

The samples must be stored in a refrigerator at 0°C to 6°C, not frozen. Soils are collected/submitted in bulk in glass containers with Teflon-lined screw-caps or in field core sampling/storage containers (i.e., EnCore or equivalent). Samples are preserved in methanol and either frozen reagent water or Sodium Bisulfate. All samples must be analyzed within 14 days of collection.

Apparatus and Equipment

1. Gastight micro syringes – 10-µL and larger
2. 5-mL gastight syringes
3. Analytical balance, capable of accurately weighing ±0.0001 g
4. Top-loading balance capable of weighing ±0.01 g
5. Glassware
   a. Class A Volumetric flasks with ground-glass stopper
   b. Vials, 1.5-mL, 15-mL, and 40-mL screw cap, with Teflon/silicone septa
   c. Mininert vials, 1-mL, 2-mL, and 5-mL

6. Purge and trap device – Consisting of the sample purger, the trap, and desorber; the OI Analytical 4560, OI Analytical 4660, or equivalent meets the requirements of this method. The purging chamber must have the purge gas passing through the sample as finely divided bubbles and minimize the headspace between the sample and the trap to <15 mL.

7. Autosampler – OI Analytical 4551, Archon, or equivalent meets the requirements of this method. The Archon has the capability to purge solid samples directly in the 40-mL vial (needed for samples prepared by analysis 8389).

8. Spiker units (optional) – OI Analytical Model 4551 SIM/Spiker or equivalent. One or two automated syringe spikers can be added to the OI Analytical Model 4551 autosampler to automatically introduce 10 µL of internal standard (ISTD), surrogate standard, and/or matrix spiking solutions to the sample as it is being transferred to the sparge vessel. The Archon has a groove that can deliver 1 µL of appropriate standards.

9. GC/MS system – The HP 5890GC/5972 MSD, HP 6890GC/5973MSD, HP 6890GC/5975MSD, and Shimadzu GC/MS QP5000 meet the requirements for this method.

10. Data System/Computer/Software– this is interfaced to the GC/MS system, which continuously acquires and stores data during the analysis, and can process/reduce data to generate the appropriate forms and supporting data. The software used for acquisition is HP Chemstation®, and data reduction is accomplished using Target® software.

11. GC Columns

a. Column 1 – 30M × 0.25 mm ID DB624 capillary column with a 1.4-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

b. Column 2 – 20M × 0.18 mm ID DB624 capillary column with a 1.0-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

Different sampling/analysis combinations are used based on how the sample was collected, expected level of VOCs in the sample, possible matrix interferences, list of target compounds, whether TICs were requested, the required quantitation limits and the type of equipment/instrumentation available.

NOTE: Refer to *T-VOA-WI7619* for instrumentation maintenance and troubleshooting.

Reagents and Standards

A. Reagents

1. Reagent water is defined as water in which an interferant is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory must meet these criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.

2. Purge and Trap grade Methanol or equivalent

3. Sodium bisulfate – ACS grade

4. Sand- Ottawa Standard

B. Standards

See *T-VOA-WI7629* for standards traceability.

1. Stock standard solutions – Stock solutions must be prepared in methanol. Standards are prepared from ampulated and neat compounds obtained from suppliers that indicate the purity of the compound. No correction for purity is made if the purity is listed as ≥96%. Pre-made solutions can be used if the supplier documents the concentrations of the solutions. All ampulated standards are stored at ≤-10°C until the expiration date indicated by the vendor or for 1 year if no expiration date is provided.

NOTE: For most of the target compounds, the stock standard solutions are purchased from a vendor as custom mixes (V for calibration and Q for separate source quality control). The internal and surrogate standards are purchased from a vendor, as well as the target compounds that are gases at room temperature. These gaseous standards have a 1-week expiration date, starting from the date they are opened.

2. Surrogate stock standard solution (for high level soils) – a 2500 µg/mL stock standard solution of dibromofluoromethane, toluene-d8, 4-bromofluorobenzene, and 1,2-dichloroethane-d4 is prepared in methanol by a commercial supplier

3. 8260A Internal standard spiking solution (8260IS) – a 2500 µg/mL stock standard solution of fluorobenzene, chlorobenzene-d5, 1,4-dichlorobenzene-d4, and 12500 µg/mL deuterated tertiary butyl alcohol (tBA-d10) is prepared in methanol by a commercial supplier. Deuterated tertiary butyl alcohol (tBA-d10) is used sometimes as an auxiliary ISTD. If an autosampler is used, dilute the stock to 250 µg/mL (1250 µg/mL for tBA-d10) in methanol. This is assuming a 1-µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained (50 µg/kg).

4. GRO calibration standard – a 5500-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier.

5. GRO QC standard – a 20,000-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier

6. To prepare stock standards from neat compounds:

a. Place about 9.8 mL methanol or an equivalent solvent into a tared 10.0-mL glass-stoppered volumetric flask. Weigh the flask to the nearest 0.1 mg.

b. Add the liquids using a syringe or pipette by adding 2 or more drops of the assayed material to the flask, being careful that no drop hits the side of the flask. Reweigh the flask, record/note the amount, dilute to volume, stopper, and mix by inverting the flask at least 3 times. Calculate the concentration of the standard.

c. The stock standard solutions are stored in Teflon-sealed screw-capped vials at ≤-10°C. The compound name, concentration, date prepared, expiration date, preparer name and storage conditions must appear on the bottle.

d. Replace in house prepared stock standard solutions every 6 months.

7. Secondary dilution standards – Using the stock standard solutions, prepare secondary stock solutions in methanol containing the desired compounds. These standards are prepared by calculating the volume of each stock standard required producing a given volume of a mixed working standard with a known concentration of each analyte. When custom mixes are used, these may be diluted down individually, or combined together with other mixes. The working standard is tested according to *T-VOA-WI7629*. The verified working standard is poured into Teflon-lined screw -capped GC vials or mininert vials and stored at ≤-10°C. A designator indicating the standard, month, and preparation date must be on the standard vials. The designator and all data pertaining to the working standard preparation are to be recorded in the standards logbook. Replace secondary dilution standards every 2-4 weeks (1 week for standards containing gases) unless otherwise indicated.

a. 1,4-Bromofluorobenzene (BFB) standard – Prepare a 50-µg/mL solution of BFB in methanol by diluting the stock standard (prepared from neat material) with methanol to a final volume of 100 mL. The volume of stock standard used varies, depending on the actual stock concentration.

b. Surrogate standard spiking solution (high level only) – Prepare the surrogate standard spiking solution from the stock standard solutions at a concentration of 25 or 250 µg/mL in methanol. The requested soil preparation method dictates what concentration of surrogates are required for analysis.

c. Internal standard (IS) solution (high level only) – fluorobenzene, chlorobenzene-d5, 1,4-dichlorobenzene-d4, and tert-Butyl Alcohol-d10. One mL of 8260IS is diluted with methanol to a total volume of 10 mL to give a final concentration of 250 µg/mL (1250 µg/mL for tBA-d10). This is assuming a 1-µL groove in the autosampler. If the

groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained (50 µg/kg).

d. IS/SS spiking solution (low level only)– Dilute 1 mL of 8260IS and 1 mL of 8260SS with methanol to 10-mL final volume (resulting in a concentration of 250 µg/mL, 1250 µg/mL for tBA-d10). This is assuming a 1-µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained 50 µg/kg).

e. Calibration spiking solution – Prepare solutions in methanol that contain the compounds of interest at known concentrations. Suggested calibration levels are 4, 10, 20, 50, 100, and 300 (µg/kg). Replace the calibration spiking solution every 2-4 weeks (1 week for standards containing gases).

f. Matrix spiking solution – Prepare solutions in methanol that contain the compounds of interest at known concentrations. These solutions serve as both the matrix spiking solution and the laboratory control sample solutions. Matrix spikes also serve as duplicates; therefore, two aliquots of the same sample need to be spiked for analysis with these solutions. Replace the matrix spiking solution every 2-4 weeks (1 week for standards containing gases). See Figures 2-5 for preparation information.

g. Store all standard solutions at ≤-10°C and protected from light.

Calibration

A. Instrument Conditions:

1. The purge and trap device must have the trap conditioned for at least 10 minutes at 180° to 220°C at a flow rate of 20 to 60 mL/min prior to initial use.

2. An example of purge and trap conditions are listed below:

Purge gas	Helium
Purge flow	35 – 40 mL/min
Purge temperature	40°C for low level soils and ambient temp. for medium/high level soils
Purge time	11 min
Desorb temperature	190°-220°C
Desorb time	0.5 to 4 minutes **
Bake temperature	180°-220°C
Bake time	8 min (±3 min)

** - Range as suggested by the purge and trap instrument manufacturer

NOTE: Purge and trap conditions may be changed to optimize instrument operations. A record of actual purge and trap conditions for each instrument may be found in the appropriate instrument maintenance log.

3. The suggested gas chromatographic operating conditions are listed in the table below, depending on the column used:

	Column 1	Column 2
Column liquid phase	DB-624	DB-624
Carrier gas	Helium	Helium

Carrier gas flow	0.8 mL/min	0.6 mL/min
Make-up gas flow	None	None
Initial temperature	45°C	45°C
Initial hold time	4.5 min	2.5 min
Temperature ramp	12°/min to 100°C then 25°/min to 240° C	12°/min to 100°C then 25°/min to 235° C
Final temperature	240°C	235°C
Final hold time	None	.02 min

4. Recommended mass spectrometer (MS) operating conditions:

Ions Positive
Electron energy 70 volts
Mass range 35 – 300 amu

H-P systems Scan time:

Number A/D Samples 22 (4)
Integration Time/Sample 50 microsec
Total Scan Time 0.6 sec

B. Tuning:

Tune the GC/MS system to meet the criteria in Table 1 following a 50-ng injection of BFB. The chromatographic conditions must be the same as those under which the samples are analyzed except that the temperature ramp may be increased and the initial temperature and flow rate may be different. The BFB tune must be verified every 12 hours.

The tune must be evaluated by taking the average of the three scans across the BFB peak apex with a background subtraction of a scan within 20 scans prior to the start of the BFB peak.

NOTE: All standards, samples, and associated quality control samples must be analyzed with the same mass spectrometer parameters as those used to obtain a successful tune.

C. Initial Calibration:

1. Perform the initial calibration by analyzing at least six distinct levels of analyte concentration. For high level soils, the surrogates are also analyzed at each distinct level. Response factors for each analyte are determined from these levels. Six levels are required if second order regression fits are used. Calibration for GRO consists of analyzing six distinct levels of GRO area in order to produce a response factor for the GRO quantitation range of interest using the internal standard, fluorobenzene. The relative standard deviation of the response factor determines the suitability of the average relative response factor for calculation of the GRO concentration. Refer to Figure 1 for the preparation of calibration standards and Figure 6 for preparation of GRO standards. The relative standard deviation of the response factors determines the suitability of the average relative response factor for calculation of the analyte or GRO concentration. Prior to the analysis of any calibration level, retention time markers must be run for the GRO range of interest. The retention time markers are hexane (C6) and Dodecane (C12). Other markers can be used if different ranges are required by a project.

NOTE: 5 levels are required by the method.

2. A method detection limit (MDL) standard must be analyzed with each initial calibration. This standard is prepared at or near the departmental MDL and is not to be included in the calibration curve. All compounds must be detected at or below MDL standard.

3. For medium/high level soils, methanol is added to all calibration standards. For low-level soils prepared according to EPA Method 5035, 1 scoop (approximately .50 -.75 grams) of sodium bisulfate is added to all calibration standards.

4. When using an autosampler, blanks and standards are prepared and poured into 40-mL vials with Teflon-lined septa. For the high-level method, 5 mL is withdrawn from the vial and transferred to the sparge vessel along with the appropriate amount of the internal standard spiking solution. For the low-level method, the autosampler transfers 5 mL of reagent water along with the appropriate amount of IS/SS spiking solution to the 40-mL vial.

5. Purge and desorb according to conditions listed in Calibration A.2.

6. Collect GC/MS data until the end of the GC run.

7. Empty and rinse the purging chamber at least twice with reagent water prior to loading another sample into the vessel, to minimize the possibility of carryover contamination.

8. Each level is analyzed as described above. Next, tabulate the area response of the characteristic ions (Table 2) against concentration for each analyte, surrogate standard, and internal standard and calculate relative response factors (RRF) for each compound (see Calculation section). The following table describes the guidelines for an acceptable initial calibration:

Frequency	Acceptance Criteria	Corrective Action
Initially and then when analytes in the daily calibration standard fail criteria.	1. % RSD of ≤20% is required for all analytes. 10% of the analytes may fail this criteria. 2. All compounds of interest must be detected in the MDL standard. 3. The relative retention times of the target compounds must agree within 0.06 relative retention time (RRT) units. The exception would be in the case of system maintenance. 4. Minimum response factors must be met for select compounds. See Table 3.	1. Any target analyte with a %RSD of ≤20% must use the average RRF for quantitation. For any analyte in which the %RSD >20%, a first-degree linear regression can be used (providing that the correlation coefficient [CC] is ≥0.995). A quadratic fit ** (using 6 stds) can also be used (provided the coefficient of determination [CD] is >0.99). If the linear fit and quadratic fit pass the criteria for any given analyte, then use the line/curve with the smallest positive y-intercept. If the y-intercept quantifies to be greater than the LOQ, consult your supervisor immediately or recalibrate. If CC or CD is <0.995 for linear or <0.99 for quadratic, recalibrate. Supervisory approval is required for exceptions to these guidelines. If >10% target

Frequency	Acceptance Criteria	Corrective Action
		analytes fail, recalibration is required. If a linear or quadratic curve fit is used for a target analyte, the calibration data must be refit back into the calibration model for all calibration levels. Percent error between the calculated and expected amounts of an analyte should be ≤ 30% for all standards. For some data uses, ≤ 50% may be acceptable for the lowest calibration point. 2. If a compound is not detected in the MDL standard, then report to the level of the lowest standard detected. 3,4. Perform system maintenance and recalibrate.

**Consult USEPA method 8000D for non-linear curve fitting techniques/guidelines

9. Each GRO level is analyzed as described above. Next, tabulate the area response for the GRO quantitation range minus the peak areas for the internal and surrogate standards that elute within the GRO range. Calculate the relative response factor (RRF) for GRO (see Calculation section) using the internal standard peak area for Fluorobenzene. Although four internal standard compounds are spiked for the 8260C analysis, only Fluorobenzene, is used for the quantitation of the GRO result.

10. Calculate the average relative response factors for the GRO quantitation range of interest. The calibration levels are evaluated on the basis of the relative standard deviation of the RRF values (%RSD). The %RSD for the GRO range of interest must be ≤20%. If the calibration meets this requirement, then the average RRF is used to calculate sample concentrations. If the %RSD is >20% then re-analysis of one or more levels can be necessary before the calibration is valid.

D. Initial Calibration Verification:

Following the calibration, an Initial Calibration Verification (ICV) standard must be run. The ICV is prepared according to the TSC sheet in Figure 5. The ICV acts as a second source standard to check against the initial calibration. All analytes must meet ICV acceptance windows of 70%-130%. If the ICV does not meet the aforementioned criteria, a second ICV is analyzed before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken.

For the GRO analysis, the ICV is prepared according to the TSC sheet in Figure 6 (QC prep). The ICV acts as a second source standard to check against the initial calibration. Results must quantitate within the 70-130% window. If the ICV does not meet the aforementioned criteria, a second ICV can be run before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken.

E. Continuing Calibration:

Continuing Calibration Verification (CCV) – The CCV is performed by analyzing a 50-ppb calibration standard (prepared daily due to aqueous nature) in subsequent tune periods after an initial calibration. The CCV is considered valid when the criteria listed below are met:

Frequency	Acceptance Criteria	Corrective Action
Every 12 hours.	1. % Drift of ≤20% is required for all analytes. No more than 20% of analytes may fail this criteria if not detected in proceeding samples. 2. The relative retention times (RRT) of the target compounds must agree within 0.06 RRT units. The exception would be in the case of system maintenance. 3. The extracted ion current profile (EICP) area for each internal standard must fall within the window of –50 % to +100 % from the mid-level standard area produced during the last initial calibration. 4. Minimum response factors must be met for select compounds. See Table 3.	1. - 4. In the event that the continuing calibration verification (CCV) standard fails any of these criteria, sample analysis must be suspended and the CCV must be re-analyzed. If the re-analysis fails any of the criteria then adjustments are to be made to the analytical system to return it to its original condition, followed by the analyses of 2 consecutive CCVs at the same level that failed. If both CCVs pass the criteria, then sample analysis can continue. Otherwise, the system must be recalibrated and the samples reanalyzed, or the data can be qualified.

A 1100-ppb standard is analyzed for the GRO analysis. The calibration is considered valid if the percent drift is ≤20%. Also, the internal standard peak area of fluorobenzene for the CCV is monitored against the mid-point standard of the initial calibration and must be –50% to +100% of the area counts. If any criteria listed above fails, the CCV is considered invalid. In the case where two consecutive CCVs fail, corrective action must be taken which can include re-analysis of the calibration check, instrument maintenance, and/or recalibration. If the criteria are met, the selected quantitation method from the initial calibration is used for blank and sample calculations until the end of the 12-hour period.

F. MDL Sensitivity Check- A MDL Sensitivity Check must be analyzed in cases where compounds fail to meet the % drift criteria in the CCV and have decreased sensitivity (-20% drift or greater). Affected compounds can be reported as non-detects if it is demonstrated that there is adequate sensitivity to detect the compound at the MDL. If the failed compound is detected, the concentration must be reported as an estimated value.

Calibration Calculations

1. Calculation of the relative response factor (RRF):

$$RRF = \frac{[A(x) \times C(is)]}{[A(is) \times C(x)]}$$

Where:

A(x) = Characteristic ion area for the compound being measured

A(is) = Characteristic ion area for the specific internal standard

C(x) = Concentration of the compound being measured

C(is) = Concentration of specific internal standard

2. Regression equations:

1st Order (linear) regression: $Y = Mx + B$

2nd order (quadratic) regression: $Y = Cx2 + Mx + B$

Where:

x = Area(Std) /Area(Istd)

Y = Conc.(Std)/Conc.(Istd)

M = 1st degree slope

C = 2nd degree slope

B = Y-intercept

3. Percent relative standard deviation (%RSD):

$$\%\ RSD = \frac{Standard\ Deviation}{Mean} \times 100$$

4. Calculation of the percent drift:

$$\%\ Drift = \frac{C(i) - C(c)}{C(i)} \times 100$$

Where:
C(i) = Calibration check compound standard concentration
CI = Measured concentration using selected quantification method

Procedure

A. Method Blank:

Analyze the method blank as described above for the initial calibration standards using reagent water. Refer to table in QA/QC section for specific requirements. The method blank is examined for interfering peaks. Any target compound peaks are calculated as described under the Calculations section of this procedure. All compounds must be less than the reporting limit for the associated samples. If the blank values exceed these values, corrective action must be taken and the method blank reanalyzed until the criteria are met. The method blank must be analyzed before processing any samples.

B. Laboratory Control Sample/ Duplicate and Matrix Spike/Duplicate: Refer to table in QA/QC section for specific requirements.

C. Qualitative Analysis:

Sample analysis for soil, solids, and nonaqueous matrices proceeds as described in the Calibration section. The aqueous matrix is replaced by the soil sample, which is prepared according to *S-SS-WI10682* and *S-SS-WI11170*. A compound is identified by comparison of the following parameters with those of a standard of this target compound (standard reference spectra). In order to verify identification, the following criteria must be met:

1. The intensities of the characteristic ions of the compound must maximize in the same scan or within one scan of each other.

2. The compound relative retention time must compare within ±0.06 RRT units of the RRT of the standard.

3. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum.

4. The relative intensities of the characteristic ions must agree within 30% of the relative intensities of these ions in the reference spectrum. Analyst discretion is used to determine compound identification. (Example: for an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).

5. The above criteria apply to hits greater than or equal to the LOQ. For hits between the MDL and the LOQ, both the above criteria and analyst discretion are used to determine compound identification.

6. The analyst must account for peaks that are greater than 10% relative intensity in the sample mass spectrum, but not present in the standard mass spectrum. Also, if a compound fails any of the criteria listed above but in the judgment of the mass spectral interpretation specialist is a correct identification, the identification is used and the quantitation of the peak is performed. The primary and secondary ions can be found in Table 2.

7. For the GRO analysis, the Total Ion Chromatogram (TIC) is reviewed to insure proper integration around the 8260 surrogates and internal standards. Also the TIC is checked to make sure all major peaks are integrated.

D. Quantitative Analysis:

Once a compound has been identified, quantitation of identified priority pollutant compounds is performed using the equations listed in the Calculations section of this SOP. The primary ions listed in Table 2 are used for quantitation. A secondary ion may be used if there is interference with the primary ion. All calculations must report concentrations in values of µg/kg. Any analyte with a calculated concentration above the highest standard must be reanalyzed at a dilution that brings the concentration in the solution within the calibration curve. It is desirable to have the dilution fall within the top half of the calibration curve, but it is not required.

The quantitation of the GRO range is performed using the equations listed in the Calculations section of this procedure. All calculations must report concentrations in values of µg/L. In the case where the total GRO concentration exceeds the calibration range, the sample is re-analyzed at a dilution that brings the GRO concentration within the calibration range of the GC/MS system.

Calculations

A. Analyte Concentration

1. Low level

$$\text{Concentration } (\mu g/kg) \frac{(Ax)\,(Is)}{(Ais)\,(RRF)\,(Ws)}$$

Where:

Ax = Area of the quantitation ion peak for the compound to be measured
Ais = Area of the quantitation ion peak for the appropriate internal standard
Is = Amount of internal standard added in nanograms
Ws = Weight of sample purged
RRF = Relative response factor from the initial calibration

2. Medium/high level

$$\text{Concentration } (\mu g/kg) \frac{(Ax)\,(Is)\,(Vt)}{(Ais)\,(RRF)\,(Ws)\,(Vi)}$$

Where:

Ax = Area of the quantitation ion peak for the compound to be measured
Ais = Area of the quantitation ion peak for the appropriate internal standard
Is = Amount of internal standard added in nanograms
Vt = Volume of the total extract in microliters
Vi = Volume of the extract used for purging in microliters
Ws = Weight of sample extracted
RRF = Relative response factor from the initial calibration

B. QC Calculations:

$$\%\ Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = Spiked sample result

SR = Sample result

SA = Spike added

C. Relative percent difference (RPD)

$$RPD = \frac{MSR - MSDR}{(1/2)\ (MSR + MSDR)} \times 100$$

Where:

MSR = Matrix spike measured concentration

MSDR = Matrix spike duplicate measured concentration

Statistical Information/Method Performance

The LCS must contain 80% to100% of the compounds in the calibration mix. LCS, MS, and surrogate recoveries and RPD are compared to the limits stored on the LIMS. These limits are statistically derived but must fall within 70% to 130% recovery for South Carolina compliance samples. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated on an annual basis in accordance with 40 CFR Part 136. Updates to the LIMS are made as needed by the QA Department and only as directed by the supervisor. The department database is updated via a download from the LIMS.

Quality Assurance/Quality Control

Each analysis batch must contain a method blank, a laboratory control sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD), or a laboratory control sample/laboratory control sample duplicate (LCS/LCSD). Additional QC samples may be required to meet project or state certification requirements. Every sample or QC analysis must contain internal standards and surrogate compounds.

The laboratory will establish the Lower Limit of Quantitation (LLOQ) at concentrations where both quantitative and qualitative requirements can consistently be met for 8000D. The LLOQ is the lowest concentration at which the laboratory has demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be ≥ the lowest point in the calibration curve. The LLOQ must be verified annually per instrument and is performed by the analysis of an LCS at 0.5-2 times the established LLOQ, using laboratory reagent water and following all preparation and analytical procedures as are used for environmental and QC samples. Acceptance criteria for target analytes in the LLOQ verification should be within established in-house limits or within other such project-specific acceptance limits. Until the laboratory has sufficient data to determine acceptance limits, the LCS criteria ± 20% may be used for the LLOQ acceptance criteria.

The GC/MS system must be tuned to meet the criteria in Table 1 following BFB injection. The chromatographic conditions must be the same as those under which the samples are analyzed except that the rate of temperature ramping may be increased and the initial temperature and column flow may be different. The BFB tune must be verified every 12 hours.

Quality Control Item	Acceptance Criteria	Corrective Action
Internal Standards • Added to every sample, standard, method blank or QC sample	1. Peak areas within -50% to +100% of the area in the associated reference standard. 2. Retention time (RT) within 30 seconds of RT for associated reference standard.	1. Check instrument for possible problems and then reanalyze samples. 2. If re-injecting meets the criteria, report this analysis. 3. If this reanalysis still shows the same problem, report results from first analysis and qualify data with a comment.
Surrogates • Added to every sample, standard, method blank or QC sample	All % recoveries must fall within statistically derived QC limits, which are reviewed and updated on a semi -annual basis.	If non-compliant, check for calculation or preparation errors. If no errors are found, check system for problems and reanalyze. If this reanalysis still shows the same problem, report first analysis and qualify data with a comment. If recoveries are outside of specification high and no target compounds are detected then a reanalysis or comment is not required.
Method Blank (MB) Performed during each tune period after the initial calibration or CCV (minimum of 1 MB per 20 samples)	1. Must meet internal standard criteria. 2. Must meet surrogate criteria.	1,2. Inspect system for possible problems and reanalyze. 3. If the MB contains target analytes and the associated samples do not, then no corrective action is required.

Quality Control Item	Acceptance Criteria	Corrective Action
• 1 scoop of Sodium Bisulfate is added if the preservative was added to the initial calibration. • Approximately 5 grams of sand is required for low level analysis.	3. Quantitative results for all target compounds must be less than the reporting limit for the associated samples.	If the target compounds in the MB are also in the associated samples, then they must be reanalyzed after a clean MB is obtained (certain projects may allow some exceptions for common laboratory contaminants like methylene chloride and acetone up to 5X the LOQ)
Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) • LCS analyzed with each batch of ≤ 20 samples • LCSD analyzed if MS/MSD unavailable • Approximately 5 grams of sand is required for low level analysis. • 1 scoop of Sodium Bisulfate is added if the preservative was added to the initial calibration. • See Figures 2, 3 and 4 for preparation info.	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. All % recoveries must fall within statistically derived QC limits, which are reviewed and updated on a semi -annual basis.	1,2. If non-compliant, check for calculation or preparation errors. If no errors found, check system for problems and reanalyze. 3. If LCS/LCSD re-analysis still fails, perform appropriate system maintenance and restart the tune period. Only with an LCS % recovery failing high (for the requested target compounds) with targets non-detected in the sample, can the results be reported. Otherwise, the sample must be analyzed with a compliant LCS.
Matrix Spike/Matrix Spike Duplicate (MS/MSD) • MS/MSD analyzed with each batch of ≤ 20 samples (if sufficient sample volume available) • See Figures 2 and 3 for preparation info.	1. % Recoveries must fall within statistically derived QC limits, which are reviewed and updated on a semi -annual basis 2. RPDs within QC limits.	1. If LCS within QC limits, proceed with sample analysis. 2. If most recoveries and/or RPDs outside of QC limits, consult the supervisor.

The method blank must meet all the above criteria for internal standard recoveries and surrogate recoveries. In addition, the method blank may not contain any target compound above the reporting limit for the associated samples. All method blanks must meet these criteria; otherwise, the system is considered out of control and corrective action must be taken.

If sufficient sample volume is not available to perform MS/MSD, LCS/LCSD are prepared and analyzed and must meet the above-mentioned criteria.

NOTE: Prior to release from the analytical laboratory, all data is reviewed in accordance with *T-VOA-WI8373*.

The sample is analyzed using the same instrumental conditions as the standard (whether ICAL or CCV), tune and method blank. If the QA criteria are satisfied and no target compounds are detected at concentrations above the calibration range, the results can be reported. To avoid possible matrix effects, sample carryover and re-analyses, an initial dilution may be performed if:

1. Prescreening indicates a high volatile organic content in the sample

2. Historical data (or lack thereof) and/or sample appearance indicate a need for dilution

If target compounds are detected in the sample at concentrations above the calibration range, a dilution must be performed (see *T-VOA-WI7692* for information on when cleaning blanks must be run). See method SW-846 8260C for the recommended dilution procedures.

Table 1

BFB Key Ion Abundance Criteria

Mass	Ion Abundance Criteria
50	15% to 40% of mass 95
75	30% to 60% of mass 95
95	base peak, 100% relative abundance
96	5% to 9% of mass 95
173	less than 2% of mass 174
174	greater than 50% of mass 95
175	5% to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5% to 9% of mass 176

Table 2

Primary and Secondary Ions

Compound Name	Primary Ion	Secondary Ion
Chloromethane	50	52
Vinyl Chloride	62	64
Bromomethane	94	96
Chloroethane	64	66
1,1-Dichloroethene	96	61, 63
Acetone	43	58
Carbon Disulfide	76	78
Methylene Chloride	84	49, 86
1,1-Dichloroethane	63	65, 83
trans-1,2-Dichloroethene	96	61, 63
cis-1,2-Dichloroethene	96	61, 63
2-Butanone	43	72
Chloroform	83	85
1,2-Dichloroethane	62	98

Compound Name	Primary Ion	Secondary Ion
1,1,1-Trichloroethane	97	61, 99
Carbon Tetrachloride	117	119
Benzene	78	
Trichloroethene	95	130, 132
1,2-Dichloropropane	63	76
Bromodichloromethane	83	85
cis-1,3-Dichloropropene	75	77, 110
trans-1,3-Dichloropropene	75	77, 110
1,1,2-Trichloroethane	97	83, 85
Dibromochloromethane	129	127
Bromoform	173	175
4-Methyl-2-pentanone	43	58
Toluene	92	91
Tetrachloroethene	166	131, 164
2-Hexanone	43	58
Chlorobenzene	112	77
Ethylbenzene	91	106
Xylene (total)	106	91
Styrene	104	78
1,1,2,2-Tetrachloroethane	83	85, 131
Dibromofluoromethane	113	111
1,2-Dichloroethane-d4	102	104
Fluorobenzene	96	70
Toluene-d8	98	100
Chlorobenzene-d5	117	82
4-Bromofluorobenzene	95	174
1,4-Dichlorobenzen-d4	152	115

Continued
Primary and Secondary Ions

Compound Name	Primary Ion	Secondary Ion
Chloromethane	50	52
Vinyl Chloride	62	64
Bromomethane	94	96
Chloroethane	64	66
1,1-Dichloroethene	96	61, 63
Acetone	43	58
Carbon Disulfide	76	78
Methylene Chloride	84	49, 86
1,1-Dichloroethane	63	65, 83
trans-1,2-Dichloroethene	96	61, 63
cis-1,2-Dichloroethene	96	61, 63
2-Butanone	43	72
Chloroform	83	85
1,2-Dichloroethane	62	98
1,1,1-Trichloroethane	97	61, 99
Carbon Tetrachloride	117	119
Benzene	78	

Compound Name	Primary Ion	Secondary Ion
Trichloroethene	95	130, 132
1,2-Dichloropropane	63	76
Bromodichloromethane	83	85
cis-1,3-Dichloropropene	75	77, 110
trans-1,3-Dichloropropene	75	77, 110
1,1,2-Trichloroethane	97	83, 85
Dibromochloromethane	129	127
Bromoform	173	175
4-Methyl-2-pentanone	43	58
Toluene	92	91
Tetrachloroethene	166	131, 164
2-Hexanone	43	58
Chlorobenzene	112	77
Ethylbenzene	91	106
Xylene (total)	106	91
Styrene	104	78
1,1,2,2-Tetrachloroethane	83	85, 131
Dibromofluoromethane	113	111
1,2-Dichloroethane-d4	102	104
Fluorobenzene	96	70
Toluene-d8	98	100
Chlorobenzene-d5	117	82
4-Bromofluorobenzene	95	174
1,4-Dichlorobenzene-d4	152	115

Table 3
Minimum Relative Response Factors For ICAL and CCV

Volatile Compounds	Minimum Response Factor
Dichlorodifluoromethane	0.100
Chloromethane	0.100
Vinyl Chloride	0.100
Bromomethane	0.100
Chloroethane	0.100
Trichlorofluoromethane	0.100
1,1-Dichloroethene	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	0.100
Acetone	0.100
Carbon Disulfide	0.100
Methyl Acetate	0.100
Methylene Chloride	0.100
trans-1,2-Dichloroethene	0.100
cis-1,2-Dichloroethene	0.100
Methyl tert-Butyl Ether	0.100
1,1-Dichloroethane	0.200
2-Butanone	0.100
Chloroform	0.200
1,1,1-Trichloroethane	0.100
Cyclohexane	0.100

Carbon Tetrachloride	0.100
Benzene	0.500
1,2-Dichloroethane	0.100
Trichloroethene	0.200
Methylcyclohexane	0.100
1,2-Dichloropropane	0.100
Bromodichloromethane	0.200
cis-1,3-Dichloropropene	0.200
trans-1,3-Dichloropropene	0.100
4-Methyl-2-pentanone	0.100
Toluene	0.400
1,1,2-Trichloroethane	0.100
Tetrachloroethene	0.200
2-Hexanone	0.100
Dibromochloromethane	0.100
1,2-Dibromoethane	0.100
Chlorobenzene	0.500
Ethylbenzene	0.100

Table 3 Continued

Volatile Compounds	Minimum Response Factor
m&p-Xylene	0.100
o-Xylene	0.300
Styrene	0.300
Bromoform	0.100
Isopropylbenzene	0.100
1,1,2,2-Tetrachloroethane	0.300
1,3-Dichlorobenzene	0.600
1,4-Dichlorobenzene	0.500
1,2-Dichlorobenzene	0.400
1,2-Dibromo-3-chloropropane	0.050
1,2,4-Trichlorobenzene	0.200

S-SS-WI10682 GC/MS - Bulk Solids Matrix Sample Preparation
S-SS-WI11170 Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035 and Method 5035A
T-VOA-WI7619 GC and GC/MS Instrumentation Maintenance
T-VOA-WI7629 GC/MS Volatile Standards Traceability
T-VOA-WI7692 Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
T-VOA-WI8373 GC/MS Volatiles Audit Process

Attachment:
Figure 1
Figure 2
Figure 3
Figure 4
Figure 5
Figure 6

End of document

Version history

Version	Approval	Revision information
4	24.JUN.2016	
5	21.MAR.2019	
6	12.APR.2019	

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260B/C

Date:_____
Instrument:_____

VOA1= 1:5 dilution of VCS#1B, VCS#2B, and VCS#4C
VOA2= 1:5 dilution of VCS#2B
VOA3= 1:5 dilution of VCS#3B and Vacrolein
VOA6= 1:5 dilution of VCS#6
2CEVE= 1:5 dilution of VCS#1B-2CEVE
VOA8= 1:5 dilution of Hexachloroethane and 2,2'-oxybis(1-Chloropropane)

Stock mix name	VOA1 _____ 2CEVE _____ 1,3-BUT _____	VOA3 _____	VOA2 _____	VOA6 _____ EE _____ Custom V LG Freon _____	n-PEN _____ VOA8 _____	CYC _____	EOH _____	Restek Gases (2000 ppm) Lt#_____	IH826SS 250 ppm @ _____ 2500 ppm 8260SS $ ----------	Flask mL	MeOH mL Lt#____
300 ppb std	15 µL	6 µL		15µL	15 µL	30 µL	60 µL	7.5 µL	60µL@/6µL$	50	1
100 ppb std	5 µL	2 µL		5 µL	5 µL	10 µL	20 µL	2.5 µL	20µL/2µL$	50	1
50 ppb std	5 µL	2 µL		5 µL	5 µL	10 µL	20 µL	2.5 µL	20µL @/ 2µL$	100	2
20 ppb std	4 µL	1.6 µL	4 µL	4 µL	4 µL	16 µL	32 µL	2.0 µL	16µL@/1.6µL$	200	4
10 ppb std	2 µL	0.8 µL	2 µL	2 µL	2 µL	8 µL	16 µL	1.0 µL	8µL@/ 0.8µL$	200	4
4 ppb std	4 µL	1.6 µL	12 µL	4 µL	4 µL	32 µL	40 µL	2.0 µL	16µL@/ 1.6µL$	1000 *	20
1 ppb std	* Aliquot 12.5 mL of 1000 mL flask into 50 mL flask										
0.5 ppb MDL std	+ Aliquot 12.5 mL of 1000 mL flask into 100 mL flask										

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
Benzene	CS#1B	5000	300	100	50	20	10	4	1	0.5
Bromobenzene		5000	300	100	50	20	10	4	1	0.5
Bromodichloromethane		5000	300	100	50	20	10	4	1	0.5
Bromoform		5000	300	100	50	20	10	4	1	0.5
n-Butylbenzene		5000	300	100	50	20	10	4	1	0.5
sec-Butylbenzene		5000	300	100	50	20	10	4	1	0.5
tert-Butylbenzene		5000	300	100	50	20	10	4	1	0.5
Carbon Tetrachloride		5000	300	100	50	20	10	4	1	0.5
Chlorobenzene		5000	300	100	50	20	10	4	1	0.5
Chloroform		5000	300	100	50	20	10	4	1	0.5
2-Chlorotoluene		5000	300	100	50	20	10	4	1	0.5
4-Chlorotoluene		5000	300	100	50	20	10	4	1	0.5
Dibromochloromethane		5000	300	100	50	20	10	4	1	0.5
1,2-Dibromo-3-chloropropane		5000	300	100	50	20	10	4	1	0.5
1,2-Dibromoethane (EDB)		5000	300	100	50	20	10	4	1	0.5
Dibromomethane		5000	300	100	50	20	10	4	1	0.5
1,2-Dichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,3-Dichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,4-Dichlorobenzene		5000	300	100	50	20	10	4	1	0.5

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260A/B

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
1,1-Dichloroethane	CS#1B	5000	300	100	50	20	10	4	1	0.5
1,2-Dichloroethane		5000	300	100	50	20	10	4	1	0.5
1,1-Dichloroethene		5000	300	100	50	20	10	4	1	0.5
cis-1,2-Dichloroethene		5000	300	100	50	20	10	4	1	0.5
trans-1,2-Dichloroethene		5000	300	100	50	20	10	4	1	0.5
1,2-Dichloropropane		5000	300	100	50	20	10	4	1	0.5
1,3-Dichloropropane		5000	300	100	50	20	10	4	1	0.5
2,2-Dichloropropane		5000	300	100	50	20	10	4	1	0.5
1,1-Dichloropropene		5000	300	100	50	20	10	4	1	0.5
cis-1,3-Dichloropropene		5000	300	100	50	20	10	4	1	0.5
trans-1,3-Dichloropropene		5000	300	100	50	20	10	4	1	0.5
Ethylbenzene		5000	300	100	50	20	10	4	1	0.5
Hexachlorobutadiene		5000	300	100	50	20	10	4	1	0.5
Isopropylbenzene		5000	300	100	50	20	10	4	1	0.5
p-Isopropyltoluene		5000	300	100	50	20	10	4	1	0.5
Methylene Chloride		5000	300	100	50	20	10	4	1	0.5
Naphthalene		5000	300	100	50	20	10	4	1	0.5
n-Propylbenzene		5000	300	100	50	20	10	4	1	0.5
Styrene		5000	300	100	50	20	10	4	1	0.5
1,1,1,2-Tetrachloroethane		5000	300	100	50	20	10	4	1	0.5
1,1,2,2-Tetrachloroethane		5000	300	100	50	20	10	4	1	0.5
Tetrachloroethene		5000	300	100	50	20	10	4	1	0.5
Toluene		5000	300	100	50	20	10	4	1	0.5
1,2,3-Trichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,2,4-Trichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,3,5-Trichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,1,1-Trichloroethane		5000	300	100	50	20	10	4	1	0.5
1,1,2-Trichloroethane		5000	300	100	50	20	10	4	1	0.5
Trichloroethene		5000	300	100	50	20	10	4	1	0.5
1,2,3-Trichloropropane		5000	300	100	50	20	10	4	1	0.5
1,2,4-Trimethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,3,5-Trimethylbenzene		5000	300	100	50	20	10	4	1	0.5
m-Xylene		5000	300	100	50	20	10	4	1	0.5
o-Xylene		5000	300	100	50	20	10	4	1	0.5
p-Xylene		5000	300	100	50	20	10	4	1	0.5
1-Chlorohexane		5000	300	100	50	20	10	4	1	0.5
Pentachloroethane	CS#6	5000	300	100	50	20	10	4	1	0.5
Allyl Chloride		5000	300	100	50	20	10	4	1	0.5
Bromochloromethane		5000	300	100	50	20	10	4	1	0.5
Methyl Acetate		5000	300	100	50	20	10	4	1	0.5
Methylcyclohexane		5000	300	100	50	20	10	4	1	0.5
2-Methylnaphthalene		5000	300	100	50	20	10	4	1	0.5
1,2,3-Trimethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,2-Diethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,3-Diethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,4-Diethylbenzene		5000	300	100	50	20	10	4	1	0.5

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260A/B

Compound name	Std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
Methacrylonitrile	CS#2B	12500	750	250	125	100	50	40	10	5
Propionitrile		25000	1500	500	250	200	100	80	20	10
trans-1,4-Dichloro-2-Butene		12500	750	250	125	100	50	40	10	5
t-Butyl Alcohol		25000	1500	500	250	200	100	80	20	10
2-Propanol		25000	1500	500	250	200	100	80	20	10
Isobutyl Alcohol		62500	3750	1250	625	500	250	200	50	25
n-Butanol		125000	7500	2500	1250	1000	500	400	100	50
1,4-Dioxane		62500	3750	1250	625	500	250	200	50	25
2-Butanone	CS#3B	25000	600	200	100	40	20	8	2	1
2-Hexanone		25000	600	200	100	40	20	8	2	1
4-Methyl-2-Pentanone		25000	600	200	100	40	20	8	2	1
Acetone		25000	600	200	100	40	20	8	2	1
Acrylonitrile		12500	300	100	50	20	10	4	1	0.5
2-Nitropropane		25000	600	200	100	40	20	8	2	1
Tetrahydrofuran		25000	600	200	100	40	20	8	2	1
Methyl-t-butyl Ether	CS#4C	5000	300	100	50	20	10	4	1	0.5
Ethyl Methacrylate		5000	300	100	50	20	10	4	1	0.5
Methyl Methacrylate		5000	300	100	50	20	10	4	1	0.5
Freon 113		5000	300	100	50	20	10	4	1	0.5
Hexane		5000	300	100	50	20	10	4	1	0.5
Heptane		5000	300	100	50	20	10	4	1	0.5
Cyclohexane		5000	300	100	50	20	10	4	1	0.5
Benzyl Chloride		5000	300	100	50	20	10	4	1	0.5
Methyl Iodide		5000	300	100	50	20	10	4	1	0.5
Carbon Disulfide		5000	300	100	50	20	10	4	1	0.5
2-Chloro-1,3-Butadiene		5000	300	100	50	20	10	4	1	0.5
di-Isopropyl Ether		5000	300	100	50	20	10	4	1	0.5
tert-Amyl Methyl Ether		5000	300	100	50	20	10	4	1	0.5
Ethyl-t-butyl Ether		5000	300	100	50	20	10	4	1	0.5
Bromomethane	Gas	2000	300	100	50	20	10	4	1	0.5
Chloroethane	mix	2000	300	100	50	20	10	4	1	0.5
Chloromethane		2000	300	100	50	20	10	4	1	0.5
Dichlorodifluoromethane		2000	300	100	50	20	10	4	1	0.5
Trichlorofluoromethane		2000	300	100	50	20	10	4	1	0.5
Vinyl Chloride		2000	300	100	50	20	10	4	1	0.5
Cyclohexanone	CYC	6250	3750	1250	625	500	250	200	50	25
2-Chloroethyl Vinyl Ether	2CEVE	5000	300	100	50	20	10	4	1	0.5
1,3-Butadiene	1,3-BUT	1000	300	100	50	20	10	4	1	0.5

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260C

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb
Ethyl Ether	EE	1000	300	100	50	20	10	4	1
n-Pentane	n-PEN	1000	300	100	50	20	10	4	1
Acrolein	VACR	125000	3000	1000	500	200	100	40	10
Cyclohexanone	CYC	6250	3750	1250	625	500	250	200	50
Ethanol	EOH	12500	15000	5000	2500	2000	1000	500	125
Dichlorofluoromethane	Custom	1000	300	100	50	20	10	4	1
Freon 123a	V Freon	1000	300	100	50	20	10	4	1

ppb of analytical standard = (stock ppm)(µL stock) / flask mL

Analyst:_____
Date:_____

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Low Soil and NJ MeOH Prep

QVOA1= 1:25 QCS#1B, QCS#2B, QCS3B,QCS#4C Date:_____
QVOA6 = 1: 25 QCS#6 QGASES=1:50 Restek 502.2 "Q" Gas mix Instrument:_____
QARC = 1: 25 QCS#1B2CEVE, QACR stock QVOA8= 1:25 VOA8
Qn-pentane = 40ul of n-pentane lot#_____ to 960ul MEOH lot# _____
QBUT = 40ul of 1,3-Butadiene lot#_____ to 960ul MEOH lot# _____
Custom Freon Q = 40ul of Custom Q LG Freon lot#_____ to 960 ul MEOH lot#_____

Stock mix Name	QVOA1 _____ QARC _____ QBUT _____	QVOA6 _____ QEE _____	QCYC _____	QEOH _____	8260 SS 2500 ppm Lot#_____ MeOH Prep Only	QGASES _____ Qn-pentane QVOA8 _____ _____ Custom Q LG Freon _____	Final Volume	MeOH Lot# _____ MeOH Prep Only	Used
20 ppb	2.5 µL	2.5 µL	2.5 µL	5.0 µL	0.1 ul	2.5 µL	5 mL Syringe	.1 mL	
20 ppb	21.5 µL	21.5 µL	21.5 µL	43.0 µL	-	21.5 µL	43 mL Vial	-	
20 ppb	25.0 µL	25.0 µL	25.0 µL	50.0 µL	1.0 ul	25.0 µL	50 mL Flask	1 mL	

Compound name	std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20
1,2-Dichloropropane		1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20
1,1-Dichloropropene		1000	20
cis-1,3-Dichloropropene		1000	20

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
trans-1,3-Dichloropropene	QCS#1B	1000	20
Ethylbenzene		1000	20
Hexachlorobutadiene		1000	20
p-Isopropyltoluene		1000	20
Methylene Chloride		1000	20
Isopropylbenzene (Cumene)		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,3,5-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
1-Chlorohexane		1000	20
Bromomethane	QGas	2000	20
Chloroethane	mix	2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500
2-Butanone	QCS#3B	7500	150
2-Hexanone		5000	100

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
4-Methyl-2-Pentanone	QCS#3B	5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
2-Methylnaphthalene		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20
Acrolein	QACR	7500	150
2- Chloroethyl Vinyl Ether	QCS#1B 2CEVE	1000	20
Cyclohexanone	QCYC	1000	500
Ethyl Ether	QEE	40	20
n-Pentane	Qn-PEN	40	20
1,3-Butadiene	QBUT	40	20

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
Dichlrofluoromethane	Custom Q	1000	20
Freon 123a	LG Freon	1000	20
Ethanol	QEOH	1000	1000
Hexachloroethane	QVOA8	1000	20
2,2'-oxybis(1-chloropropane)		1000	20

ppb of analytical standard = (stock ppm)(µl stock) / final volume

Analyst:_____
Date:_____

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
High Level Prep with QC

Prep date:_____
Instrument:_____
exp. date:_____

*LCS/LCSD = DF 50 of final volume

Stock mix name	QCS#1B Lt#_____ QCS#3B Lt#_____ QCS#4C Lt#_____ QCS#1B-2CEVE Lt#_____ QCS#2B Lt#_____ QCS#6 Lt#_____	QACR _____ EE _____ Custom Q LG Freon Lot #____	CYC _____	EtOH _____	2000 ppm Restek 502.2 "Q" Gas mix Lt#_____	8260 SS $ Lt#_____ 2500 ppm $	Final Volume * MeOH Lot# _____
High Level	10 µL	10 µL	40 µL	40 µL	5 µL	10 µL	10 mL

Compound name	std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20
1,2-Dichloropropane		1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20
1,1-Dichloropropene		1000	20
cis-1,3-Dichloropropene		1000	20
trans-1,3-Dichloropropene		1000	20
Ethylbenzene		1000	20

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
High Level Prep with QC

Compound name	std mix	Stock ppm	20 ppb
Hexachlorobutadiene	QCS#1B	1000	20
Isopropylbenzene (Cumene)		1000	20
p-Isopropyltoluene		1000	20
Methylene Chloride		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,3,5-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Tricholroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
1-Chlorohexane		1000	20
2-Chloroethyl Vinyl Ether	QCS#1B 2CLEVE	1000	20
Bromomethane	Gas	2000	20
Chloroethane	mix	2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
High Level Prep with QC

Compound name	std mix	Stock ppm	20 ppb
2-Hexanone	QCS#3B	5000	100
2-Butanone		7500	150
4-Methyl-2-Pentanone		5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
2-Methylnaphthalene		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
High Level Prep with QC

Compound name	std mix	Stock ppm	20 ppb
Freon 123a	Custom Q	1000	20
Dichlorofluoromethane	LG Freon	1000	20
Acrolein	QACR	7500	150
Cyclohexanone	CYC	6250	500
Ethanol	EtOH	12500	1000
Ethyl Ether	EE	1000	20

ppb of analytical standard = (stock ppm)(µl stock) / final volume

Analyst:_____
Date:_____

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
MeOH Prep

Prepped:_____
Instrument:_____
exp. date:_____

QVOA6= 1:25 QCS#6
QARC = 1: 25 QCS#1B2CEVE, QACR stock
QVOA1= 1:25 QCS#1B, QCS#2B, QCS3B, QCS#4C QGASES=1:50 Restek 502.2 "Q" Gas mix
QCustom LG Freon = 40uL of Custom Q LG Freon lot#_____to 960uL MEOH lot#_____
Qn-pentane = 40ul of n-pentane lot#_____ to 960ul MEOH lot# _____

Stock mix name	QVOA1 _____ QARC _____ QCUSTOM LG FREON _____	QVOA6 _____ QEE _____ QVOA8 _____	QGASES _____ QCYC _____ Q n-Pentane _____	QEOH _____	826SS $ _____ 25 ppm $ 8260 SS@ _____ 2500ppm @	Final Volume MeOH Lot#_____	Prep Used
As Rec'd Med	250 µL	250 µL	250 ul	500 µl	1.0 mL $	10 mL MeOH	
High Level **NO QC**	250 µL	250 µL	250 ul	500 µL	10 µL @	10 mL MeOH	

Compound name	std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20
1,2-Dichloropropane		1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20
1,1-Dichloropropene		1000	20
cis-1,3-Dichloropropene		1000	20

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
trans-1,3-Dichloropropene	QCS#1B	1000	20
Ethylbenzene		1000	20
Hexachlorobutadiene		1000	20
Isopropylbenzene (Cumene)		1000	20
p-Isopropyltoluene		1000	20
Methylene Chloride		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,3,5-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
1-Chlorohexane		1000	20
Bromomethane	Gas	2000	20
Chloroethane	mix	2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500
2-Hexanone	QCS#3B	5000	100
4-Methyl-2-Pentanone		5000	100

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
Acetone	QCS#3B	7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100
2-Butanone		7500	150
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
2-Chloroethyl Vinyl Ether	QCS#1B 2CEVE	1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
2-Methylnaphthalene		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20
Ethanol	QEOH	1000	1000
Cyclohexanone	QCYC	1000	500
Ethyl Ether	QEE	40	20
Hexachloroethane	QVOA8	1000	20
2,2'-oxybis(1-chloropropane)		1000	20

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
Dichlorofluoromethane	QCUSTOM	1000	20
Freon 133a	LG FREON	1000	20
Acrolein	QACR	7500	150
n-Pentane	Q n-Penane	40	20

ppb of analytical standard = (stock ppm)(µl stock) / final volume .

Analyst:_____
Date:_____

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Low Soil and NJ MeOH Prep

Date:_____
Instrument:_____

Qn-pentane = 40ul of n-pentane lot#_____ to 960ul MEOH lot# _____
QBUT = 40ul of 1,3-Butadiene lot#_____ to 960ul MEOH lot# _____

Stock mix Name	QCS#1B _____ QCS#2B _____ QCS#3B _____ QCS#4C _____ QACR _____	QCYC _____ QEE _____ QBUT _____ Qn-pentane _____	QEOH _____	8260 SS 2500 ppm Lot#_____ QCS#1B 2CEVE _____ QCS#6 _____ Cust. Q LG Freon _____	Restek 502.2 "Q" Gas mix _____	Final Volume	MeOH Lot# _____	Used
20 ppb	2.0 µL	50.0 µL	100.0 µL	2.0 ul	1.0 µL	100 mL Flask	2 mL	

Compound name	std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20
1,2-Dichloropropane		1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20
1,1-Dichloropropene		1000	20

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
cis-1,3-Dichloropropene	QCS#1B	1000	20
trans-1,3-Dichloropropene		1000	20
Ethylbenzene		1000	20
Hexachlorobutadiene		1000	20
p-Isopropyltoluene		1000	20
Methylene Chloride		1000	20
Isopropylbenzene (Cumene)		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,3,5-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
1-Chlorohexane		1000	20
Bromomethane	QGas	2000	20
Chloroethane	mix	2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500
2-Butanone	QCS#3B	7500	150

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
2-Hexanone	QCS#3B	5000	100
4-Methyl-2-Pentanone		5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
2-Methylnaphthalene		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20
Acrolein	QACR	7500	150
2- Chloroethyl Vinyl Ether	QCS#1B 2CEVE	1000	20
Cyclohexanone	QCYC	1000	500
Ethyl Ether	QEE	40	20
n-Pentane	Qn-PEN	40	20
1,3-Butadiene	QBUT	40	20

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Low Soil and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
Ethanol	QEOH	1000	1000
Dichlorofluoromethane	Custom Q	1000	20
Freon 123a	LG Freon	1000	20

ppb of analytical standard = (stock ppm)(µl stock) / final volume

Analyst:_____
Date:_____

Theoretical Standard Concentrations
Gasoline Range Organics
Low Level / High Level Soil Prep

Instrument:_____
Restek V Unleaded Gasoline Composite Standard Date:_____

Lot: _____ Exp: _____
8260 SS Lt#_____

INITIAL CALIBRATION TSC			level 6	level 5	level 4	level 3	level 2	level 1	MDL
		ul stock	40	20	10	10	4	2	4
		ul SS stock	1	1	1	2	2	2	10
		FV H20 Ml	50	50	50	100	100	100	500
Compound Name	**CAS #**	**Stock ppm**	**Conc. ug/Kg**	**Conc. ug/Kg**	**Conc. ug/Kg**	**Conc. ug/Kg**	**Conc. ug/Kg**	**Conc. ug/Kg**	**Conc. ug/Kg**
Unleaded Gasoline Composite Std.	8006-61-9	5500	4400	2200	1100	550	220	110	44
MeOH Man./lot_____			1.0mL	1.0mL	1.0mL	2.0mL	2.0mL	2.0mL	10.0mL

Analyst:_____
Date:_____

QUALITY CONTROL TSC
Restek Q Unleaded Gasoline Composite Std. Lot_____ 20000ug/mL
QGRO=1:10 Restek Q Unleaded Gasoline Composite Std.

Low Level

Stock mix	QGRO _____	Final Volume	Prep Used
1000 ppb GRO	2.5 ul	5 ml Syringe	
1000 ppb GRO	25.0 ul	50 mL Flask	

Analyst:_____
Date:_____

High Level

		mL stock	Final Vol
QGRO :	2000 ug/mL	0.25	10mL
8260SS lot # :	2500 ug/mL	0.01	10mL
R826 SS :	25 ug/mL	1	10mL

Then dilute 1.0mL of spiked extract into a 50.0mL flask
Final Spike Concentration = 1000 ppb GRO

eurofins	Always check on-line for validity. **VOCs and GRO by GC/MS in Waters and Wastewaters by EPA 8260C/D**	Level: **Work Instruction**
Document number: **T-VOA-WI8194**		
Old Reference: **1-P-QM-WI- 9013078**		
Version: **8**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date **18-JUL-2019**	Document users: **6_EUUSLA_GC/MS Volatiles_GC/MS Auditors/Verifiers, 6_EUUSLA_GC/MS Volatiles_Level II Peer Review, 6_EUUSLA_GC/MS Volatiles_Management, 6_EUUSLA_GC/MS Volatiles_SW846 8260B/C Water**	Responsible: **5_EUUSLA_GC/MS Volatiles_Manager**

LIMS ID
Analysis 11996, 11997, 13130

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Revision Log

	Revision: 8	**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per G-DC-SOP16244	Removed revision logs up to the previous version
Sample Collection, Preservation and Handling	Current practice	Added verbiage concerning Acrolein and Acrylonitrile in regard to pH and holding time.
Calibration	Process change	Removed MDL standard requirement from initial calibration

	Revision: 7	**Effective Date:** April 11 2019
Section	**Justification**	**Changes**
Title	Updated scope	Updated title to reflect new methods
Revision Log	Formatting requirement per G-DC-SOP16244	Removed revision logs up to the previous version
Reference	Updated scope	Added 8260D reference

Reference

1. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), SW-846 Method 8260C, August 2006.

1. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), SW-846 Method 8260D, June 2018.

2. Determinative Chromatographic Separations, SW-846 Method 8000D, Revision 4, July 2014.

3. Purge and Trap for Aqueous Samples, SW-846 Method 5030B, December 1996.

4. Purge and Trap for Aqueous Samples, SW-846 Method 5030C, Rev 3, May 2003.

5. *Total Petroleum Hydrocarbons Analysis-Gasoline Method*, California Department of Health Services, LUFT Task Force.

6. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-VOA-WI7691	Glassware Washing
T-VOA-WI7619	GC and GC/MS Instrumentation Maintenance
T-VOA-WI7629	GC/MS Volatile Standards Traceability
T-VOA-WI7692	Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
T-VOA-WI8373	GC/MS Volatiles Audit Process
T-VOA-WI8400	Level II Review of GS/MS Volatiles

Scope

This method is suitable for the determination of the target compounds listed and maintained in the LIMS (Laboratory Information Management System) for aqueous matrices. Associated MDLs/LOQs are also listed in the LIMS under the analysis number and/or Project Information lists. Non-target volatile compounds in the sample can be tentatively identified (TIC) using a mass spectral reference library comparison. This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by purge and trap GC/MS methodologies and skilled in mass spectral interpretation. Using this method, the TICs are quantitated with an estimated concentration. Compounds other than those listed in the LIMS for this group of master scans are analyzed using USEPA SW-846 Method 8260C. Theoretical Standard Calibration (TSC) Sheets are included in the Appendix (Figures 1-7). These TSC sheets are to serve as examples only and may not reflect most current version in use. Due to poor purging efficiency or poor gas chromatographic performance, some analytes require calibration at higher levels and higher practical quantitation limits (PQLs). Any additional compounds must be added to the theoretical standard concentrations (TSC) sheet. Standards containing additional analytes must be prepared as described in the Standards section of this document. Both secondary stock solutions and matrix spike solutions must be prepared for use in analyzing additional compounds.

Basic Principles

A 5-mL or 25-mL sample or a dilution of a sample is placed in a specially designed purge vessel. The sample is purged with an inert gas and the effluent gas passed through a sorbent tube where the volatile organics are trapped. After purging, the sorbent trap is rapidly heated and backflushed on to the head of a gas chromatographic (GC) capillary column. The GC column is temperature programmed to separate the volatile compounds, which are subsequently detected and identified using mass spectrometric techniques.

When a compound reaches the Mass Spectrometer, it is bombarded by high-energy electrons (70 eV). This causes the compound to fragment and form ions. The positive ions are focused into a quadrupole mass analyzer, where the ions are separated according to their mass/charge ratios during rapid repetitive scans. These ions are then amplified and detected with an electron multiplier.

The resulting time/intensity/mass spectra data are stored and processed by a computer. Target compounds are identified on the basis of relative retention times and mass spectral matches to standards, which are injected every 12 hours on the same system. The internal standard method is used for quantitation.

The GRO analysis is typically performed in conjunction with the analysis of other volatile target compounds by SW-846 Method 8260C. The GRO quantitation range is 0.1 minutes before the peak apex of C6 (hexane) to 0.2 minutes after the peak apex of C12 (dodecane); however, other ranges can be established. By establishing a (C12) GRO window to 0.2 minutes following the elution of dodecane, the areas from a trio of unresolved peaks eluting near to the upper limit of the range must consistently be included in the total GRO area. In addition, the range remains tight enough to ensure that no C13 or greater compounds can be included in the total GRO area. The C4 range retention time is determined by selecting the first peak after the air and/or artifact peak minus 0.1 minutes in the first standard analyzed in the ICAL. The C5 range retention time is 0.1 minutes before the peak apex of pentane. This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by GC/MS purge and trap methodologies. The area of the total ion chromatogram for the GRO range is determined. The area of the internal standards and surrogate standards are found and subtracted from the total area of the chromatogram within the desired time range. The resulting area is then quantitated versus the internal standard, fluorobenzene.

Interferences

Contaminant sources are volatile compounds in the laboratory environment, impurities in the inert purging gas, carryover from samples containing high concentrations of volatile organic compounds and dirty glassware. The analyst must demonstrate that the system is free from interferences (by producing acceptable method blank data) before analyzing a batch of samples. Matrix effects from heavily contaminated waters can interfere with the internal standard responses, target analytes and surrogate recoveries, thereby hindering accurate quantitation. See Section 4.0 of SW-846 Method 8260C for further discussion.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; therefore, each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as the use of fume hoods, safety glasses, lab coats, and gloves. Neat compound sources and stock solutions must be collected into a lab pack upon expiration. The lab pack is delivered to Safety personnel for appropriate disposal. Expired secondary standard solutions in methanol must be disposed of as solvent waste. Pour expired secondary standard solutions into the appropriate solvent waste collection container. Aqueous calibration standard mixes are disposed of as nonhazardous aqueous waste due to the low concentration. Samples with a pH ≤2 are taken to storage until disposal in an acid waste container.

Personnel Training and Qualifications

Education Requirement: A 4-year Baccalaureate Degree from an accredited College or University in one of the physical sciences and/or one to three years of relevant gas chromatography experience.

Analysts must be trained in the proper method of volatile organic sample preparation and analysis as determined by the supervisor(s). All training and education relating to volatile organic sample preparation and analysis must be documented by each analyst in his/her training record. Specifically, each new chemist trains with an experienced chemist for the first 12 weeks depending on the individual and his/her previous experience. The first 12 weeks are spent working one-on-one with the trainer. This time is less if the new chemist has prior relevant experience in GC/MS and/or analytical chemistry background.

During the training period, the new chemist learns daily maintenance, calibration techniques, data and library search review, and forms generation. He/she is also required to read all relevant SOPs and EPA methods. All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP. Each analyst must perform an Initial Demonstration of Capability to measure proficiency. Thereafter, an annual Demonstration of Capability is performed and maintained in the analyst's training records.

NOTE: A separate Demonstration of Capability for GRO is required.

Sample Collection, Preservation, and Handling

The samples to be analyzed with this method must be stored in a refrigerator at 0°C to 6°C, not frozen. Samples are collected in 40-mL vials with no headspace. Preserve samples to a pH of <2 in order to prevent degradation of aromatic

compounds that are present in the sample. 1:1 HCL is the recommended preservative. Preserved samples must be analyzed within 14 days of collection; those that are not preserved must be analyzed within 7 days of collection. Samples to be tested for Acrolein and Acrylonitrile must be collected without headspace in vials that are preserved to a pH range of 4.0 to 5.0 and must be analyzed within 7 days of collection. Samples may also be submitted in unpreserved vials for Acrolein and Acrylonitrile, but must be analyzed within 3 days of collection. Samples submitted outside of the pH range or analyzed outside of the specified holding time windows will be reported with a comment on the final analytical report.

Apparatus and Equipment

1. Gastight micro-syringes – 1 to 1000 µL (various sizes)

2. 5-mL gastight syringes

3. Analytical balance, capable of accurately weighing ±0.0001 g

4. Glassware

   a. Class-A Volumetric flasks with ground-glass stopper

   b. Vials, 1.5-mL, 15-mL, and 40-mL screw cap, with Teflon™/silicone septa

   c. Mininert vials, 1 mL, 2 mL, and 5 mL

5. Purge and trap device – Consisting of the sample purger, the trap, and desorber; the OI Analytical 4560, OI Analytical 4660, or equivalent meets the requirements of this method. The purging chamber must have the purge gas passing through the sample as finely divided bubbles and minimize the headspace between the sample and the trap to <15 mL.

6. Autosampler – OI Analytical 4551, OI Analytical 4552, Archon, or equivalent meets the requirements of this method.

7. Spiker unit – OI analytical Model 4551/4552 SAM/Spiker or equivalent. One or two automated syringe spikers can be added to the OI Analytical Model 4551/4552 autosampler to automatically introduce 1 µL of internal standard (ISTD), surrogate standard, and/or matrix spiking solutions to the sample as it is being transferred to the sparge vessel. The Archon has a groove that can deliver 1 µL of appropriate standards.

8. GC/MS system – The Agilent 5890GC/5972 MSD, Agilent 6890GC/5973MSD, Agilent 6890GC/5975MSD and Shimadzu GC/MS QP5000 meet the requirements for this method.

9. Data System/Computer/Software – this is interfaced to the GC/MS system that continuously acquires and stores data during the analysis, and can process/reduce data to generate the appropriate forms and supporting data. The software used for acquisition is HP Chemstation®, and data reduction is accomplished using Target® software.

10. GC Columns

   a. Column 1 – 30M × 0.25 mm ID DB624 capillary column with a 1.4-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

b. Column 2 – 20M × 0.18 mm ID DB624 capillary column with a 1.0-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

c. Column 3 – 20M × 0.18 mm ID DB-VRX capillary column with a 1.0-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

NOTE: Refer to *T-VOA-WI7619* for instrumentation maintenance and troubleshooting.

Reagents and Standards

A. Reagents

1. Reagent water is defined as water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets these criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.

2. Methanol, Purge and Trap Grade or equivalent.

B. Standards

See *T-VOA-WI7629* for standards traceability.

1. Stock standard solutions – Stock solutions must be prepared in methanol. Standards are prepared from ampulated and neat compounds obtained from suppliers that indicate the purity of the compound. No correction for purity is made if the purity is listed as ≤96%. Pre-made solutions can be used if the supplier documents the concentrations of the solutions. All ampulated standards are stored at ≤-10°C until the expiration date indicated by the vendor or for 1 year if no expiration date is provided.

a. For most of the target compounds, the stock standard solutions are purchased from a vendor as custom mixes (V for calibration and Q for separate source quality control). The internal and surrogate standards are purchased from a vendor, as well as the target compounds that are gases at room temperature. These gaseous standards have a 1-week expiration date, starting from the date they are opened.

b. 8260A Surrogate standard spiking solution (8260SS) – a 2500 µg/mL stock standard solution of dibromofluoromethane, toluene-d8, 4-bromofluorobenzene, and 1,2-dichloroethane-d4 is prepared in methanol by a commercial supplier.

c. 8260A Internal standard spiking solution (8260IS) – a 2500 µg/mL stock standard solution of fluorobenzene, chlorobenzene-d5, 1,4-dichlorobenzene-d4, and 12500 µg/mL deuterated tertiary butyl alcohol (tBA-d10) is prepared in methanol by a commercial supplier. Deuterated tertiary butyl alcohol (tBA-d10) is used sometimes as an auxiliary ISTD.

d. GRO calibration standard – a 5500-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier.

e. GRO QC standard – a 20,000-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier

To prepare stock standards from neat compounds:

(1) Place about 9.8 mL methanol or an equivalent solvent into a tared 10.0-mL glass-stoppered volumetric flask. Weigh the flask to the nearest 0.1 mg.

(2) Add the liquids using a syringe or pipette by adding 2 or more drops of the assayed material to the flask, being careful that no drop hits the side of the flask. Reweigh the flask, record/note the amount, dilute to volume, stopper, and mix by inverting the flask at least 3 times. Calculate the concentration of the standard.

(3) The stock standard solutions are stored in Teflon™-sealed screw-capped vials at ≤-10°C. The compound name, concentration, date prepared, expiration date, preparer name and storage method must appear on the bottle.

(4) Replace in-house prepared stock standard solutions every 6 months.

2. Secondary dilution standards - Using the stock standard solutions, prepare secondary stock solutions in methanol containing the desired compounds. These standards are prepared by calculating the volume of each stock standard required to produce a given volume of a mixed working standard with a known concentration of each analyte. When custom mixes are used, these are diluted down individually or combined together with other mixes. The working standard is tested according to *T-VOA-WI7629*. The verified working standard is poured into Teflon-lined screw-capped GC vials or mininert vials and stored at ≤-10°C. A designator indicating the standard name, month, and day of preparation and expiration date must be on the standard vials. The designator and all data pertaining to the working standard preparation are to be recorded in the standards logbook. Replace secondary dilution standards every 2-4 weeks (1 week for standards containing gases) unless otherwise indicated.

a. 1,4-Bromofluorobenzene (BFB) standard – Prepare a 50-µg/mL solution of BFB in methanol by diluting the stock standard (prepared from neat material) with methanol to a final volume of 100 mL. The volume of stock standard used varies depending on the actual stock concentration.

b. IS/SS spiking solution – Dilute 1 mL of 8260IS and 1 mL of 8260SS with methanol to 10-mL final volume (resulting in a concentration of 250 µg/mL, 1250 µg/mL for tBA-d10). This is assuming a 1-µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained.(50& µg/L for 5-mL purge, 10 µg/L for 25-mL purge).

c. Calibration spiking solution – Prepare solutions in methanol that contain the compounds of interest at known concentrations. Suggested calibration levels are 1, 4, 10, 20, 50, 100, and 300 ppb for 5-mL purge analysis. Suggested calibration levels are 0.2, 0.5, 1, 2, 5, 10, and 25 ppb for 25-mL purge analysis. A Theoretical Standard Concentration (TSC) sheet is filled out for all initial calibrations (see Figures 1, 2, and 5). Replace calibration spiking solution every 2-4 weeks (1 week for standards containing gases).

d. Matrix spiking solution – Prepare second source solutions in methanol that contain the compounds of interest at known concentrations. A TSC sheet is filled out for all quality control samples (see Figures 4 and 5). These solutions serve as both the matrix spiking solution and the laboratory control sample solutions. Matrix spikes also serve as duplicates. Therefore, two aliquots of the same sample need to be spiked for analysis with these solutions. Replace matrix spiking solution every 2-4 weeks (1 week for standards containing gases).

Store all standard solutions at ≤-10°C and protected from light.

Preparation of Glassware

All glassware is cleaned according to *T-VOA-WI7691*.

Calibration

A. Instrument conditions

1. The purge and trap device must have the trap conditioned for at least 10 minutes at 180° to 220°C at a flow rate of 20 to 60 mL/min prior to initial use.

2. An example of purge and trap conditions are listed below:

Purge Gas	Helium
Purge Flow	35 - 45 mL/min
Purge Temperature	40°C for 8260C waters
Purge Time	11 minutes
Desorb Temperature	190°- 220°C
Desorb Time	0.5 to 4 minutes **
Bake Temperature	180°-220°C
Bake Time	5 – 16 min

**Range as suggested by the purge and trap instrument manufacturer

NOTE: Purge and trap conditions are changed to optimize instrument operations. A record of actual purge and trap conditions for each instrument is found in the appropriate instrument maintenance log.

3. The suggested gas chromatographic operating conditions are listed in the table below, depending on the column used:

	Column 1	Column 2	Column 3
Column liquid phase	DB-624	DB-624	DB-VRX
Carrier gas	Helium	Helium	Helium
Carrier gas flow	0.8 mL/min	0.6 mL/min	0.6 mL/min
Make-up gas flow	None	None	None
Initial temperature	45°C	45°C	45°C
Initial hold time	4.5 min	2.5 min	4 min
Temperature ramp	12°/min until 100°C then 25°/min until 240°C	12°/min until 100°C then 25°/min until 235°C	25°/min until 60°C then 36°/min until 240°C
Final temperature	240°C	235°C	240°C
Final hold time	None	.02 min	1 min

4. The recommended mass spectrometer operating conditions are listed below:

Mass range:	35 – 300 amu
Scan time:	One scan cycle per second or less and resulting in at least five scans per chromatographic peak

NOTE: It is not necessary to use the exact parameters listed above. Equivalent columns and conditions that give the performance required by the method are acceptable.

B. Tuning

Tune the GC/MS system to meet the criteria in Table 1 following a 50-ng injection of BFB. The chromatographic conditions must be the same as those under which the samples are analyzed except that the temperature ramp is increased and the initial temperature and flow rate is different. The BFB tune must be verified every 12 hours.

The tune must be evaluated by taking the average of the three scans across the BFB peak apex with a background subtraction of a scan within 20 scans prior to the start of the BFB peak.

NOTE: All standards, samples, and associated quality control samples must be analyzed with the same MS parameters as those used to obtain a successful tune.

C. Initial calibration

1. The initial internal standard calibration consists of analyzing seven distinct levels of analyte concentrations and producing response factors for each compound (six levels are required if second order regression fits are used). Calibration for GRO consists of analyzing six distinct levels of GRO area in order to produce a response factor for the GRO quantitation range of interest using the internal standard, fluorobenzene. The relative standard deviation of the response factor determines the suitability of the average relative response factor for calculation of the GRO concentration. Refer to Figure 1, 2 or 5 for the preparation of the calibration standards and Figure 7 for preparation of GRO standards. The relative standard deviation of the response factors determines the suitability of the average relative response factor for calculation of the analyte concentration. Prior to the analysis of any calibration level, retention time markers must be run for the GRO range of interest. The retention time markers are hexane (C6) and Dodecane (C12). Other markers can be used if different ranges are required by a project.

NOTE: 5 levels of standard are required by the method.

a. When using an OI 4552 or OI 4551 autosampler, the standards (including target and surrogate compounds) are prepared and poured into 40-mL vials with Teflon™-lined septa. A 5-mL or 25-mL aliquot is withdrawn from the vial by the autosampler. The aliquot is transferred through the spiker unit to add the IS/SS spiking solution and then transferred to the sparge vessel.

b. Purge and desorb according to instrument conditions listed in Calibration A.

c. Collect GC/MS data until the end of the GC run.

d. Empty and rinse the purging chamber at least twice with reagent water prior to loading another sample into the vessel, to minimize the possibility of carryover contamination.

e. Each level is analyzed as described above. Next, tabulate the area response of the characteristic ions (Table 2) against concentration for each analyte, surrogate standard, and internal standard and calculate relative response factors (RRF) for each compound (see Calculation section). The calibration is valid for 12 hours from the injection of the BFB tune standard, at which time a new tune check and a continuing calibration check standard are evaluated prior to the analysis of additional samples. The following table describes the guidelines for an acceptable initial calibration:

Frequency	Acceptance Criteria	Corrective Action
Initially and then when analytes in the daily calibration standard fail criteria.	1. % RSD of≤20% is required for all analytes. 10% of the analytes may fail this criteria. 2. The relative retention times of the target compounds must agree within 0.06 relative retention time (RRT) units. The exception would be in the case of system maintenance. 3. Minimum response factors must be met for select compounds. See Table 3.	1. Any target analyte with a %RSD of ≤20% must use the average RRF for quantitation. For any analyte in which the %RSD >20%, a first-degree linear regression can be used (providing that the correlation coefficient [CC] is ≥0.995). A quadratic fit ** (using 6 stds) can also be used (provided the coefficient of determination [CD] is >0.99). If the linear fit and quadratic fit pass the criteria for any given analyte, then use the line/curve with the smallest positive y-intercept. If the y-intercept quantifies to be greater than the LOQ, consult your supervisor immediately or recalibrate. If CC or CD is <0.995 for linear or <0.99 for quadratic, recalibrate. Supervisory approval is required for exceptions to these guidelines. If >10% target analytes fail, recalibration is required. If a linear or quadratic curve fit is used for a target analyte, the calibration data must be refit back into the calibration model for all calibration levels. Percent error between the calculated and expected amounts of an analyte should be ≤30% for all standards. For some data uses, ≤50% may be acceptable for the lowest calibration point. 2.-3. Perform system maintenance and recalibrate.

**Consult USEPA method 8000D for non-linear curve fitting techniques/guidelines

f. Each level is analyzed as described above. Next, tabulate the area response for the GRO quantitation range minus the peak areas for the internal and surrogate standards that elute within the GRO range. Calculate the relative response factor (RRF) for GRO (see Calculation section) using the internal standard peak area for fluorobenzene. Although four internal standard compounds are spiked for the 8260C analysis, only one, fluorobenzene, is used for the quantitation of the GRO result.

Calculate the average relative response factors for the GRO quantitation range of interest. The calibration levels are evaluated on the basis of the relative standard deviation of the RRF values (%RSD). The %RSD for the GRO range of interest must be ≤20%. If the calibration meets this requirement then the average RRF is used to calculate sample

concentrations. If the %RSD is >20% then re-analysis of one or more levels can be necessary before the calibration is valid.

D. Following the calibration, an Initial Calibration Verification (ICV) standard must be run. The ICV acts as a second source standard to check against the initial calibration. All analytes must meet ICV acceptance windows of 70%-130%. If the ICV does not meet the aforementioned criteria, a second ICV is analyzed before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken. For the GRO analysis, the ICV is prepared according to the TSC sheet in Figure 7 (QC prep). The ICV acts as a second source standard to check against the initial calibration. Results must quantitate within the 70-130% window. If the ICV does not meet the aforementioned criteria, a second ICV can be run before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken.

E. Continuing calibration verification (CCV) – The CCV is performed by analyzing a CCV standard in subsequent tune periods after an initial calibration. The CCV (prepared daily due to aqueous nature) is analyzed at 50 ppb for 5-mL purge waters and 10 ppb for 25-mL purge waters. The CCV is considered valid when the criteria listed below are met:

Frequency	Acceptance Criteria	Corrective Action
Every 12 hours.	1. % Drift of ≤20% is required for all analytes. No more than 20% of analytes may fail this criteria if not detected in proceeding samples. 2. The relative retention times (RRT) of the target compounds must agree within 0.06 RRT units. The exception would be in the case of system maintenance. 3. The extracted ion current profile (EICP) area for each internal standard must fall within the window of −50 % to +100 % from the mid-level standard area produced during the last initial calibration. 4. Minimum response factors must be met for select compounds. See Table 3.	1.-4. In the event that the continuing calibration verification (CCV) standard fails any of these criteria, sample analysis must be suspended and the CCV must be re-analyzed. If the re-analysis fails any of the criteria then adjustments are to be made to the analytical system to return it to its original condition, followed by the analyses of 2 consecutive CCVs at the same level that failed. If both CCVs pass the criteria, then sample analysis can continue. Otherwise, the system must be recalibrated and the samples reanalyzed, or the data can be qualified.

A 1100-ppb standard (prepared daily due to aqueous nature) is analyzed for the GRO analysis. The calibration is considered valid if the percent drift is ≤20%. Also, the internal standard peak area of fluorobenzene for the CCV is monitored against the mid-point standard of the initial calibration and must be −50% to +100% of the area counts. If any criteria listed above fails, the CCV is considered invalid. In the case where two consecutive CCVs fail, corrective action must be taken which can include re-analysis of the calibration check, instrument maintenance, and/or recalibration. If the criteria are met, the selected quantitation method from the initial calibration is used for blank and sample calculations until the end of the 12-hour period.

F. MDL Sensitivity Check- A MDL Sensitivity Check must be analyzed in cases where compounds fail to meet the % drift criteria in the CCV and have decreased sensitivity (-20% drift or greater). Affected compounds can be reported as non-detects if it is demonstrated that there is adequate sensitivity to detect the compound at the MDL. If the failed compound is detected, the concentration must be reported as an estimated value.

Procedure

A. Method Blank

Analyze the method blank as described above for the initial calibration standards using reagent water. Refer to table in QA/QC section for specific requirements. The method blank is examined for interfering peaks. Any target compound peaks are calculated as described under the Calculations section of this procedure. All compounds must be less than the reporting limit for the associated samples. If the blank values exceed these values, corrective action must be taken and the method blank reanalyzed until the criteria are met. The method blank must be analyzed before processing any samples.

B. Laboratory Control Sample/ Duplicate and Matrix Spike/Duplicate: Refer to table in QA/QC section for specific requirements.

C. Qualitative analysis

A compound is identified by comparison of the following parameters with those of a standard of this suspected compound (standard reference spectra). In order to verify identification, the following criteria must be met:

1. The intensities of the characteristic ions of the compound must maximize in the same scan or within one scan of each other.

2. The compound relative retention time must compare within ±0.06 RRT units of the RRT of the standard.

3. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum.

4. The relative intensities of the characteristic ions must agree within 30% of the relative intensities of these ions in the reference spectrum. Analyst discretion is used to determine compound identification. Example: for an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).

5. The above criteria apply to hits greater than or equal to the LOQ. For hits between the MDL and the LOQ, both the criteria listed above and the analyst's discretion is used to determine compound identification.

6. The analyst must account for peaks that are greater than 10% relative intensity in the sample mass spectrum, but not present in the standard mass spectrum. Also, if a compound fails any of the criteria listed above but in the judgment of the mass spectral interpretation specialist is a correct identification, the identification is used and the quantitation of the peak is performed.

The primary and secondary ions for the target compounds can be found in Table 2.

7. For GRO, the Total Ion Chromatogram (TIC) is reviewed to insure proper integration around the 8260 surrogates and internal standards. Also the TIC is checked to make sure all major peaks are integrated.

D. Quantitative analysis

Once a compound has been identified, quantitation is based on the internal standard technique and the integrated area from the extracted ion current profile (EICP) of the primary characteristic ion. The list of primary characteristic ions is listed in Table 2.

The quantitation of the GRO range is performed using the equations listed in the Calculations section of this procedure. All calculations must report concentrations in values of µg/L. In the case where the total GRO concentration exceeds the calibration range, the sample is re-analyzed at a dilution that brings the GRO concentration within the calibration range of the GC/MS system.

E. Sample Analysis

A 5-mL or 25-mL aliquot of the sample is analyzed using the same instrumental conditions as the standard (whether ICAL or CCV), tune and method blank. If the QA criteria are satisfied and no target compounds are detected at concentrations above the calibration range, the results can be reported. To avoid possible matrix effects, sample carryover and re-analyses, an initial dilution is performed if:

1. Prescreening indicates a high volatile organic content in the sample

2. Historical data (or lack thereof) and/or sample appearance indicate a need for dilution

If target compounds are detected in the sample at concentrations above the calibration range, a dilution must be performed (See *T-VOA-WI7692* for information on when cleaning blanks must be run). See Section 11.5.6 in method SW-846 8260C for recommended dilution procedures.

Calculations

A. Calibration calculations

1. Calculation of the relative response factor (RRF):

$$RRF = \frac{[A(x) \times C(is)]}{[A(is) \times C(x)]}$$

Where:

A(x) = Characteristic ion area for the compound being measured

A(is) = Characteristic ion area for the specific internal standard

C(x) = Concentration of the compound being measured

C(is) = Concentration of specific internal standard

2. Regression Equations:

1st Order (linear) regression: Y = MX + B

2nd order (quadratic) regression: Y = CX2 + MX + B

Where:
x = Area(Std) /Area(Istd)
Y = Conc.(Std)/Conc.(Istd)
M = 1st degree slope
C = 2nd degree slope
B = Y-intercept

3. Percent relative standard deviation (%RSD):

$$\%\ RSD = \frac{Standard\ Deviation}{Mean} \times 100$$

4. Calculation of the percent drift:

$$\%\ Drift = \frac{C(i) - C(c)}{C(i)} \times 100$$

Where:
C(i) = Calibration check compound standard concentration
C(c) = Measured concentration using selected quantification method

B. QA Calculations

1. Calculation of percent recovery

$$\%\ Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = Spiked sample result

SR = Sample result

SA = Spike added

2. Relative percent difference (RPD):

$$RPD = \frac{MSR - MSDR}{(1/2)(MSR + MSDR)} \times 100$$

Where:

MSR = Matrix spike measured concentration

MSDR = Matrix spike duplicate measured concentration

3. Analyte Concentration

$$Concentration\ (\mu g/L) = \frac{(Ax)(Is)}{(Ais)(RRF)}$$

Where:

Ax = Area of the quantitation ion peak for the compound to be measured

Ais = Area of the quantitation ion peak for the appropriate internal standard

Is = Concentration of internal standard added in µg/L

RRF = Relative response factor from the initial calibration

Statistical Information/method Performance

The LCS must contain 80% to100% of the compounds in the calibration mix. LCS, MS, and surrogate recoveries and RPD are compared to the limits stored on the LIMS. These limits are statistically derived but must fall within 70% to 130% recovery for South Carolina compliance samples. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated on an annual basis in accordance with 40 CFR Part 136. The MDLs are maintained in the LIMS. Updates to the LIMS are made as needed by the QA Department and only as directed by the supervisor. The department database is updated via a download from the LIMS.

Quality Assurance/Quality Control

Each analysis batch (consisting of no more that 20 samples) must contain a method blank, a laboratory control sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD), a laboratory control sample/laboratory control sample duplicate (LCS/LCSD) or a duplicate (DUP). The LCS serves as a 2nd source standard verification of the initial calibration (ICAL). Additional QC samples are required to meet project or state certification requirements. Every sample or QC analysis must contain internal standards and surrogate compounds at a concentration of 50 µg/L for a 5-mL purge or 10 µg/L for a 25-mL purge.

The laboratory will establish the Lower Limit of Quantitation (LLOQ) at concentrations where both quantitative and qualitative requirements can consistently be met for 8000D. The LLOQ is the lowest concentration at which the laboratory has demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be = the lowest point in the calibration curve. The LLOQ must be verified annually per instrument and is performed by the analysis of an LCS at 0.5-2 times the established LLOQ, using laboratory reagent water and following all preparation and analytical procedures as are used for environmental and QC samples. Acceptance criteria for target analytes in the LLOQ verification should be within established in-house limits or within other such project-specific acceptance limits. Until the laboratory has sufficient data to determine acceptance limits, the LCS criteria ± 20% may be used for the LLOQ acceptance criteria.

The GC/MS system must be tuned to meet the criteria in Table 1 following BFB injection. The chromatographic conditions must be the same as those under which the samples are analyzed except that the rate of temperature ramping may be increased and the initial temperature and column flow may be different. The BFB tune must be verified every 12 hours.

Quality Control Item	Acceptance Criteria	Corrective Action
1. Internal Standards Added to every sample, standard, method blank and QC sample	1. Peak areas within -50% to +100% of the area in the associated reference standard. 2. Retention time (RT) within 30 seconds of RT for associated reference standard.	1. Check instrument for possible problems and then reanalyze samples. 2. If re-injecting meets the criteria, report this analysis. 3. If this reanalysis still shows the same problem, report results from first analysis and qualify data with a comment.
2 Surrogates	All % recoveries must fall within statistically derived QC	If non-compliant, check for calculation or preparation errors. If no errors are found,

Quality Control Item	Acceptance Criteria	Corrective Action
Added to every sample, standard, method blank and QC sample	limits, which are evaluated on a semi-annual basis.	check system for problems and reanalyze. If this reanalysis still shows the same problem, report first analysis and qualify data with a comment. If recoveries are outside of specification high and no target compounds are detected, then a reanalysis or comment is not required.
3 Method Blank (MB) Performed during each tune period after the initial calibration or CCV (minimum of 1 MB per 20 samples)	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. Quantitative results for all target compounds must be less than the reporting limit for the associated samples.	1.-2.Inspect system for possible problems and reanalyze. 3. If the MB contains target analytes and the associated samples do not, then no corrective action is required. If the target compounds in the MB are also in the associated samples, then they must be reanalyzed after a clean MB is obtained (certain projects may allow some exceptions for common laboratory contaminants like methylene chloride and acetone up to 5X the LOQ)
Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) LCS analyzed with each batch of ≤ 20 samples LCSD analyzed if MS/MSD unavailable See Figure	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. All % recoveries must fall within statistically derived QC limits, which are evaluated on a semi-annual basis.	1.-2. If non-compliant, check for calculation or preparation errors. If no errors found, check system for problems and reanalyze. 3. If LCS/LCSD re-analysis still fails, perform appropriate system maintenance and restart the tune period. Only with a LCS % recovery failing high (for the requested target compounds) with targets non-detected in the sample, can the results be reported. Otherwise, the sample must be analyzed with a compliant LCS.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	1. % Recoveries must fall within statistically derived QC	

Quality Control Item	Acceptance Criteria	Corrective Action
MS/MSD analyzed with each batch of ≤ 20 samples (if sufficient sample volume available) See Figures 4 and 5 for preparation info.	limits, which are evaluated on a semi-annual basis 2. RPDs within QC limits.	1. If LCS within QC limits, proceed with sample analysis. 2. If most recoveries and/or RPDs outside of QC limits, consult the supervisor.

NOTE: Prior to release from the analytical laboratory, all data is reviewed in accordance with *T-VOA-WI8373* or *T-VOA-WI8400* (dual purge and trap).

Table 1

BFB Key Ion Abundance Criteria

Mass	Ion Abundance Criteria
50	15% to 40% of mass 95
75	30% to 60% of mass 95
95	base peak, 100% relative abundance
96	5% to 9% of mass 95
173	less than 2% of mass 174
174	greater than 50% of mass 95
175	5% to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5% to 9% of mass 176

Table 2

Primary and Secondary Ions

Compound Name	Primary Ion	Secondary Ion
Chloromethane	50	52
Vinyl Chloride	62	64
Bromomethane	94	96
Chloroethane	64	66
1,1-Dichloroethene	96	61, 63

Compound Name	Primary Ion	Secondary Ion
Acetone	43	58
Carbon Disulfide	76	78
Methylene Chloride	84	49, 86
1,1-Dichloroethane	63	65, 83
trans-1,2-Dichloroethene	96	61, 63
cis-1,2-Dichloroethene	96	61, 63
2-Butanone	43	72
Chloroform	83	85
1,2-Dichloroethane	62	98
1,1,1-Trichloroethane	97	61, 99
Carbon Tetrachloride	117	119
Benzene	78	
Trichloroethene	95	130, 132
1,2-Dichloropropane	63	76
Bromodichloromethane	83	85
cis-1,3-Dichloropropene	75	77, 110
trans-1,3-Dichloropropene	75	77, 110
1,1,2-Trichloroethane	97	83, 85
Dibromochloromethane	129	127
Bromoform	173	175
4-Methyl-2-pentanone	43	58
Toluene	92	91
Tetrachloroethene	166	131, 164
2-Hexanone	43	58
Chlorobenzene	112	77
Ethylbenzene	91	106
Xylene (total)	106	91
Styrene	104	78
1,1,2,2-Tetrachloroethane	83	85, 131
Dibromofluoromethane	113	111
1,2-Dichloroethane-d4	102	104
Fluorobenzene	96	70
Toluene-d8	98	100
Chlorobenzene-d5	117	82
4-Bromofluorobenzene	95	174
1,4-Dichlorobenzen-d4	152	115

Table 3
Minimum Relative Response Factors For ICAL and CCV

Volatile Compounds	Minimum Response Factor
Dichlorodifluoromethane	0.100
Chloromethane	0.100
Vinyl Chloride	0.100
Bromomethane	0.100
Chloroethane	0.100

Trichlorofluoromethane	0.100
1,1-Dichloroethene	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	0.100
Acetone	0.100
Carbon Disulfide	0.100
Methyl Acetate	0.100
Methylene Chloride	0.100
trans-1,2-Dichloroethene	0.100
cis-1,2-Dichloroethene	0.100
Methyl tert-Butyl Ether	0.100
1,1-Dichloroethane	0.200
2-Butanone	0.100
Chloroform	0.200
1,1,1-Trichloroethane	0.100
Cyclohexane	0.100
Carbon Tetrachloride	0.100
Benzene	0.500
1,2-Dichloroethane	0.100
Trichloroethene	0.200
Methylcyclohexane	0.100
1,2-Dichloropropane	0.100
Bromodichloromethane	0.200
cis-1,3-Dichloropropene	0.200
trans-1,3-Dichloropropene	0.100
4-Methyl-2-pentanone	0.100
Toluene	0.400
1,1,2-Trichloroethane	0.100
Tetrachloroethene	0.200
2-Hexanone	0.100
Dibromochloromethane	0.100
1,2-Dibromoethane	0.100
Chlorobenzene	0.500
Ethylbenzene	0.100

Table 3 - Continued

Volatile Compounds	Minimum Response Factor
m&p-Xylene	0.100
o-Xylene	0.300
Styrene	0.300
Bromoform	0.100
Isopropylbenzene	0.100
1,1,2,2-Tetrachloroethane	0.300
1,3-Dichlorobenzene	0.600
1,4-Dichlorobenzene	0.500
1,2-Dichlorobenzene	0.400
1,2-Dibromo-3-chloropropane	0.050
1,2,4-Trichlorobenzene	0.200

T-VOA-WI7619 GC and GC/MS Instrumentation Maintenance
T-VOA-WI7629 GC/MS Volatile Standards Traceability
T-VOA-WI7691 Glassware Washing
T-VOA-WI7692 Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
T-VOA-WI8373 GC/MS Volatiles Audit Process
T-VOA-WI8400 Level II Review of GC/MS Volatiles

Attachment:
Figure 1
Figure 2
Figure 3
Figure 4
Figure 5
Figure 6
Figure 7

End of document

Version history

Version	Approval	Revision information
6	21.MAR.2019	
7	11.APR.2019	
8	18.JUL.2019	

Figure 1

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260A/B/C

Date:_____
Instrument:_____

VOA1= 1:5 dilution of VCS#1B, VCS#2B, and VCS#4C
VOA2= 1:5 dilution of VCS#2B
VOA3= 1:5 dilution of VCS#3B and Vacrolein
VOA6= 1:5 dilution of VCS#6
2CEVE= 1:5 dilution of VCS#1B-2CEVE
VOA8= 1:5 dilution of Hexachloroethane and 2,2'-oxybis(1-Chloropropane)

Stock mix name	VOA1 _____ 2CEVE _____ 1,3-BUT _____	VOA3 _____	VOA2 _____	VOA6 _____ EE _____ Custom V LG Freons _____	n-PEN _____ VOA8 _____	CYC _____	EOH _____	Restek Gases (2000 ppm) Lt#_____ TAEE _____		Flask mL	
300 ppb std	15 µL	6 µL		15µL	15 µL	30 µL	30 µL	7.5 µL		50	
100 ppb std	5 µL	2 µL		5 µL	5 µL	10 µL	10 µL	2.5 µL		50	
50 ppb std	5 µL	2 µL		5 µL	5 µL	10 µL	10 µL	2.5 µL		100	
20 ppb std	4 µL	1.6 µL	4 µL	4 µL	4 µL	16 µL	16 µL	2.0 µL		200	
10 ppb std	2 µL	0.8 µL	2 µL	2 µL	2 µL	8 µL	8 µL	1.0 µL		200	
4 ppb std	4 µL	1.6 µL	12 µL	4 µL	4 µL	32 µL	20 µL	2.0 µL		1000 *	
1 ppb std	* Aliquot 12.5 mL of 1000 mL flask into 50 mL flask										
0.5 ppb MDL std	+ Aliquot 12.5 mL of 1000 mL flask into 100 mL flask										

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
Benzene	CS#1B	5000	300	100	50	20	10	4	1	0.5
Bromobenzene		5000	300	100	50	20	10	4	1	0.5
Bromodichloromethane		5000	300	100	50	20	10	4	1	0.5
Bromoform		5000	300	100	50	20	10	4	1	0.5
n-Butylbenzene		5000	300	100	50	20	10	4	1	0.5
sec-Butylbenzene		5000	300	100	50	20	10	4	1	0.5
tert-Butylbenzene		5000	300	100	50	20	10	4	1	0.5
Carbon Tetrachloride		5000	300	100	50	20	10	4	1	0.5
Chlorobenzene		5000	300	100	50	20	10	4	1	0.5
Chloroform		5000	300	100	50	20	10	4	1	0.5
2-Chlorotoluene		5000	300	100	50	20	10	4	1	0.5
4-Chlorotoluene		5000	300	100	50	20	10	4	1	0.5
Dibromochloromethane		5000	300	100	50	20	10	4	1	0.5
1,2-Dibromo-3-chloropropane		5000	300	100	50	20	10	4	1	0.5
1,2-Dibromoethane (EDB)		5000	300	100	50	20	10	4	1	0.5
Dibromomethane		5000	300	100	50	20	10	4	1	0.5
1,2-Dichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,3-Dichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,4-Dichlorobenzene		5000	300	100	50	20	10	4	1	0.5

Figure 1 Continued

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260A/B/C

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
1,1-Dichloroethane	CS#1B	5000	300	100	50	20	10	4	1	0.5
1,2-Dichloroethane		5000	300	100	50	20	10	4	1	0.5
1,1-Dichloroethene		5000	300	100	50	20	10	4	1	0.5
cis-1,2-Dichloroethene		5000	300	100	50	20	10	4	1	0.5
trans-1,2-Dichloroethene		5000	300	100	50	20	10	4	1	0.5
1,2-Dichloropropane		5000	300	100	50	20	10	4	1	0.5
1,3-Dichloropropane		5000	300	100	50	20	10	4	1	0.5
2,2-Dichloropropane		5000	300	100	50	20	10	4	1	0.5
1,1-Dichloropropene		5000	300	100	50	20	10	4	1	0.5
cis-1,3-Dichloropropene		5000	300	100	50	20	10	4	1	0.5
trans-1,3-Dichloropropene		5000	300	100	50	20	10	4	1	0.5
Ethylbenzene		5000	300	100	50	20	10	4	1	0.5
Hexachlorobutadiene		5000	300	100	50	20	10	4	1	0.5
Isopropylbenzene		5000	300	100	50	20	10	4	1	0.5
p-Isopropyltoluene		5000	300	100	50	20	10	4	1	0.5
Methylene Chloride		5000	300	100	50	20	10	4	1	0.5
Naphthalene		5000	300	100	50	20	10	4	1	0.5
n-Propylbenzene		5000	300	100	50	20	10	4	1	0.5
Styrene		5000	300	100	50	20	10	4	1	0.5
1,1,1,2-Tetrachloroethane		5000	300	100	50	20	10	4	1	0.5
1,1,2,2-Tetrachloroethane		5000	300	100	50	20	10	4	1	0.5
Tetrachloroethene		5000	300	100	50	20	10	4	1	0.5
Toluene		5000	300	100	50	20	10	4	1	0.5
1,2,3-Trichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,2,4-Trichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,3,5-Trichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,1,1-Trichloroethane		5000	300	100	50	20	10	4	1	0.5
1,1,2-Trichloroethane		5000	300	100	50	20	10	4	1	0.5
Trichloroethene		5000	300	100	50	20	10	4	1	0.5
1,2,3-Trichloropropane		5000	300	100	50	20	10	4	1	0.5
1,2,4-Trimethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,3,5-Trimethylbenzene		5000	300	100	50	20	10	4	1	0.5
m-Xylene		5000	300	100	50	20	10	4	1	0.5
o-Xylene		5000	300	100	50	20	10	4	1	0.5
p-Xylene		5000	300	100	50	20	10	4	1	0.5
1-Chlorohexane		5000	300	100	50	20	10	4	1	0.5
Pentachloroethane	CS#6	5000	300	100	50	20	10	4	1	0.5
Allyl Chloride		5000	300	100	50	20	10	4	1	0.5
Bromochloromethane		5000	300	100	50	20	10	4	1	0.5
Methyl Acetate		5000	300	100	50	20	10	4	1	0.5
Methylcyclohexane		5000	300	100	50	20	10	4	1	0.5
2-Methylnaphthalene		5000	300	100	50	20	10	4	1	0.5
1,2,3-Trimethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,2-Diethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,3-Diethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,4-Diethylbenzene		5000	300	100	50	20	10	4	1	0.5

Figure 1 Continued

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260A/B/C

Compound name	Std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
Methacrylonitrile	CS#2B	12500	750	250	125	100	50	40	10	5
Propionitrile		25000	1500	500	250	200	100	80	20	10
trans-1,4-Dichloro-2-Butene		12500	750	250	125	100	50	40	10	5
t-Butyl Alcohol		25000	1500	500	250	200	100	80	20	10
2-Propanol		25000	1500	500	250	200	100	80	20	10
Isobutyl Alcohol		62500	3750	1250	625	500	250	200	50	25
n-Butanol		125000	7500	2500	1250	1000	500	400	100	50
1,4-Dioxane		62500	3750	1250	625	500	250	200	50	25
2-Butanone	CS#3B	25000	600	200	100	40	20	8	2	1
2-Hexanone		25000	600	200	100	40	20	8	2	1
4-Methyl-2-Pentanone		25000	600	200	100	40	20	8	2	1
Acetone		25000	600	200	100	40	20	8	2	1
Acrylonitrile		12500	300	100	50	20	10	4	1	0.5
2-Nitropropane		25000	600	200	100	40	20	8	2	1
Tetrahydrofuran		25000	600	200	100	40	20	8	2	1
Methyl-t-butyl Ether	CS#4C	5000	300	100	50	20	10	4	1	0.5
Ethyl Methacrylate		5000	300	100	50	20	10	4	1	0.5
Methyl Methacrylate		5000	300	100	50	20	10	4	1	0.5
Freon 113		5000	300	100	50	20	10	4	1	0.5
Hexane		5000	300	100	50	20	10	4	1	0.5
Heptane		5000	300	100	50	20	10	4	1	0.5
Cyclohexane		5000	300	100	50	20	10	4	1	0.5
Benzyl Chloride		5000	300	100	50	20	10	4	1	0.5
Methyl Iodide		5000	300	100	50	20	10	4	1	0.5
Carbon Disulfide		5000	300	100	50	20	10	4	1	0.5
2-Chloro-1,3-Butadiene		5000	300	100	50	20	10	4	1	0.5
di-Isopropyl Ether		5000	300	100	50	20	10	4	1	0.5
tert-Amyl Methyl Ether		5000	300	100	50	20	10	4	1	0.5
Ethyl-t-butyl Ether		5000	300	100	50	20	10	4	1	0.5
Bromomethane	Gas	2000	300	100	50	20	10	4	1	0.5
Chloroethane	mix	2000	300	100	50	20	10	4	1	0.5
Chloromethane		2000	300	100	50	20	10	4	1	0.5
Dichlorodifluoromethane		2000	300	100	50	20	10	4	1	0.5
Trichlorofluoromethane		2000	300	100	50	20	10	4	1	0.5
Vinyl Chloride		2000	300	100	50	20	10	4	1	0.5
Cyclohexanone	CYC	6250	3750	1250	625	500	250	200	50	25
2-Chloroethyl Vinyl Ether	2CEVE	5000	300	100	50	20	10	4	1	0.5
1,3-Butadiene	1,3-BUT	1000	300	100	50	20	10	4	1	0.5

Figure 1 Continued

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260A/B/C

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
Acrolein	VACR	125000	3000	1000	500	200	100	40	10	5
tert-Amyl ethyl ether	TAEE	2000	300	100	50	20	10	4	1	0.5
Ethyl Ether	EE	1000	300	100	50	20	10	4	1	0.5
n-Pentane	n-PEN	1000	300	100	50	20	10	4	1	0.5
Freon 123a	Custom V	1000	300	100	50	20	10	4	1	0.5
Dichlorofluoromethane	LG Freon	1000	300	100	50	20	10	4	1	0.5
Hexachloroethane	VOA8	5000	300	100	50	20	10	4	1	0.5
2,2'-oxybis(1-Chloropropane)		5000	300	100	50	20	10	4	1	0.5
Ethanol	EOH	12500	7500	2500	1250	1000	500	250	62.5	31.25

ppb of analytical standard = (stock ppm)(µL stock) / flask mL

Analyst:_____
Date:_____

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
25 mL Purge

Date:_____
Instrument:_____

Stock mix name	RV4MIX1 _____ RV4GAS _____	RV4 826 _____					Flask ml
25 ppb std	25 µl	25 µl					50
10 ppb std	10 µl	10 µl					50
5 ppb std	5 µl	5 µl					50
2 ppb std	2 µl	2 µl					50
1 ppb std	2 µl	2 µl					100
.5 ppb std	2 µl	2 µl					200
.2 ppb std	2 µl	2 µl					500
.1 ppb std	1 µl	1 µl					500

	Std mix	Stock ppm	25 ppb	10 ppb	5 ppb	2 ppb	1 ppb	.5 ppb	.2 ppb	.1 ppb
Benzene	CS#1B	5000	25	10	5	2	1	.5	.2	.1
Bromobenzene		5000	25	10	5	2	1	.5	.2	.1
Bromodichloromethane		5000	25	10	5	2	1	.5	.2	.1
Bromoform		5000	25	10	5	2	1	.5	.2	.1
n-Butylbenzene		5000	25	10	5	2	1	.5	.2	.1
sec-Butylbenzene		5000	25	10	5	2	1	.5	.2	.1
tert-Butylbenzene		5000	25	10	5	2	1	.5	.2	.1
Carbon Tetrachloride		5000	25	10	5	2	1	.5	.2	.1
Chlorobenzene		5000	25	10	5	2	1	.5	.2	.1
Chloroform		5000	25	10	5	2	1	.5	.2	.1
2-Chlorotoluene		5000	25	10	5	2	1	.5	.2	.1
4-Chlorotoluene		5000	25	10	5	2	1	.5	.2	.1
Dibromochloromethane		5000	25	10	5	2	1	.5	.2	.1
1,2-Dibromo-3-chloropropane		5000	25	10	5	2	1	.5	.2	.1
1,2-Dibromoethane (EDB)		5000	25	10	5	2	1	.5	.2	.1
Dibromomethane		5000	25	10	5	2	1	.5	.2	.1
1,2-Dichlorobenzene		5000	25	10	5	2	1	.5	.2	.1
1,3-Dichlorobenzene		5000	25	10	5	2	1	.5	.2	.1
1,4-Dichlorobenzene		5000	25	10	5	2	1	.5	.2	.1
1,1-Dichloroethane		5000	25	10	5	2	1	.5	.2	.1

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C

Compound name	std mix	Stock ppm	25 ppb	10 ppb	5 ppb	2 ppb	1 ppb	.5 ppb	.2 ppb	.1 ppb
1,2-Dichloroethane	CS#1B	5000	25	10	5	2	1	.5	.2	.1
1,1-Dichloroethene		5000	25	10	5	2	1	.5	.2	.1
cis-1,2-Dichloroethene		5000	25	10	5	2	1	.5	.2	.1
trans-1,2-Dichloroethene		5000	25	10	5	2	1	.5	.2	.1
1,2-Dichloropropane		5000	25	10	5	2	1	.5	.2	.1
1,3-Dichloropropane		5000	25	10	5	2	1	.5	.2	.1
2,2-Dichloropropane		5000	25	10	5	2	1	.5	.2	.1
1,1-Dichloropropene		5000	25	10	5	2	1	.5	.2	.1
cis-1,3-Dichloropropene		5000	25	10	5	2	1	.5	.2	.1
trans-1,3-Dichloropropene		5000	25	10	5	2	1	.5	.2	.1
Ethylbenzene		5000	25	10	5	2	1	.5	.2	.1
Hexachlorobutadiene		5000	25	10	5	2	1	.5	.2	.1
Isopropylbenzene (Cumene)		5000	25	10	5	2	1	.5	.2	.1
p-Isopropyltoluene		5000	25	10	5	2	1	.5	.2	.1
Methylene Chloride		5000	25	10	5	2	1	.5	.2	.1
Naphthalene		5000	25	10	5	2	1	.5	.2	.1
n-Propylbenzene		5000	25	10	5	2	1	.5	.2	.1
Styrene		5000	25	10	5	2	1	.5	.2	.1
1,1,1,2-Tetrachloroethane		5000	25	10	5	2	1	.5	.2	.1
1,1,2,2-Tetrachloroethane		5000	25	10	5	2	1	.5	.2	.1
Tetrachloroethene		5000	25	10	5	2	1	.5	.2	.1
Toluene		5000	25	10	5	2	1	.5	.2	.1
1,2,3-Trichlorobenzene		5000	25	10	5	2	1	.5	.2	.1
1,2,4-Trichlorobenzene		5000	25	10	5	2	1	.5	.2	.1
1,3,5-Trichlorobenzene		5000	25	10	5	2	1	.5	.2	.1
1,1,1-Trichloroethane		5000	25	10	5	2	1	.5	.2	.1
1,1,2-Trichloroethane		5000	25	10	5	2	1	.5	.2	.1
Trichloroethene		5000	25	10	5	2	1	.5	.2	.1
1,2,3-Trichloropropane		5000	25	10	5	2	1	.5	.2	.1
1,2,4-Trimethylbenzene		5000	25	10	5	2	1	.5	.2	.1
1,3,5-Trimethylbenzene		5000	25	10	5	2	1	.5	.2	.1
m-Xylene		5000	25	10	5	2	1	.5	.2	.1
o-Xylene		5000	25	10	5	2	1	.5	.2	.1
p-Xylene		5000	25	10	5	2	1	.5	.2	.1
1-Chlorohexane		5000	25	10	5	2	1	.5	.2	.1
2-Chloroethyl Vinyl Ether	2-CEVE	5000	25	10	5	2	1	.5	.2	.1
Bromomethane	Gas	2000	25	10	5	2	1	.5	.2	.1
Chloroethane	mix	2000	25	10	5	2	1	.5	.2	.1
Chloromethane		2000	25	10	5	2	1	.5	.2	.1
Dichlorodifluoromethane		2000	25	10	5	2	1	.5	.2	.1
Trichlorofluoromethane		2000	25	10	5	2	1	.5	.2	.1
Vinyl Chloride		2000	25	10	5	2	1	.5	.2	.1

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C

Compound name	std mix	Stock ppm	25 ppb	10 ppb	5 ppb	2 ppb	1 ppb	.5 ppb	.2 ppb	.1 ppb
Methacrylonitrile	CS#2B	12500	250	100	50	20	10	5	2	1
Propionitrile		25000	500	200	100	40	20	10	4	2
trans-1,4-Dichloro-2-Butene		12500	250	100	50	20	10	5	2	1
t-Butyl Alcohol		25000	500	200	100	40	20	10	4	2
2-Propanol		25000	500	200	100	40	20	10	4	2
Isobutyl Alcohol		62500	1250	500	250	100	50	25	10	5
n-Butanol		125000	2500	1000	500	200	100	50	20	10
1,4-Dioxane		62500	1250	500	250	100	50	25	10	5
2-Butanone	CS#3B	25000	250	100	50	20	10	5	2	1
2-Hexanone		25000	250	100	50	20	10	5	2	1
4-Methyl-2-Pentanone		25000	250	100	50	20	10	5	2	1
Acetone		25000	250	100	50	20	10	5	2	1
2-Nitropropane		25000	250	100	50	20	10	5	2	1
Tetrahydrofuran		25000	250	100	50	20	10	5	2	1
Acrylonitrile		12500	125	50	25	10	5	2.5	1	.5
Methyl-t-butyl Ether	CS#4C	5000	25	10	5	2	1	.5	.2	.1
Ethyl Methacrylate		5000	25	10	5	2	1	.5	.2	.1
Methyl Methacrylate		5000	25	10	5	2	1	.5	.2	.1
Freon 113		5000	25	10	5	2	1	.5	.2	.1
Hexane		5000	25	10	5	2	1	.5	.2	.1
Heptane		5000	25	10	5	2	1	.5	.2	.1
Cyclohexane		5000	25	10	5	2	1	.5	.2	.1
Benzyl Chloride		5000	25	10	5	2	1	.5	.2	.1
Methyl Iodide		5000	25	10	5	2	1	.5	.2	.1
Carbon Disulfide		5000	25	10	5	2	1	.5	.2	.1
2-Chloro-1,3-Butadiene		5000	25	10	5	2	1	.5	.2	.1
di-Isopropyl Ether		5000	25	10	5	2	1	.5	.2	.1
tert-Amyl Methyl Ether		5000	25	10	5	2	1	.5	.2	.1
Ethyl-t-butyl Ether		5000	25	10	5	2	1	.5	.2	.1
1,3-Butadiene		5000	25	10	5	2	1	.5	.2	.1
Freon 123a		5000	25	10	5	2	1	.5	.2	.1
n-Pentane		5000	25	10	5	2	1	.5	.2	.1
tert-Amyl ethyl ether		5000	25	10	5	2	1	.5	.2	.1
Acrolein	VACR	125000	1250	500	250	100	50	25	10	5
Ethyl Ether	EE	1000	25	10	5	2	1	.5	.2	.1

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C

Compound name	std mix	Stock ppm	25 ppb	10 ppb	5 ppb	2 ppb	1 ppb	.5 ppb	.2 ppb	.1 ppb
Bromochloromethane	CS#6	5000	25	10	5	2	1	.5	.2	.1
Allyl Chloride		5000	25	10	5	2	1	.5	.2	.1
Methyl Acetate		5000	25	10	5	2	1	.5	.2	.1
Methylcyclohexane		5000	25	10	5	2	1	.5	.2	.1
Pentachloroethane		5000	25	10	5	2	1	.5	.2	.1
1,2,3-Trimethylbenzene		5000	25	10	5	2	1	.5	.2	.1
2-Methylnaphthalene		5000	25	10	5	2	1	.5	.2	.1
1,2-Diethylbenzene		5000	25	10	5	2	1	.5	.2	.1
1,3-Diethylbenzene		5000	25	10	5	2	1	.5	.2	.1
1,4-Diethylbenzene		5000	25	10	5	2	1	.5	.2	.1
1-Bromo-2-chloroethane	BCE	2000	25	10	5	2	1	.5	.2	.1
Dichlorofluoromethane	DCFM	2000	25	10	5	2	1	.5	.2	.1
Bromoethane	EtBr	1000	25	10	5	2	1	.5	.2	.1

ppb of analytical standard = (stock ppm)(µL stock) / flask mL

Analyst:_____
Date:_____

(saved as 8260C Lg Ical 25 mL purge)

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Water Prep

Date:_____
Instrument:_____

QARC = 1: 25 QCS#1B2CEVE, QACR stock
QVOA6= 1:25 QCS#6
QVOA1= 1:25 QCS#1B, QCS#2B, QCS3B, QCS#4C
QVOA8= 1:25 VOA8
QGASES= 1:50 Restek 502.2 "Q" Gas mix
QDCFM = 20µL Dichlorofluoromethane Lt#_____ + 980µL MeOH Lt#_____

Stock mix Name	QVOA1 _____ QARC _____	QVOA6 _____ QEE _____ QDEM _____	QEOH _____ QCYC _____	8260 SS 2500 ppm Lot#_____	QGASES _____ QVOA8 _____ QDCFM _____	Final Volume	MeOH Lot# _____	Used
20 ppb	2.5 µL	2.5 µL	2.5 µL	0.1 ul	2.5 µL	5 mL Syringe	.1 mL	
20 ppb	21.5 µL	21.5 µL	21.5 µL	-	21.5 µL	43 mL Vial	-	
20 ppb	25.0 µL	25.0 µL	25.0 µL	1.0 ul	25.0 µL	50 mL Flask	1 mL	

Compound name	std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Water Prep

1,2-Dichloropropane	QCS#1B	1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20
1,1-Dichloropropene		1000	20
cis-1,3-Dichloropropene		1000	20
trans-1,3-Dichloropropene		1000	20
Ethylbenzene		1000	20
Hexachlorobutadiene		1000	20
p-Isopropyltoluene		1000	20
Methylene Chloride		1000	20
Isopropylbenzene (Cumene)		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,3,5-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
1-Chlorohexane		1000	20
Bromomethane	QGas	2000	20
Chloroethane	mix	2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol	QCS#2B	50000	1000
1,4-Dioxane		25000	500

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Water Prep

2-Butanone	QCS#3B	7500	150
2-Hexanone		5000	100
4-Methyl-2-Pentanone		5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
1,3-Butadiene		1000	20
Freon 123a		1000	20
n-Pentane		1000	20
tert-Amyl ethyl ether		1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
2-Methylnaphthalene		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20
Acrolein	QACR	7500	150
2- Chloroethyl Vinyl Ether	QCS#1B 2CEVE	1000	20
Cyclohexanone	QCYC	1000	500
Ethyl Ether	QEE	40	20

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
Water Prep

Diethoxymethane	QDEM	40	20
Hexachloroethane	QVOA8	1000	20
2,2'-oxybis(1-Chloropropane)		1000	20
Ethanol	QEOH	1000	500
Dichlorofluoromethane	DCFM	2000	20

ppb of analytical standard = (stock ppm)(µl stock) / final volume

Analyst/Date:_____

Reviewer/Date:_____

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
25 ml Purge Waters

Date:_____
Instrument:_____

QARC= 1:25 QCS#1B2CEVE, QACR stock
QVOA1= 1:25 QCS#1B, QCS#2B, QCS3B, QCS#4C QVOA6= 1:25 QCS#6
QGAS=1:50 Restek 502.2 "Q" Gas Mix + 1:50 1-Bromo-2-chloroethane + 1:50 Dichlorofluoromethane

Stock mix Name	QVOA1 _____ QARC _____	QVOA6 _____	QEE _____ QEtBr _____	QGAS _____	Final Volume	Prep Used
5 ppb	6.25 µL	6.25 µL	6.25 uL	6.25 ul	50 mL	
5 ppb	12.5 µL	12.5 µL	12.5 uL	12.5 ul	100 mL	
5 ppb	5.38 µL	5.38 µL	5.38 uL	5.38 ul	43 mL vial	

Compound name	std mix	Stock ppm	5 ppb
Benzene	QCS#1B	1000	5
Bromobenzene		1000	5
Bromodichloromethane		1000	5
Bromoform		1000	5
n-Butylbenzene		1000	5
sec-Butylbenzene		1000	5
tert-Butylbenzene		1000	5
Carbon Tetrachloride		1000	5
Chlorobenzene		1000	5
Chloroform		1000	5
2-Chlorotoluene		1000	5
4-Chlorotoluene		1000	5
Dibromochloromethane		1000	5
1,2-Dibromo-3-chloropropane		1000	5
1,2-Dibromoethane (EDB)		1000	5
Dibromomethane		1000	5
1,2-Dichlorobenzene		1000	5
1,3-Dichlorobenzene		1000	5
1,4-Dichlorobenzene		1000	5
1,1-Dichloroethane		1000	5
1,2-Dichloroethane		1000	5
1,1-Dichloroethene		1000	5
cis-1,2-Dichloroethene		1000	5
trans-1,2-Dichloroethene		1000	5
1,2-Dichloropropane		1000	5
1,3-Dichloropropane		1000	5
2,2-Dichloropropane		1000	5
1,1-Dichloropropene		1000	5
cis-1,3-Dichloropropene		1000	5
trans-1,3-Dichloropropene		1000	5
Ethylbenzene		1000	5

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
25 ml Purge Waters

Compound name	std mix	Stock ppm	5 ppb
Hexachlorobutadiene	QCS#1B	1000	5
Isopropylbenzene (Cumene)		1000	5
p-Isopropyltoluene		1000	5
Methylene Chloride		1000	5
Naphthalene		1000	5
n-Propylbenzene		1000	5
Styrene		1000	5
1,1,1,2-Tetrachloroethane		1000	5
1,1,2,2-Tetrachloroethane		1000	5
Tetrachloroethene		1000	5
Toluene		1000	5
1,2,3-Trichlorobenzene		1000	5
1,2,4-Trichlorobenzene		1000	5
1,3,5-Trichlorobenzene		1000	5
1,1,1-Trichloroethane		1000	5
1,1,2-Trichloroethane		1000	5
Trichloroethene		1000	5
1,2,3-Trichloropropane		1000	5
1,2,4-Trimethylbenzene		1000	5
1,3,5-Trimethylbenzene		1000	5
m-Xylene		1000	5
o-Xylene		1000	5
p-Xylene		1000	5
1-Chlorohexane		1000	5
2-Chloroethyl Vinyl Ether	QCS#1B 2CLEVE	1000	5
Bromomethane	QGas	2000	5
Chloroethane	mix	2000	5
Chloromethane		2000	5
Dichlorodifluoromethane		2000	5
Trichlorofluoromethane		2000	5
Vinyl Chloride		2000	5
Methacrylonitrile	QCS#2B	7500	37.5
Propionitrile		7500	37.5
trans-1,4-Dichloro-2-Butene		5000	25
t-Butyl Alcohol		10000	50
2-Propanol		7500	37.5
Isobutyl Alcohol		25000	125
n-Butanol		50000	250
1,4-Dioxane		25000	125

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
25 ml Purge Waters

Compound name	std mix	Stock ppm	5 ppb
2-Hexanone	QCS#3B	5000	25
4-Methyl-2-Pentanone		5000	25
Acetone		7500	37.5
Acrylonitrile		5000	25
2-Nitropropane		1000	5
Tetrahydrofuran		5000	25
2-Butanone		7500	37.5
Methyl-t-butyl Ether	QCS#4C	1000	5
Ethyl Methacrylate		1000	5
Methyl Methacrylate		1000	5
Freon 113		1000	5
Hexane		1000	5
Heptane		1000	5
Cyclohexane		1000	5
Benzyl Chloride		1000	5
Methyl Iodide		1000	5
Carbon Disulfide		1000	5
2-Chloro-1,3-Butadiene		1000	5
di-Isopropyl Ether		1000	5
tert-Amyl Methyl Ether		1000	5
Ethyl-t-butyl Ether		1000	5
1,3-Butadiene		1000	5
Freon 123a		1000	5
n-Pentane		1000	5
tert-Amyl ethyl ether		1000	5
Pentachloroethane	QVOA6	1000	5
Allyl Chloride		1000	5
Bromochloromethane		1000	5
Methyl Acetate		1000	5
Methylcyclohexane		1000	5
2-Methylnaphthalene		1000	5
1,2,3-Trimethylbenzene		1000	5
1,2-Diethylbenzene		1000	5
1,3-Diethylbenzene		1000	5
1,4-Diethylbenzene		1000	5
Bromoethane	QEtBr	40	5
Ethyl Ether	QEE	40	5

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C
25 ml Purge Waters

Compound name	std mix	Stock ppm	5 ppb
Acrolein	QACR	7500	37.5
Dichlorofluoromethane	DCFM	2000	5
1-Bromo-2-chloroethane	BCE	2000	5

ppb of analytical standard = (stock ppm)(µl stock) / final volume

Analyst/Date:_____
Reviewer/Date:_____

Theoretical Standard Concentrations
Initial Calibration for Dual PT
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C

Date:_____
Instrument:_____

Stock mix name	EOH _____	dMBOH _____	Custom UST V MIX Lt#_____	MTBE _____	tAmOH _____	tBF _____		Flask mL
200 ppb std	40 µL	20 µL	10.0 ul	40.0 ul	25 µL	20 µL		100
100 ppb std	20 µL	10 µL	5.0µL	20.0 µL	20 µL	10 µL		100
50 ppb std	10 µL	8 µL	2.5 µL	7.5 µL	10 µL	5 µL		100
20 ppb std	8 µL	4 µL	1.0 µL	1.5 µL	5 µL	2 µL		100
20 ppb std for .4 ppb MDL	20uL	5 µL	1.0 µL		10 µL	2 µL		100*
0.4 ppb MDL	*Dilute 2 mL of 20 ppb standard prepped for .4 MDL run in 100 mL flask.							

Dilute stock mix As noted w/ MeOH Lt#_____	EOH _____	1:10# dMBOH _____	1:20 Custom UST V Mix Lt#_____		1:20^ tAmOH _____	1:20 tBF _____		
10 ppb std	4 µL	2 µL	10 µL		2 µL	20 µL		100
2 ppb std	2 uL	8 µL#	2 µL		20 µL^	4 µL		100
1 ppb std	1 uL	4 µL#	1 µL		N/A	N/A		100

Compound name	std mix	Stock ppm	200 ppb	100 ppb	50 ppb	20 ppb	10 ppb	2 ppb	1 ppb	0.4 ppb
Benzene	UST	2000	200	100	50	20	10	2	1	.4
Bromoform	V	2000	200	100	50	20	10	2	1	.4
Chlorobenzene	Mix	2000	200	100	50	20	10	2	1	.4
Chloroform		2000	200	100	50	20	10	2	1	.4
Chloromethane		2000	200	100	50	20	10	2	1	.4
1,2-Dibromoethane		2000	200	100	50	20	10	2	1	.4
1,1-Dichloroethane		2000	200	100	50	20	10	2	1	.4
1,2-Dichloroethane		2000	200	100	50	20	10	2	1	.4
1,1-Dichloroethene		2000	200	100	50	20	10	2	1	.4
1,2-Dichloropropane		2000	200	100	50	20	10	2	1	.4
Ethylbenzene		2000	200	100	50	20	10	2	1	.4
Isopropylbenzene		2000	200	100	50	20	10	2	1	.4
Methyl-t-butyl Ether @		2000	200	100	50	20	10	2	1	.4
Naphthalene		2000	200	100	50	20	10	2	1	.4
1,1,2,2,-Tetrachloroethane		2000	200	100	50	20	10	2	1	.4
Toluene		2000	200	100	50	20	10	2	1	.4
Vinyl Chloride		2000	200	100	50	20	10	2	1	.4
m+p-Xylene		4000	400	200	100	40	20	4	2	.8
o-Xylene		2000	200	100	50	20	10	2	1	.4
Isopropyl ether (dIPE)		2000	200	100	50	20	10	2	1	.4
tert-Amyl methyl ether		2000	200	100	50	20	10	2	1	.4
Ethyl-tert-butyl ether		2000	200	100	50	20	10	2	1	.4
Tert-Butanol (tBA)		10000	1000	500	250	100	50	10	5	2

Theoretical Standard Concentrations
Initial Calibration
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C

Compound name	std mix	Stock ppm	200 ppb	100 ppb	50 ppb	20 ppb	10 ppb	2 ppb	1 ppb	0.4 ppb
1,2,4-Trimethylbenzene	UST	2000	200	100	50	20	10	2	1	.4
1,3,5-Trimethylbenzene	V Mix	2000	200	100	50	20	10	2	1	.4
tert-Amyl ethyl ether		2000	200	100	50	20	10	2	1	0.4
t-Amyl Alcohol	tAmOH	5000	1250	1000	500	250	100	50	N/A	10
Methyl-t-butyl Ether @	MTBE	2000	800	400	150	30				
Ethanol	EOH	12500	5000	2500	1250	1000	500	250	125	50
3,3-Dimethyl-1,1-butanol	dMBOH	12500	2500	1250	1000	500	250	100	50	10
t-Butyl Formate	tBF	2500	500	250	125	50	25	5	N/A	1

ppb of analytical standard = (stock ppm)(µL stock) / flask mL

@ Methyl-t-butyl Ether is present in both MTBE and UST V mix standards

Analyst _____
Date_____

saved as 8260B USToxy (DUALPT)

Theoretical Standard Concentrations
Quality Control for Dual PT
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B/C

Date:_____
Instrument:_____

Stock mix name	QUST Lot#_____	QEOH _____	Qt-AmOH _____	QdmBOH _____	QtBF _____	Final Volume	Prep Used
20 ppb	21.5 µL	21.5 µL	21.5 µL	21.5 µL	21.5 µL	43 mL Vial	
20 ppb	25.0 µL	25.0 µL	25.0 µL	25.0 µL	25.0 µL	50 mL Flask	

Compound name	std mix	Stock ppm	20 ppb
Benzene	QUST	40	20
Bromoform		40	20
Chlorobenzene		40	20
Chloroform		40	20
1,2-Dibromoethane (EDB)		40	20
1,1-Dichloroethane		40	20
1,2-Dichloroethane		40	20
1,1-Dichloroethene		40	20
1,2-Dichloropropane		40	20
Ethylbenzene		40	20
Isopropylbenzene (Cumene)		40	20
Chloromethane		40	20
Naphthalene		40	20
Vinyl Chloride		40	20
1,1,2,2-Tetrachloroethane		40	20
m-Xylene		40	20
o-Xylene		40	20
p-Xylene		40	20
Toluene		40	20
t-Butyl Alcohol		400	200
Methyl t-butyl Ether		40	20
Diisopropyl ether		40	20
Tert-amyl methyl ether		40	20
Ethyl-tert-butyl ether		40	20
1,2,4-Trimethylbenzene		40	20
1,3,5-Trimethylbenzene		40	20
tert-Amyl ethyl ether		40	20
t-Amyl Alcohol	Qt-AmOH	400	200
3,3-Dimethyl-1-1-butanol	QdmBOH	1000	500
t-Butyl Formate	QtBF	200	100
Ethanol	QEOH	1000	500

Analyst/Date:_____
Reviewer/Date:_____

Theoretical Standard Concentrations
Gasoline Range Organics
Water Prep

Instrument:_____

Restek V Unleaded Gasoline Composite Standard

Date:_____

Lot: _____ Exp: _____

INITIAL CALIBRATION TSC

			level 6	level 5	level 4	level 3	level 2	level 1	MDL
		ul stock	40	20	10	10	2	4	2
		FV H20 Ml	50	50	50	100	100	500	500
Compound Name	**CAS #**	**Stock ppm**	**Conc. ug/L**	**Conc. ug/L**	**Conc. ug/L**	**Conc. ug/L**	**Conc. ug/L**	**Conc. ug/L**	**Conc. ug/L**
Unleaded Gasoline Composite std.	8006-61-9	5500	4400	2200	1100	550	110	44	22

Analyst:_____

Date:_____

QUALITY CONTROL TSC

Restek Q Unleaded Gasoline Composite std. Lot_____ 20000ug/mL

QGRO=1:10 Restek Q Unleaded Gasoline Composite std.

Stock mix	QGRO _____	Final Volume	Prep Used
1000 ppb GRO	21.5 ul	43 ml Vial	
1000 ppb GRO	25.0 ul	50 mL Flask	

Analyst:_____

Date:_____

eurofins	Always check on-line for validity. **Microwave Extraction by Method 3546 for Semivolatiles**	Level: **Work Instruction**
Document number: **T-OE-SVOA-WI10928**		
Old Reference: **1-P-QM-WI -9015105**		
Version: **13**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date **20-MAR-2019**	Document users: **5_EUUSLA_GC/MS Semivolatiles_Manager, 5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Semivolatile Soils, 6_EUUSLA_GC/MS Semivolatiles_Analysts**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

LIMS ID

Analysis - 10498, 10487, 10809, 10810, 10811, 10812, 10813, 10814, 11630, 11916, 10489

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Revision Log
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Calibration
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Table I

Revision Log

Revision 13	**Effective Date:**	**This version**
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Update	Removed "DOD"
Throughout procedure	Reflects current practice	Added amounts for tissue samples/QC

Revision 13	**Effective Date:**	**This version**
Apparatus and Equipment	Reflects current equipment	Added Rapid Vap evaporators and Rapid Vap evaporator tubes.
Procedure 1.b.2	Clarification	Replaced "less than" with "greater than"
Procedure 2, 2.a	Clarification	Added "approximately"
Procedure 13 through 18	Reflects current procedure	Added rapid vap concentration technique to replace steam bath.

Revision 12	**Effective Date:**	**14-JUN-2017**
Section	**Justification**	**Changes**
LIMS ID	Reflects current LIMS scan numbers	Added Analysis #10487
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	Reflects current document numbers	Removed old document numbers and replaced with D4 document numbers
Procedure 6	Reflects current practice	Added spikes for Analysis #6397

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 3546, Revision 0, February 2007.

2. *MARS Operation Manual*, Revision 2, February 2006.

3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #0949, 1309, 1476, 1536, 1947, 1953, 2035, 2395, 4615, 4678, 4688, 6387, 6397, 7804, 7805, 10723, 10724, 10727, 10728, 13615, 13618	Semivolatile Organic Compounds, Including DRO/ORO, by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC-MS
Analysis #2487	Food and Tissue Preparation
Analysis #4220, 4221	Determination of Tetraethyl Lead (TEL) and Tetramethyl Lead (TML) by GC/MS Analysis
Analysis #8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971	Semivolatiles by Methods 8270C/D SIM

Document	Document Title
Analysis 10242, 10262, 11305, 11597	Determination of Parent and Alkyl Substituted Polynuclear Aromatic Hydrocarbons (PAHs), Alkanes and Geochemical Biomarkers by Gas Chromatography/Mass Spectrometry (GC/MS-SIM)
Analysis #10461, 10462, 10726	Semivolatile Organic Compounds by Method 8270D in Aqueous and Non-Aqueous Matrices using GC-MS
Analysis #10962, 11622	Determination of N-Nitrosodimethylamine (NDMA) in Water and Soil by EPA 1625C
T-OE-SVOA-WI10554	Semivolatile Extract Cleanup Using Gel Permeation Chromatography
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Scope

This procedure is used to clearly outline the steps taken for the extraction of semivolatile compounds from soils or solid wastes using microwave technology.

Basic Principles

A portion of sample is placed in an extraction vessel. Surrogate standards are added to each sample to monitor recovery. The vessel is then loaded into the instrument and extracted. The organic compounds present in the sample dissolve in the solvent, which is then removed. The extract is concentrated to about 1 mL. At this time, it is determined if the sample requires gel-permeation cleanup (GPC). If needed, the extract is diluted to 10 mL, then cleaned using GPC and concentrated to 0.5 mL. If GPC is not necessary, the extract is brought to 1.0 mL and bottled. The extract is stored in an amber-autosampler vial in the freezer until analysis.

Reference Modifications

Base/Neutral and Acid compounds are added at a concentration of 50 ppm in the matrix spiking and LCS solutions so that the concentrations in the extract are within calibration range.

After Procedure Step 24, the joint of the K-D is not rinsed with fresh solvent when the ampule is removed. Quad and MDL studies have shown that this step is unnecessary.

Interferences

Impurities in solvents, reagents, glassware, or other hardware used in sample processing can interfere with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are then transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that is carried through all steps of the extraction and meet the defined acceptance criteria. The criteria for the LCSs include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation and Handling

Samples are collected in glass wide-mouth jars with PTFE-lined lids and stored under refrigeration at 0° to 6°C, not frozen, prior to extraction. Samples must be extracted within 14 days of sample collection. Extracts are stored in the freezer at ≤-10° C and must be analyzed within 40 days of the date extracted.

Apparatus and Equipment

1. MARS Xpress – CEM Corp. or equivalent

2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during the extraction

3. Steam bath, VWR/LLI Model #1127 or equivalent

4. Balance – Capable of weighing to 0.01 g

5. Beakers – Stainless steel – Assorted sizes

6. Scoop

7. Pipettes – Class A, assorted sizes

8. Wash bottles – Teflon®

9. Teflon®-boiling chips

10. Micro Snyder columns

11. Disposable pipettes

12. Autosampler vials – Amber, crimp top

13. Funnels – Stainless steel or Teflon®

14. Extraction vessels

15. Frits – Various

16. Sodium sulfate columns

17. Rapid-Vap Evaporators – Labconco model number 7910000 or equivalent.

18. Rapid-Vap Evaporator Tubes – Class A

Reagents and Standards

1. Methylene chloride (CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to one year.

2. Acetone – Pesticide grade or equivalent. Store at room temperature for up to one year.

3. Sodium Sulfate (Na_2SO_4) – Reagent grade or equivalent. Bake at 400°C for a minimum of 4 hours in a shallow pan to remove contaminants. Store in a glass jar for up to 1 year after baking.

4. Ottawa sand - Bake at ~ 400° C for a minimum of 4 hours to remove organic contaminants. Store in a glass jar for up to 1 year after baking.

NOTE: All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical analyses for scans 4221, 10242, 10723, 10724, 10725, 10726, 11622 and 11917.

Calibration

Not applicable to this procedure.

Preparation of Glassware

See *T-OE-GEN-WI10864*.

Procedure

1. Sample aliquot

a. If Sample Registration has pre-weighed the sample into a glass jar, add 5g of sodium sulfate, mix and proceed.

b. If the sample is not pre-weighed, weigh 30.0 - 30.5 g of sample into a labeled stainless steel beaker. If sample matrix is tissue, use 15.0 - 15.5 g.

(1) Record the initial weight and any comments about the sample in the extraction log.

(2) Alternative sample weights may be used to meet certain reporting limits. However, if sample weight greater than 30.5 g is used the sample must be divided among multiple vessels and the extracts combined.

c. Process all tissues by *Analysis #2487* prior to extraction.

2. Add approximately 5 g of sodium sulfate to each sample and mix.

a. If the sample has high water content or is a clay-like soil, add an additional 10 g (approximate) of sodium sulfate.

b. Mix the sodium sulfate and sample until a free-flowing consistency is reached.

3. Perform the background, matrix spike (MS), and matrix spike duplicate (MSD) on three separate aliquots of a field sample.

4. Prepare the Blank, laboratory control sample (LCS), and laboratory control sample duplicate (LCSD) (if applicable) by filling a Teflon® extraction vessel with 35 g of sodium sulfate. Use 15.0 g tilapia if matrix is tissue.

NOTE: For samples from SC, use Ottawa Sand for the preparation of the Blank, LCS, and LCSD (if applicable).

Record 30.0 g on the extraction log (or 15.0 for tissue samples). (The sodium sulfate used for the QC samples is measured out as 35.0 g to account for the 30 g "sample" plus the 5g of sodium sulfate.)

5. Place each sample into its clearly marked corresponding extraction vessel. Use a funnel to prevent spillage and loss of sample.

6. Add surrogate standards and spiking solutions using pipettes. Add surrogates to all samples, blanks and spiked samples. Add spikes to the LCS, LCSD (if applicable), MS, and MSD samples. Typically they are as follows:

a. Analysis 10727 – Surrogate: 1.0mL of BNA surrogate. Spike: 1.0mL of LCS spike.

b. Analysis 10725 – Surrogate: 1.0mL of BNA surrogate. Spike: 1.0mL of SIM LCS spike.

c. Analysis 10728 – Surrogate: 1.0mL of BNA surrogate. Spike: 1.0mL of LCS Spike. If required, spike 1.0 mL of Benzenthiol spike in a separate LCS/LCSD.

d. Analysis 10723, 10726, 1947 – Surrogate: 1.0mL of BNA surrogate. Spike: 1.0mL each of LCS and AppIX Mix #1. If required, Spike 1.0 mL of AppIX Mix #2 in a separate LCS/LCSD.

e. Analysis 10724 – Surrogate: 1.0mL of BNA Surrogate. Spike: 1.0mL of LCS spike.

f. Analysis 4221 – Surrogate: 1.0mL of BNA Surrogate. Spike: 1.0mL of TEL/TML spike.

g. Analysis 10242 – Surrogate: 1.0 mL of BNA surrogate. Spike: 1.0 mL of "Client Specified" spike. If required, 1.0 mL of DPnB spike.

h. Analysis 11622 – Surrogate: 1.0 mL of NDMA Surrogate. Spike: 1.0 mL of NDMA spike

i. Analysis 11917 – Surrogate: 1.0 mL of BNA surrogate. Spike: 1.0mL of SIM LCS.

j. Analysis 06397 - Surrogate: 1.0 mL of BNA surrogate. Spike: 1.0 mL of LCS matrix spiking solution and 1.0 mL of the Appendix IX Mix #1 spike is added. If required, prep a separate LCS/LCSD with 1.0 mL of Appendix IX Mix #2

NOTE: If the sample is being analyzed for Benzoic Acid, a separate LCS/LCSD must be created with 1.0 mL of Appendix IX Mix#1 spike.

See *T-OE-GEN-WI10876* for storage and handling of spikes and *T-SVOA-WI11998* for SVOA spiking and calibration standards.

NOTE: If the sample is being divided among multiple vessels, the spike must be divided among the vessels as well.

7. Add 30 mL of 50% acetone in methylene chloride to each vessel.

8. Cap each vessel according to manufacturer's guidelines.

9. Invert each vessel to ensure mixing of sample and solvent.

10. Place the vessels into the carousel. When all samples are loaded, place the carousel into the microwave.

11. Run Program "LL Soils". See Table I for Instrument conditions. Verify that the run reaches the 100 °C temperature requirement and document on batch log.

12. Uncap the cooled vessel.

13. Pour the extract and sample from the vessel into a salt column filled with approximately 10 cm of sodium sulfate on top of an evaporator tube.

14. Rinse the microwave vessel with 10 to 20 mL of methylene chloride from a wash bottle and pour it into the salt column.

15. Allow the salt column to drip dry into the evaporator tube.

16. Place the evaporator tube containing the solvent extract into the pre-heated (approximately 90°C) Rapid-Vap Evaporator. Set the timer for 15 minutes and speed at 75%(the speed is the rotation within

the unit while the sample is evaporating). Confirm that the nitrogen is set at 15 psi (this is adjusted on the regulator attached to the nitrogen line).

17. Allow the samples to concentrate to around 5.0 mL and rinse the sides of the evaporator tube down. This ensures that all the analytes sticking to the glassware are rinsed down into the evaporator tube.

Note: Failure to rinse down the sides of the evaporator tube may cause poor recoveries.

18. After rinsing down the sides of the evaporator tubes continue concentrating the extracts to just below 1.0 mL.

19. If GPC is not needed, go to Procedure Step 25.

a. For samples that require GPC bring the final volume to 10.0 mL with methylene chloride in a class A volumetric. Filter extracts into a 100 mm. screw cap tubes using a 10mL Luer-Lok glass syringe and a disposable 0.45-micron filter (Whatman catalog number 6874-2504 or equivalent).

b. Place the extract into the appropriate GPC queuing area for storage until the cleanup is performed. See *T-OE-SVOA-WI10554*.

c. Once the GPC clean up is completed, go to Step 20.

20. Place the extract in a Kuderna-Danish containing a Teflon®-boiling chip.

21. Place a 3-ball Snyder column on the set-up, wet the column with methylene chloride.

22. Concentrate over a steam bath at 80° to 90°C until the apparent volume reaches 1 to 2 mL.

23. Allow the sample to cool at least 10 minutes. Approximately 3 mL condenses into the ampule at this time.

24. Attach the ampule of the K-D to a micro-Snyder column, and concentrate the extract to below 0.5 mL. Allow the sample to cool.

25. Bring to a final volume of 1.0 mL (0.5 mL if GPC was performed) with methylene chloride in a labeled amber GC vial.

a. The final volume is determined by placing the extract into an amber-autosampler vial and comparing the level in the vial to a reference vial containing the exact targeted final volume.

b. The vials used for bottling must be the same lot number as the reference vial.

c. Methylene chloride is added to the extract using a disposable pipette until exactly the same level is in both vials.

d. If too much solvent is added to the sample vial, remove the extract from the vial and concentrate it by micro-snydering to slightly less than the targeted final volume and rebottle.

e. Cap the vial and store in the freezer until analysis.

f. Record the final volume in the extraction log.

Calculations
See analysis method.

Statistical Information/Method Performance
See analysis method.

Quality Assurance/Quality Control
For each batch of samples extracted, a method blank, an LCS, an unspiked background sample, an MS, and an MSD must be extracted. If insufficient volume of sample is available for MS/MSD, then an LCSD must be prepared instead.

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. If any client, state, or agency has more stringent QC or batching requirements, these must be followed.

Table I

Instrument Conditions

Power:	1600W
Ramp Temperature:	100°C
Ramp Time:	30 minutes
Hold Time:	10 minutes
Cool Down Time:	20 minutes

T-OE-GEN-WI10864 Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876 Organic Extraction Standards Storage and Handling
T-OE-GEN-WI7154 Food and Tissue Preparation
T-OE-SVOA-WI10554 Semivolatile Extract Cleanup Using Gel Permeation Chromatography
T-SSG-WI9553 Determination of N-Nitrosodimethylamine (NDMA) in Water and Soil by EPA 1625C
T-SVOA-WI11998 Semivolatile Spiking and Calibration Standards
T-SVOA-WI9252 Parent and Alkyl Substituted PAHs and Geochemical Biomarkers by 8270C/D SIM by GC/MS
T-SVOA-WI9587 Tetraethyl lead (TEL) in Water and Solids by 8270D/E by GC/MS
T-SVOA-WI9617 Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS
T-SVOA-WI9623 Semivolatile Organic Compounds, Including DRO/ORO, by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC-MS
T-SVOA-WI9995 Semivolatiles in Waters and Soils by Methods 8270C/D SIM and 625.1 SIM by GC/MS

End of document

Version history

Version	Approval	Revision information
11	04.OCT.2016	
12	31.MAY.2017	
13	20.MAR.2019	

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Errortext: The remote server returned an error: (404) Not Found.

eurofins	Always check on-line for validity. **Separatory Funnel Extraction (Method 3510C) or Waste Dilution (Method 3580A) of Base Neutrals and Acid Extractables in Leachates**	Level: **Work Instruction**
Document number: **T-OE-SVOA-WI10935**		
Old Reference: **1-P-QM-WI -9015149**		
Version: **13**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date **02-MAY-2018**	Document users: **5_EUUSLA_GC/MS Semivolatiles_Manager, 5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Semivolatile Waters, 6_EUUSLA_GC/MS Semivolatiles_Analysts**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

LIMS ID

Analysis - 4731

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Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Preparation of Glassware
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision 13		Effective Date: This version
Section	Justification	Changes
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Formatting Update	Removed DOD from title
Basic principles	Reflects current practice	Updated to read "50 mL" of sample
Apparatus and Eqiupment	Reflects current practice	Removed 2L sep funnel, added automated water extraction bench, RapidVap evaporator and RapidVap tubes

Revision 13		Effective Date: This version
Procedure	Reflects current practice	Updated procedure to reflect the new 250 mL tumbled process using Rapid-Vap concentration

Revision: 12		Effective Date: 26-APR-2016
Section	Justification	Changes
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Cross Reference	Reflects current process Waste dilution document referenced in this procedure	Removed turbovap reference Added reference to waste dilution procedure
Definitions	Common terms defined in higher level document	Removed section and defined first use of each acronym in text
Personnel Training and Qualifications	Reflects current process	Revised text relating to IDOCs and DOCs
Sample Collection, Preservation, and Handling	Reflects current process	Clarified temperature storage requirements for samples and extracts
Reagents and Standards	Reflects current process Reflects current process	Added the word approximately relative to the baking temperature of sodium sulfate Revised the temperature storage requirement for extraction fluid
Procedure	Enhancement	Added note referencing waste dilution procedure
Procedure 9	Clarification	Added step for visual confirmation of adequate phase separation during shake
Procedure 15	Reflect current process	Added use of hand held bulb to squeeze excess methylene chloride from sodium sulfate column
Procedure 18	Reflects current process	Removed reference to the turbovap. It is no longer used in the prep.
Procedure 16	Enhancement	Added language describing the concentration of extracts
Procedure 21	Reflects current process	Revised the temperature storage requirement for extracts

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3580A, July 1992

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 3510C, December 1996.

3. *Federal Register*, Friday, June 29, 1990, pp. 26986-26998.

4. *Chemical Hygiene Plan,* current version.

Cross Reference

eurofins	Always check on-line for validity.	Level:
Document number: **T-OE-SVOA-WI10935**	**Separatory Funnel Extraction (Method 3510C) or Waste Dilution (Method 3580A) of Base Neutrals and Acid Extractables in Leachates**	**Work Instruction**
Old Reference: **1-P-QM-WI -9015149**		
Version: **13**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date **02-MAY-2018**	Document users: **5_EUUSLA_GC/MS Semivolatiles_Manager, 5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Semivolatile Waters, 6_EUUSLA_GC/MS Semivolatiles_Analysts**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

Document	Document Title
Analysis #*0949, 1309, 1476, 1536, 1946, 1947, 1953, 2035, 2395, 4615, 4678, 4688, 6387, 6397, 7804, 7805, 10032, 10723, 10724, 10727, 10728, 13615, 13618*	Semivolatile Organic Compounds, Including DRO/ORO, by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC-MS
T-OE-SVOA-WI10936	Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Leachate Matrix
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Scope

This method is for the extraction of semivolatile organic compounds (base neutral and acid extractables) from the toxicity characteristic leachate (TCLP) of liquid, solid, or multi-phase wastes.

Basic Principles

A 50-mL portion of sample to be analyzed is placed into a separatory funnel. Surrogate standards are added to each sample to monitor recovery. The pH of the sample is then adjusted to >11 and the sample is serially extracted with methylene chloride. The pH is then adjusted to <2 and the sample is again extracted with methylene chloride. The solvent fractions are combined, and the extract is dried and concentrated to 1.0 mL.

Reference Modifications

Acid compounds are added at a concentration of 100 ppm in the matrix spiking and laboratory control sample (LCS) solutions so that their concentrations in the extract are within calibration range.

Surrogate and matrix spiking solutions are not added before the transfer to the separatory funnel for several reasons:

1. Samples must be poured from the amber bottles to determine the matrix and volume of sample to use for each extraction.

2. Many sample bottles have no headspace and there is no room to add surrogate to the sample in the bottle.

3. Due to the volume of samples extracted, a separate graduated cylinder for each sample is unrealistic.

4. To maintain consistency with all extractions, no samples are spiked in the bottle or graduated cylinders.

Interferences

High levels of organic compounds in the sample lead to interferences with normal detection limits.

Impurities in solvents, reagents, glassware, or other hardware used in sample processing lead to interferences with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Therefore, each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the employees training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the extraction and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, or one blind sample.

Sample Collection, Preservation, and Handling

Samples are collected in amber glass bottles with PTFE-lined lids and stored at 0° to 6°C, not frozen, prior to extraction. Samples must be extracted within 7 days of completion of the leachate. The extract is stored in an amber autosampler vial in the freezer at ≤ -10 °C for up to 40 days prior to analysis.

Apparatus and Equipment

1. Separatory funnel for extracting organic components from an aqueous matrix

2. Kuderna-Danish (K-D) assembly with appropriate ampule for extracting the solvent used during the extraction

3. Steam bath – WVR/LLI Model #1127 or equivalent

4. Graduated Cylinders – Class A, assorted sizes

5. Pipettes – Class A, assorted sizes

6. Pipettes – Disposable

7. Solvent pumps – Beckman or equivalent

8. Balance – Capable of weighing to 0.01g

9. Automatic shaker – Capable of holding 2 L separatory funnels

10. Centrifuge – Beckman GS-6 or equivalent

11. Sodium sulfate columns with extra course frits

12. Micro-snyder columns

13. Wash bottles – Teflon™

14. Vials – assorted sizes

15. Teflon™ boiling chips

16. Automated Water Extraction Bench – capable of holding separatory funnels for 250-mL extractions.

17. Rapid-Vap Evaporators – for concentration of 250-mL extractions

18. Rapid-Vap Evaporator Tubes – Class A

Reagents and Standards

1. Methylene chloride (CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

2. 10N Sodium hydroxide (NaOH) – Lab Chem or equivalent. Store at room temperature for up to 1 year.

3. Sulfuric acid (H_2SO_4) – ACS grade or equivalent. Store at room temperature for up to 1 year.

4. Sodium sulfate (Na_2SO_4), reagent grade or equivalent – Bake at approximately 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

5. Extraction Fluid – Prepared and delivered by Department 4028. Store refrigerated in an amber glass bottle at 0° to 6°C, not frozen for up to seven days.

6. All QC standards added during extraction process are prepared by Department 4036 using instructions generated by the standards database. Detailed instructions can be found in the corresponding Analysis #*0949, 1309, 1476, 1536, 1946, 1947, 1953, 2035, 2395, 4615, 4678, 4688, 6387, 6397, 7804, 7805, 10032, 10723, 10724, 10727, 10728, 13615, 13618*

Preparation of Glassware

See ***T-OE-GEN-WI10864***

Calibration

Not applicable to this procedure.

Procedure

NOTE: If sample would be an oil and needs a waste dilution, refer to *T-OE-SVOA-WI10936.*

1. If the sample bottle contains at least 200 mL of sample:

   a. Shake the bottle vigorously.

b. Use a clean graduated cylinder to measure 50 mL of sample and pour it into a separatory funnel.

c. Add 200 mL of reagent water.

d. Rinse the graduated cylinder with methylene chloride and add the rinseate to the separatory funnel.

e. Record the initial sample volume and any comments about the sample in the extraction log.

2. If required, the background (BKG), matrix spike (MS), and matrix spike duplicate (MSD) are performed on three separate aliquots of a field sample.

a. If an MS or MS/MSD is required for the sample and 200 mL of sample is available, use 50 mL for each.

b. If an MS or MS/MSD is required for the sample and there is <200 mL of sample, evenly split half of the volume available between the sample and spikes.

(1) Add enough reagent water to bring the volume in the separatory funnel to 250 mL.

(2) Rinse the graduated cylinder with methylene chloride and add the rinseate to the separatory funnel.

(3) Record the initial volume and any comments about the sample on the extraction log.

3. The blank, LCS, and laboratory control sample duplicate (LCSD) (if applicable) are prepared using 50 mL of extraction fluid measured into the separatory funnel.

4. Use pipettes to add surrogate and spiking solutions

a. Ensure the standard drips directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

b. Surrogates – 1.0 mL of BNA surrogate to all samples, blanks, and spikes.

c. Spiking solutions – 1.0 mL of mini LCS #1 matrix spiking solution is added to the LCS, LCSD (if applicable), MS, and MSD.

(1) If the sample requires any compounds in addition to the priority pollutant semivolatile compounds, 0.25 mL of 100-ppm spike of the compound is added at this time.

(2) See analysis 0949 for spike details.

(3) See ***T-OE-GEN-WI10876*** for storage and handling of spikes.

5. Add10 N sodium hydroxide with a disposable pipette to adjust the pH to >11.

6. Use a solvent pump to measure 15 mL of methylene chloride and add the solvent directly to the separatory funnel.

7. Cap the funnel, invert it, and vent immediately. Handshake and vent frequently until the pressure is stable.

8. Separatory funnels remain on the Automated Water Extraction bench. Press the green "start" button to lower the hood and activate the Automated Water Extraction Bench. The bench will tumble for 2 minutes. The sash will rise after the samples have tumbled.

9. The separatory funnel will sit undisturbed on the Automated Water Extraction Bench. The time required for extracts to set undisturbed is based upon visual confirmation that the layers are adequately separated. Additional time may be necessary for samples with unusual high density (i.e. high salt content).

a. If an emulsion forms and is >1/3 of the volume of the solvent layer, mechanical techniques such as stirring and centrifugation must be employed to complete the separation.

10. Drain the solvent layer directly into the sodium sulfate column containing approximately 10 cm of sodium sulfate. This drains into a Rapid-Vap evaporator tube.

a. After the first shake, rinse the salt column with approximately 5 mL methylene chloride.

11. Use a solvent pump to add 15 mL of methylene chloride to the separatory funnel and repeat Procedure Steps 8 through 10 two more times, venting only as necessary. The acid extract is also added to this Rapid-Vap evaporator tube.

12. Add sulfuric acid with a disposable pipette to adjust the sample pH to <2.

13. Using three 15-mL aliquots of methylene chloride, serially extract the sample as described in Procedure Steps 8 through 10 venting only as necessary and collect the solvent in a Rapid-Vap evaporator tube.

a. After the first acid shake, rinse the salt column with approximately 5 mL methylene chloride.

14. Use a wash bottle to rinse the sodium sulfate column with approximately 5 mL of methylene chloride. Use a hand held bulb to squeeze excess methylene chloride from the sodium sulfate column.

15. Place the evaporator tube containing the solvent extract into the pre-heated (approximately 80°C) Rapid-Vap Evaporator. Set the timer for 15 minutes and speed at 75% (the speed is the rotation within the unit while the sample is evaporating). Confirm that the nitrogen is set at 15 PSI (this is adjusted on the regulator attached to the nitrogen line). Allow samples to concentrate to around 0.5 mL.

NOTE: The temperature, timer, and speed settings can be adjusted as necessary to accommodate difficult sample matrices, etc.

16. Quantitatively transfer the sample from the Concentrator Tube to an amber autosampler vial.

    a. Determine the final volume (1.0mL) by placing the extract into an amber-autosampler vial and comparing the level in the vial to a vial containing the targeted final volume.

    b. Add methylene chloride to the extract using a disposable pipette until exactly the same level is in both vials.

    c. If too much solvent is added to the sample vial, remove the extract from the vial and concentrate it to slightly less than the targeted final volume and rebottle.

17. Cap the vial securely and store at in the freezer at ≤-10 °C. Record the final volume in the extraction log.

Calculations
See analysis method.

Statistical Information/Method Performance
See analysis method.

Quality Assurance/Quality Control
A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.
Each extraction batch must contain a method blank, an LCS, and any matrix type spike samples that are specified on the TCLP nonvolatiles batch sheet must be prepared. In addition, one of the matrix spike samples specified on the TCLP nonvolatile batch sheet must be extracted as MS/MSD. If no matrix spike samples are designated on the TCLP nonvolatile batch sheet, an LCSD must be prepared instead.
If the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing should be used. If any client, state, or agency has more stringent QC or batching requirements, these must be followed instead.

T-OE-GEN-WI10864 Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876 Organic Extraction Standards Storage and Handling
T-OE-SVOA-WI10936 Waste Dilution Procedure for the Determination of Acid Extractables and Base-

Neutrals in a Non-Water Soluble Leachate Matrix by Method 3580A
T-SVOA-WI9623 Semivolatile Organic Compounds, Including DRO/ORO, by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC-MS

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Version history

Version	Approval	Revision information
12	26.APR.2016	
13	18.APR.2018	

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Errortext: The remote server returned an error: (404) Not Found.

eurofins	Always check on-line for validity. **Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater**	Level: **Work Instruction**
Document number: **T-OE-SVOA-WI11432**		
Old Reference: **1-P-QM-WI-9015076**		
Version: **15**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date **30-APR-2018**	Document users: **5_EUUSLA_GC/MS Semivolatiles_Manager, 5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Semivolatile Waters, 6_EUUSLA_GC/MS Semivolatiles_Analysts**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

LIMS ID
0813, 10464, 10467, 10476, 11010, 14258

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Revision Log
Reference
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Basic Principles
Reference Modifications
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Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Preparation of Glassware
Calibration
Procedure
Calculations
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Quality Assurance/Quality Control

Revision Log

Revision 15	**Effective Date:** This version	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Purpose	Section not needed	Removed Purpose section.
Scope	Clarification	Removed water and replaced it with aqueous.
Basic Principles	Clarification	Removed quad study and replaced it with demonstrations of capability.

Revision 15		**Effective Date:** This version
Safety Precautions and Waste Handling	Reflects current process.	Added Rapid Vap.
Reagents and Standards	Clarification	Added concentrated to description of sulfuric acid.
Reagents and Standards	Reflects current process.	Added tap water.
Reagents and Standards	Reflects current process.	Added pH paper
Reagents and Standards	Reflects current process.	Added reagent water.
Reagents and Standards	Reflects current process.	Added analysis 14080.
Procedure C	Reflects current process.	Removed Procedure C due to it no longer being applicable. Reordered procedures throughout document.
Procedure B	Clarification	Added wording to clarify samples that require reduced volume are diluted with tap water except for analysis 14258 which is diluted with reagent water.
Procedure E.3	Reflects current process	Added 1,4-Dioxane-d8 Surrogate for analysis 14258.
Procedure F.9	Reflects current process	Added 1,4-Dioxane LCS spike for analysis 14258.
Procedure H	Clarification	Added wording to clarify pH adjustment of samples to >11.
Procedure I.1(d)	Clarification	Removed reference to non-deionized water.
Procedure I.2(a)	Clarification	Removed reference to non-deionized water.
Procedure O-P	Clarification	Added wording to clarify the number of methylene chloride extractions for the base/neutral compounds.
Procedure Q	Clarification	Added wording to clarify the pH adjustment of samples to <2.
Procedure R	Clarification	Added wording to clarify the number of methylene chloride extractions for the acid compounds.
Procedure U.2-4	Clarification	Added wording to clarify how samples are brought to a final volume of 1mL.
Procedure V.2-3	Clarification	Added wording to clarify how samples are brought to a final volume of 1mL.
Quality Assurance/ Quality Control	Clarification	Clarified the QC requirements.

Revision 14	**Effective Date:** Sept. 30, 2016	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version

Revision 14	**Effective Date:** Sept. 30, 2016	
Throughout Document	Reflects current analysis numbers Old reference numbers not needed	Added analysis numbers 14239, 14240, 14243, 14245, 14246, 14247, 14241,14242, 14244 Removed old reference numbers
Apparatus and Equipment	Reflects current practice	Added Automated Water Extraction Bench, Rapid-Vap Evaporator, Rapid-Vap Concentrator Tube
Procedure F. and G.	Reflects current practice	Added surrogate details for new analysis numbers
Procedure M.-U.	Reflects current practice	Separated 1 L extraction from 250 mL extraction and added new procedure for 250 mL extraction

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3510C, Rev 3, December 1996.

2. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #0949, 1309, 1476, 1536, 1946, 1947, 1953, 2035, 2395, 4615, 4678, 4688, 6387, 6397, 7804, 7805, 10032, 10723, 10724, 10727, 10728, 13615, 13618	Semivolatile Organic Compounds Including DRO/ORO by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC-MS
Analysis #10461, 10462, 10726	Semivolatile Organic Compounds by Method 8270D in Aqueous and Non-Aqueous Matrices using GC-MS
Analysis #14080	The Determination of 1,4-Dioxane by GC/MS using Isotope Dilution and Selective Ion Monitoring (SIM) by Method 8270C/D
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Scope

This method is for the extraction of semivolatile organic compounds at low ppb to low ppm levels in aqueous samples that are not prone to emulsions. High levels of organic compounds and/or extreme alkalinity or acidity in the sample often interfere with normal detection limits.

Basic Principles

A sample is placed into a separatory funnel. Surrogate standards are added to each sample to monitor recovery. The pH of the sample is adjusted to >11 and the sample is serially extracted with methylene chloride. The pH is then adjusted to <2 and the sample is again extracted with methylene chloride. The solvent fractions are combined, and the extract is concentrated to 1.0 mL.

Procedural changes to use a reduced sample aliquot while maintaining the default reporting limits are permitted as long as the reagent aliquots are reduced proportionally and a demonstration of capability study is performed and on file.

Reference Modifications

Acid compounds are added at a concentration of 100 ppm in the matrix spiking and LCS solutions so that their concentrations in the extract are within calibration range.

Surrogate and matrix spiking solutions are not added before the transfer to the separatory funnel for several reasons:

1. Samples must be poured from the amber bottles to determine the matrix and volume of sample to use for each extraction.

2. Many sample bottles have no headspace and there is no room to add surrogate to the sample in the bottle.

3. Due to the volume of samples extracted, a separate graduated cylinder for each sample is unrealistic.

4. To maintain consistency with all extractions, no samples are spiked in the bottle or graduated cylinders.

Interferences

High levels of organic compounds in the sample lead to interferences with normal detection limits.

Impurities in solvents, reagents, glassware, or other hardware used in sample processing lead to interferences with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of sample to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath or rapid vap; caution must be exercised while working around these apparatuses.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the employees training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the extraction and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, or one blind sample.

Sample Collection, Preservation, and Handling

Samples must be collected in amber glass bottles with PTFE-lined lids and stored under refrigeration at 0º to 6ºC, not frozen prior to extraction. Samples must be extracted within 7 days of collection. The extract is stored in an amber autosampler vial in the freezer ≤-10 °C for up to 40 days prior to analysis.

Apparatus and Equipment

1. Separatory funnel for extracting organic components from an aqueous matrix

2. Kuderna-Danish (K-D) assembly with appropriate ampule for extracting the solvent used during the extraction

3. Steam bath – VWR/LLI Model #1127 or equivalent

4. Graduated cylinders – Class A, assorted sizes

5. Pipettes – Class A, assorted sizes

6. Pipettes – Disposable

7. Solvent pumps – Beckman, adjustable

8. Balance – Capable of weighing to 0.01 g

9. Automatic shaker – Capable of holding separatory funnels

10. Centrifuge – Beckman GS-6 or equivalent

11. Sodium sulfate columns with extra course frits

12. Micro-snyder columns

13. Wash bottles – Teflon™

14. Amber autosampler vials

15. Teflon™ boiling chips

16. Automated Water Extraction Bench – capable of holding separatory funnels for 250-mL extractions.

17. Rapid-Vap Evaporators – for concentration of 250-mL extractions

18. Rapid-Vap Evaporator Tubes – Class A

Reagents and Standards

1. Methylene chloride – Pesticide grade or equivalent. Store at room temperature for up to one year.

2. 10N Sodium hydroxide (NaOH) – Lab chem or equivalent. Store at room temperature for up to one year.

3. Sulfuric acid – ACS grade or equivalent, concentrated. Store at room temperature for up to one year.

4. Sodium sulfate – Reagent grade or equivalent. Bake at approximately 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. Store in a glass jar for up to 1 year after baking.

5. Tap water – In general the laboratory tap water has been shown not to contribute an interferon at or above the reporting limits for parameters of interest.

6. pH paper - Hydrion 10 to 12 range or equivalent and 1 to 2.5 range or equivalent.

7. Reagent water – Deionized water (DiH2O) in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the reagent water supplied at the DiH2O taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.

8. All QC standards added during extraction process are prepared by Department 4036 using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical Analysis #0949, 1309, 1476, 1536, 1946, 1947, 1953, 2035, 2395, 4615, 4678, 4688, 6387, 6397, 7804, 7805, 10032, 10723, 10724, 10727, 10728, 13615, 13618 14239, 14240,14245, 14246,14247,14080, and *Analysis #10461*, 10462, 10726,14241, and 14242.

See *T-OE-GEN-WI10876* for storage and handling of spikes.

Preparation of Glassware

See *T-OE-GEN-WI10864*.

Calibration

Not applicable to this procedure

Procedure

A. Determine the volume of sample to be used for each extraction. Ideally, one full bottle is used (Typically this is 1L for routine extraction or 250 mL for mini-extractions).

1. 1 Liter analysis numbers: 0949, 1309, 1476, 1946, 1953, 2395, 4678, 6387, 7805, 10461,13615.

2. 250 mL analysis numbers: 14239, 14240, 14241, 14242, 14246, 14247, 14080.

B. Mark the water level on the outside of the sample bottle in order to later determine the sample volume.

1. Shake the bottle vigorously.

2. Pour the sample into a separatory funnel.

3. Record any comments about the sample in the extraction log.

NOTE: Reduced volumes of sample are only used with prior approval by the client or if the matrix of the sample does not allow the extraction to proceed using full volume. The sample must

then be diluted with tap water (except for analysis 14258 which must be diluted with reagent water) to 1 L or 250 mL depending on the extraction.

C. The method blank, laboratory control sample (LCS), and laboratory control sample duplicate (LCSD) (if applicable) are prepared using 1 L (or 250 mL for mini-extractions) of tap water (except for analysis 14258 which are prepared with reagent water) measured into the separatory funnel.

D. The background, MS, and MSD are prepared on three separate aliquots of a field sample.

E. Surrogates

1. For analyses 1309, 1423, 1476, 4678, 6387, 10464 and 13615 - Add 1.0 mL BNA surrogate to all samples, blanks, LCS, LCSD (if applicable), MS, and MSD.

2. For analysis 14239, 14240, 14241, 14242, 14246, 14247 – Add 1.0 mL of Mini BNA surrogated to all samples, blanks, LCS, LCSD(if applicable), MS, and MSD.

3. For analysis 14258 – Add 0.25 mL of Mini 1,4- Dioxane-d8 Surrogate

NOTE: The standard must drip directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

F. Spiking solutions

1. For analyses 1423 and 4678 - Add 1.0 mL of LCS spiking solution to the LCS, LCSD (if applicable), MS, and MSD.

2. For analysis1476 – Add 1.0 mL of LCS spiking solution to the LCS, LCSD (if applicable), MS, and MSD. If required, spike 1.0 mL of Benzenethiol spike to a separate LCS and LCSD.

3. For analysis 13615- Add 1.0 mL TPH-DRO spike (or 0.25 mL TPH-DRO spike for 250 mL extraction).

4. For analyses 1309 and 10464 – Add 1.0 mL of LCS & APPIX Mix #1 to the LCS, LCSD (if applicable), MS, and MSD. If required, add 1.0 mL of APPIX Mix#2 to a separate LCS/LCSD.

5. For analysis 6387 – Add 1.0 mL of LCS & APPIX Mix #1 to the LCS, LCSD (if applicable), MS, and MSD.

6. For analysis 14239, 14240, 14242 - Add 1.0 mL of Mini LCS spiking solution to the LCS, LCSD (if applicable), MS, and MSD.

7. For analysis 14247 - Add 1.0 mL of Mini LCS spiking solution to the LCS, LCSD (if applicable), MS, and MSD. If required, spike 1.0 mL of Benzenethiol spike to a separate LCS and LCSD.

8. For analysis 14241, 14246 - Add 1.0 mL of Mini LCS & Mini APPIX Mix #1 to the LCS, LCSD (if applicable), MS, and MSD. If required, add 0.25 mL of APPIX Mix#2 to a separate LCS/LCSD.

9. For analysis 14258 - Add 0.25 mL of 1,4-Dioxane LCS spike.

NOTE: The standard must drip directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

G. If the sample requires compounds in addition to the priority pollutant semivolatile compounds, add 1.0 mL (or 0.25 mL for 250-mL extractions) of the 100 ppm spike.

H. Adjusting pH of samples to >11

1. For 1 L extractions:

a. Add approximately 12 drops of 10N sodium hydroxide to Method Blank, LCS/LCSD, and samples using a disposable Pasteur pipette. Swirl samples to mix.

b. Check pH of samples using Hydrion 10 to 12 range pH paper or equivalent to check if pH of >11 has been attained.

NOTE: If a pH of >11 is not observed additional 10N sodium hydroxide should be added by adding 6 to 7 drops using a disposable Pasteur pipette, swirling, and re-checking the pH with Hydrion 10 to 12 range pH paper or equivalent. Please see a supervisor if a pH of >11 is **not** achieved after repeating the 10N sodium hydroxide addition 5x. Please note any issues on the batch log for any samples that are difficult to pH adjust.

2. For 250 mL extractions:

a. Add approximately 4 drops of 10N sodium hydroxide to samples, Method Blank, and LCS/LCSD using a disposable Pasteur pipette. Swirl samples to mix.

b. Check pH of samples using Hydrion 10 to 12 range pH paper or equivalent to check if pH of >11 has been attained.

NOTE: If a pH of >11 is not observed additional 10N sodium hydroxide should be added by adding 2 to 3 drops using a disposable Pasteur pipette, swirling, and re-checking the pH with Hydrion 10 to 12 range pH paper or equivalent. Please see a supervisor if a pH of >11 is **not** achieved after repeating the 10N sodium hydroxide addition 5x. Please note any issues on the batch log for samples that are difficult to pH adjust.

I. Determine the volume of sample used for extraction:

1. If the original sample bottle is empty:

a. Use a solvent pump to measure 60 mL of methylene chloride for 1 L extractions (15 mL for 250-mL extraction).

b. Rinse the sample bottle by adding the methylene chloride to the bottle. Then cap the bottle and invert several times.

c. Add the solvent to the separatory funnel.

d. Fill the bottle to the marked level with tap water and transfer the water to a graduated cylinder to determine the initial volume.

2. Alternatively, tare the empty sample bottle on the balance.

a. Fill the bottle with tap water to the marked line and place the bottle back onto the balance.

b. Round the weight to a whole number. This is the volume of sample used for extraction.

3. If the sample container is not empty, use a solvent pump to measure 60 mL of methylene chloride (15 mL for 250-mL extractions) and add the solvent directly to the separatory funnel.

J. Cap the funnel, invert it, and vent immediately.

K. Handshake and vent frequently until the pressure is stable.

L. For analysis numbers 0949, 1309, 1476, 1946, 1953, 2395, 4678, 6387, 7805, 10461,13615 - Place the sample on the automatic shaker and shake at the designated speed for 2 minutes with the stopcocks closed.

For analysis numbers 14239, 14240, 14241, 14242, 14246, 14247, 14258 – Separatory funnels remain on the Automated Water Extraction bench. Press the green “start” button to lower the hood and activate the Automated Water Extraction Bench. The bench will tumble for 2 minutes. The sash will rise after the samples have tumbled.

NOTE: Shaker speeds vary greatly between instruments; the proper setting is marked on each.

M. For analyses 0949, 1309, 1476, 1946, 1953, 2395, 4678, 6387, 7805, 10461, 13615, Place the separatory funnel on the rack and allow it to sit undisturbed until the methylene chloride layer (bottom layer) has separated from the water. For analyses 14239, 14240, 14241, 14242, 14246, 14247, 14258 the separatory funnel will sit undisturbed on the Automated Water Extraction Bench. The time required for extracts to set undisturbed is based upon visual confirmation that the layers are adequately separated. Additional time may be necessary for samples with unusual high density (i.e. high salt content).

If an emulsion forms and is >1/3 of the volume of the solvent layer, mechanical techniques such as stirring and centrifugation must be employed to complete the separation.

N. For analyses 0949, 1309, 1476, 1946, 1953, 2395, 4678, 6387, 7805, 10461, 13615, drain the solvent layer into a metal beaker and pour it through approximately 10 cm of sodium sulfate into a K-D apparatus containing a Teflon™-boiling chips. For analyses 14239, 14240, 14241, 14242, 14246, 14247, 14258 drain the solvent layer directly into the sodium sulfate column containing approximately 5 cm of sodium sulfate. This drains into a Rapid-Vap evaporator tube.

O. Use a solvent pump to add 60 mL of methylene chloride (15 mL for 250-mL extractions) to the separatory funnel and repeat steps L. through M.

P. Add another 60 mL of methylene chloride (15 mL for 250-ml extractions) to separatory funnel repeat Procedure L. through M. a second time for the third of three methylene chloride extractions.

NOTE: The acid extract is also added to this K-D (or evaporator tube for 250-mL extractions).

Q. Adjusting pH of sample to <2

1. For 1 L extractions:

a. Add approximately 1mL (1/2 full disposable Pasteur pipette) of concentrated sulfuric acid to samples and swirl to mix.

b. Check pH of samples using Hydrion 1 to 2.5 range pH paper or equivalent to check if pH of <2 has been attained.

NOTE: If a pH of <2 is not observed additional concentrated sulfuric acid should be added by adding 10 to 11 drops using a disposable Pasteur pipette, swirling, and re-checking the pH with Hydrion 1 to 2.5 range pH paper or equivalent. Please see a supervisor if a pH of <2 is **not** achieved after repeating the concentrated sulfuric acid addition six times. Please note any issues on the batch log for samples that are difficult to pH adjust.

2. For 250 mL extractions:

a. Add approximately 12 drops of concentrated sulfuric acid to samples, Method Blank, LCS/LCSD using a disposable glass pipette. Swirl samples to mix.

b. Check pH of samples using Hydrion 1 to 2.5 range pH paper or equivalent to check if pH of <2 has been attained.

NOTE: If a pH of <2 is not observed additional concentrated sulfuric acid should be added by adding 3 to 4 drops using a disposable Pasteur pipette, swirling, and re-checking the pH with Hydrion 1 to 2.5 range pH paper or equivalent. Please see a supervisor if a pH of <2 is **not** achieved after repeating the concentrated sulfuric addition six times. Please note any issues on the batch log for samples that are difficult to pH adjust.

R. After a pH of <2 has been attained: Using three 60-mL aliquots of methylene chloride (15 mL for 250-mL extractions), serially extract the sample as described in Procedure L. through M.

S. Collect the solvent in a K-D setup (or evaporator tube for the 250-mL extractions). For 1L extractions, rinse the metal beaker with approximately 20 mL of methylene chloride and pour into the sodium sulfate column.

T. Use a wash bottle to rinse the sodium sulfate column with approximately 20 mL of methylene chloride (approximately 5 mL for 250-mL extractions).

U. For 1-L extractions:

1. Attach a 3-ball Snyder column to the K-D, wet with solvent, and concentrate the extract to approximately 1-mL on a steam bath at 80° to 90°C. At the proper rate of distillation, the balls of the column will actively chatter, but the chambers will not flood. Adjust the vertical position of the apparatus and the water temperature as needed to complete the concentration in 10 - 20 min. Allow the sample to cool for 10 minutes.

NOTE: This steam bath temperature ensures concentration in a reasonable length of time.

2. Attach a microsnyder to the ampule and concentrate on a steam bath to slightly below 1 mL.

3. The extract is quantitatively transferred from the ampule using a Pasteur pipette to a 1mL amber autosampler vial using methylene chloride. The final volume of 1mL is quantified by comparing the extract auto sampler vial to a reference auto sampler vial containing exactly 1mL of methylene chloride.

4. If too much solvent is added to the sample vial, the extract from the vial should be transferred back into the ampule. A microsnyder is then attached to the ampule and the extract is concentrated on a steam bath to around 0.5 mL. Step 3 from this section is then repeated.

V. For 250-mL extractions:

1. Place the evaporator tube containing the solvent extract into the pre-heated (approximately 90°C) Rapid-Vap Evaporator. Set the timer for 15 minutes and speed at 75% (the speed is the rotation within the unit while the sample is evaporating). Confirm that the nitrogen is set at approximately 15 PSI (this is adjusted on the regulator attached to the nitrogen line). Allow samples to concentrate to around 0.5 mL.

NOTE: The temperature, timer, and speed settings can be adjusted as necessary to accommodate difficult sample matrices, etc.

2. The extract is quantitatively transferred from the evaporator tube using a Pasteur pipette to a 1mL amber autosampler vial using methylene chloride. The final volume of 1mL is quantified by comparing the extract auto sampler vial to a reference auto sampler vial containing exactly 1mL of methylene chloride.

3. If too much solvent is added to the sample vial, the extract from the vial should be transferred back into the evaporator tube and concentrated on the rapid vap down to around 0.5 mL. Step 2 from this section should then be repeated.

Calculations
See analysis method.

Statistical Information/Method Performance
See analysis method.

Quality Assurance/Quality Control
A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. If any client, state, or agency has more stringent QC or batch requirements, these must be followed instead.

Each extraction batch (up to 20 samples) must contain a method blank, a LCS, and an unspiked background sample, MS, and MSD. An LCSD is required if insufficient sample volume is submitted for a background/MS/MSD. If the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing should be used.

QC limits for surrogates, LCS/LCSD, and MS/MSD are established through statistical analysis of historical data. The limits are evaluated every 6 months and updated as needed. The limits are maintained in the LIMS for the relevant analysis numbers.

T-OE-GEN-WI10864 Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876 Organic Extraction Standards Storage and Handling
T-SVOA-WI13634 The Determination of 1,4-Dioxane by GC/MS using Isotope Dilution and Selective Ion Monitoring (SIM) by Method 8270C/D
T-SVOA-WI9617 Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS
T-SVOA-WI9623 Semivolatile Organic Compounds, Including DRO/ORO, by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC-MS

End of document

Version history

Version	Approval	Revision information
14	30.SEP.2016	
15	16.APR.2018	

eurofins	Always check on-line for validity. **Separatory Funnel Extraction by Method 3510C for BNAs by 8270 SIM in Wastewater**	Level: **Work Instruction**
Document number: **T-OE-SVOA-WI10931**		
Old Reference: **1-P-QM-WI -9015121**		
Version: **9**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date **20-MAR-2019**	Document users: **5_EUUSLA_GC/MS Semivolatiles_Manager, 5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Semivolatile Waters, 6_EUUSLA_GC/MS Semivolatiles_Analysts**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

LIMS ID

Analysis 11012, 10465, 10466, 10470, 10471, 11912

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Revision Log
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Reference Modifications
Interferences
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Personnel Training and Qualifications
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Revision Log

Revision 09		**Effective Date: This version**
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout document	Update	Replaced EtQ references with D4 references and added hyperlinks
Procedure A.1,2	Reflects current practice	Updated to reflect use of one full bottle for samples and QC.
Procedure A.3	Reflects current practice	Added that the sample bottle needs to be etched.

Revision 09	**Effective Date:**	**This version**
Procedure E,F	Reflects current practice	Re-ordered steps so pH adjusting is before the addition of solvent.
Procedure E.1,2 and O.1,2	Reflects current practice	Added reference to *T-OE-GEN-FRM23822* for information on adjusting and checking PH.
Procedure J	Reflects current practice	Changed RPM from 2500 to 3000
Procedure L	Reflects current practice	Clarified that rinsing of beaker is for full liter samples only
Procedure P	Reflects current practice	Updated rinse volume from 15mL to 5mL
Procedure R1	Reflects current practice	Added wording to include the rinsing of the sides of the Rapid-Vap tube.
Procedure R2	Reflects current practice	Added wording to clarify how extract is brought to a final volume of 1 mL

Revision: 8	Effective Date:	30-SEP-2016
Section	Justification	Changes
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflects current analysis numbers	Added analysis numbers 14243, 14244, 14245
Apparatus and Equipment	Reflects current practice	Added Automated Water Extraction Bench, Rapid-Vap Evaporator, Rapid-Vap Concentrator Tubes
Procedure G.1. and G.2.	Reflects current practice	Added spike and surrogate details for new analysis numbers
Procedure L.-X.	Reflects current practice	Separated 1L extraction from 250-mL extraction and added new procedure for 250-mL extraction.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3510C, Rev 3, December 1996.
2. *Chemical Hygiene Plan,* current version.

Cross Reference

Document	Document Title
Analysis #*8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971* (***T-SVOA-WI9995***)	Semivolatiles by Methods 8270C/D SIM
Analysis #*10242, 10262, 11305, 11597* (***T-SVOA-WI9252***)	Determination of Parent and Alkyl Substituted Polynuclear Aromatic Hydrocarbons (PAHs), Alkanes and Geochemical Biomarkers by Gas Chromatography/Mass Spectrometry (GC/MS-SIM)
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards

Document	Document Title
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling
T-OE-GEN-FRM23822	Instructions for checking PH during Extraction Procedures

Scope

This method is for the extraction of semivolatile organic compounds at low ppb to low ppm levels in water and wastewater matrices that are not prone to emulsions. High levels of organic compounds and/or extreme alkalinity or acidity in the sample often interfere with normal detection limits.

Basic Principles

A portion of sample is placed into a separatory funnel. Surrogate standards are added to each sample to monitor recovery. The pH of the sample is adjusted to >11 and the sample is serially extracted with methylene chloride. The pH of the sample is then adjusted to <2 and the sample is extracted with methylene chloride. The solvent fractions are combined, and the extract is dried and concentrated.

Procedural changes to use a reduced sample aliquot while maintaining the default reporting limits are permitted as long as the reagent aliquots are reduced proportionally and a quad study is performed and on file.

Reference Modifications

Surrogate and matrix spiking solutions are not added before the transfer to the separatory funnel for several reasons:

1. Samples must be poured from the amber bottles to determine the matrix and volume of sample to use for each extraction.

2. Many sample bottles have no headspace and there is no room to add surrogate to the sample in the bottle.

3. Due to the volume of samples extracted, a separate graduated cylinder for each sample is unrealistic.

4. To maintain consistency with all extractions, no samples are spiked in the bottle or graduated cylinders.

Interferences

Impurities in solvents, reagents, glassware, or other hardware used in sample processing lead to interferences with the method. All glassware must be rinsed with solvent before use. A method blank

is performed with each batch of sample to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the technicians training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the extraction and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, or one blind sample.

Sample Collection, Preservation and Handling

Samples are collected in glass bottles with PTFE-lined lids and stored at 0° to 6°C, not frozen, prior to extraction. Samples must be extracted within 7 days of sample collection. The extract is stored in an amber autosampler vial in the freezer =-10 °C for up to 40 days prior to analysis.

Apparatus and Equipment

1. 2-L separatory funnel for extracting organic components from an aqueous matrix

2. Kuderna-Danish (K-D) assembly with appropriate ampule for extracting the solvent used during the extraction

3. Water bath – VWR/LLI Model #1127 or equivalent

4. Graduated cylinders – Class A, assorted sizes

5. Pipettes – Class A, assorted sizes

6. Pipettes – Disposable

7. Solvent pumps – Brinkman, adjustable

8. Balance – Capable of weighing to 0. 1 g

9. Automatic shaker – Capable of holding 2 L separatory funnels

10. Centrifuge – Beckman GS-6 or equivalent

11. Sodium sulfate columns

12. Micro-snyder columns

13. Wash bottles – Teflon

14. Amber autosampler vials

15. Teflon boiling chips

16. Teflon separatory funnel

17. pH paper – Wide range

18. Automated Water Extraction Bench – capable of holding separatory funnels for 250-mL extractions

19. Rapid-Vap Evaporators – for concentration of 250-mL extractions

20. Rapid-Vap Evaporator Tubes – Class A

Reagents and Standards

1. Methylene chloride (CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to one year.

2. 10N Sodium hydroxide (NaOH) – Lab chem or equivalent. Store at room temperature for up to one year.

3. Sulfuric acid – ACS grade or equivalent, concentrated. Store at room temperature for up to 1 year.

4. Sodium sulfate (Na2SO4) – Granular anhydrous reagent grade or equivalent. Bake at approximately 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

5. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical Analysis #*8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971*, 14243, 14244, 14245 and Analysis #*10242, 10262, 11305, 11597*.

Preparation of Glassware

See ***T-OE-GEN-WI10864***

Calibration

Not applicable to this procedure.

Procedure

A. Determine the volume of sample to be used for each extraction. Ideally, one full bottle is used. (Typically this is 1L for routine extraction or 250-mL for mini-extractions).

1. 1 Liter analysis numbers: *8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971*, *10242, 10262, 11305, 11597*.

2. 250 mL analysis numbers: 14243, 14244, 14245

3. Etch the outside of the sample bottle with a scriber at the meniscus.

4 . Shake the bottle vigorously.

5. Pour the sample into a separatory funnel.

6 . Record any comments about the sample on the extraction sheet.

NOTE: Reduced volume of sample is only used with prior approval of the client or if the matrix of the sample does not allow the extraction to proceed using full volume. The sample must then be diluted to 1 L (or 250 mL) with DI water.

B. The method blank, laboratory control sample (LCS), and laboratory control sample duplicate (LCSD) (if applicable) are prepared using 1 L (or 250 mL for mini-extractions) of non-deionized reagent water (tap water) measured into the separatory funnel.

C. The background, MS, and MSD (if applicable) are prepared on three separate aliquots of a field sample.

D. Surrogates and Spiking Solutions

1. Surrogates

a. Analysis 0039, 8357, 10010, 10262, 10137, 11305, and 11913 - Add 1.0 mL BNA surrogate to all samples, blanks, LCS, LCSD (if applicable), MS, and MSD (if applicable).

b. Analysis 14243, 14244, and 14245 – Add 1.0 mL Mini BNA Surrogate to all samples, blanks, LCS, LCSD (if applicable), MS, and MSD (if applicable).

NOTE: Be certain the standard drips directly into the sample without touching the glass side of the separatory funnel to avoid poor recoveries.

2. Spiking solutions

a. Analysis 0039, 8357, 10137 and 11913 - Add 1.0 mL of SIM spiking solution to the LCS, LCSD (if applicable), MS, and MSD (if applicable).

b. Analysis 10010 – Add 1.0 mL of SIM spiking solution to the LCS, LCSD (if applicable) MS, and MSD (if applicable). Spike a separate LCS, LCSD with 1.0 mL of Benzenethiol spiking solution.

c Analysis 10262 – Add 1.0 mL of Alkyl PAH spike to the LCS, LCSD (if applicable) MS, and MSD (if applicable).

d. Analysis 11305 – Add 1.0 mL of DPnB spiking solution to LCS, LCSD if applicable, MS and MSD.

e. Analysis 14243, 14244, 14245 – Add 1.0 mL of Mini SIM spiking solution.

f. If the sample requires additional semivolatile compounds, 1.0 mL of 1 ppm spike (or 0.25 mL for 250-mL extractions) of this compound is added at this time.

g. See analysis SOPs for spike details.

3. See ***T-SVOA-WI11998*** for preparation of spikes and standards.

4. See ***T-OE-GEN-WI10876*** for storage and handling of spikes.

E. Adjusting pH of samples to >11

NOTE: If samples are entered for 8357, 10262, 11305, or 11913 proceed to Procedure O.

1. For 1 L extractions: See document ***T-OE-GEN-FRM23822*** for instructions on checking the PH of samples.

a. Add approximately 12 drops of 10N sodium hydroxide to Method Blank, LCS/LCSD, and samples using a disposable Pasteur pipette. Swirl samples to mix.

b. Check pH of samples using Hydrion 10 to 12 range pH paper or equivalent to check if pH of >11 has been attained. All pH checks are performed by using a glass disposable pipet to withdraw a few drops of sample and transferring the sample to the pH paper.

NOTE: If a pH of >11 is not observed additional 10N sodium hydroxide should be added by adding 6 to 7 drops using a disposable Pasteur pipette, swirling, and re-checking the pH with Hydrion 10 to 12 range pH paper or equivalent. Please see a supervisor if a pH of >11 is **not** achieved after repeating the 10N sodium hydroxide addition 5x. Please note any issues on the batch log for any samples that are difficult to pH adjust.

2. For 250 mL extractions: See document ***T-OE-GEN-FRM23822*** for instructions on checking the PH of samples.

a. Add approximately 4 drops of 10N sodium hydroxide to samples, Method Blank, and LCS/LCSD using a disposable Pasteur pipette. Swirl samples to mix.

b. Check pH of samples using Hydrion 10 to 12 range pH paper or equivalent to check if pH of >11 has been attained.

NOTE: If a pH of >11 is not observed additional 10N sodium hydroxide should be added by adding 2 to 3 drops using a disposable Pasteur pipette, swirling, and re-checking the pH with Hydrion 10 to 12 range pH paper or equivalent. Please see a supervisor if a pH of >11 is **not** achieved after repeating the 10N sodium hydroxide addition 5x. Please note any issues on the batch log for samples that are difficult to pH adjust.

F. Determine the volume of sample used for extraction:

1. If the original sample bottle is empty:

a. Use a solvent pump to measure 60 mL of methylene chloride (15 mL for 250-mL extractions) and rinse the sample bottle by capping and inverting several times prior to adding the methylene chloride to the separatory funnel.

b. Transfer the solvent to the separatory funnel.

c. Fill the bottle to the etched line with non-deionized reagent water (tap water) and pour into a graduated cylinder to determine the initial volume.

2. Alternatively, tare the empty sample bottle on the balance.

a. Fill the bottle with non-deionized reagent water (tap water) to the etched line and place the bottle back onto the balance.

b. Round the weight to a whole number. This is the volume of sample used for extraction.

3. If the sample container is not empty, use a solvent pump to measure 60 mL of methylene chloride (15 mL for 250-mL extractions) and add the solvent directly to the separatory funnel.

G. Cap the funnel, invert, and vent immediately.

H. Handshake and vent frequently until the pressure is stable.

I. For full liter analyses *8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971*, *10242, 10262, 11305, 11597*: Place the sample on the automatic shaker and shake at the designated speed for 2 minutes with the stopcocks closed.

For mini analyses 14243, 14244, 14245: Separatory funnels remain on the Automated Water Extraction Bench. Press the green "start" button to lower the hood and activate the Automated Water Extraction Bench. The bench will tumble for 2 minutes. The sash will rise after the samples have been tumbled.

NOTE: Shaker speeds vary greatly between instruments; the proper setting is marked on each.

J. For full liter analyses *8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971*, *10242, 10262, 11305, 11597*: Place the separatory funnel on the rack and allow it to sit undisturbed for approximately 10 minutes. For mini analyses 14243, 14244, 14245, the separatory funnel will sit undisturbed on the Automated Water Extraction Bench.

The time required for extracts to set undisturbed is based upon visual confirmation that the layers are adequately separated. Additional time may be necessary for samples with unusual high density (i.e. high salt content).

If an emulsion forms and is >1/3 of the volume of the solvent layer, mechanical techniques such as pouring the emulsion into a Teflon separatory funnel and centrifugation (3000 rpm for 2 minutes) must be employed to complete the separation.

K. For full liter analyses *8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971*, *10242, 10262, 11305, 11597*: Drain the solvent layer into a metal beaker and pour it through approximately 10 cm (~4 inches) of sodium sulfate into a K-D apparatus containing Teflon™ boiling chips. For mini analysis 14243, 14244, 14245, drain the solvent layer directly into the sodium sulfate column containing approximately 5 cm (~2 inches) of sodium sulfate. This drains into a Rapid-Vap Evaporator tube.

L. Full liter analyses only: Rinse the metal beaker with approximately 20 mL of methylene chloride and pour through salt column.

M. Use a solvent pump to add 60 mL of methylene chloride (15 mL for 250-mL extractions) to the separatory funnel and repeat Procedure steps I through K, venting only as necessary.

N. Again, use a solvent pump to add 60 mL of methylene chloride (15 mL for 250-mL extractions) to the separatory funnel and repeat Procedure steps I through K, venting only as necessary. The acid extract is also added to this KD.

O. Adjusting pH of sample to <2

1. For 1 L extractions: See document ***T-OE-GEN-FRM23822*** for instructions on checking the PH of samples.

a. Add approximately 1mL (1/2 full disposable Pasteur pipette) of concentrated sulfuric acid to samples and swirl to mix.

b. Check pH of samples using Hydrion 1 to 2.5 range pH paper or equivalent to check if pH of <2 has been attained.

NOTE: If a pH of <2 is not observed additional concentrated sulfuric acid should be added by adding 10 to 11 drops using a disposable Pasteur pipette, swirling, and re-checking the pH with Hydrion 1 to 2.5 range pH paper or equivalent. Please see a supervisor if a pH of <2 is **not** achieved after repeating the concentrated sulfuric acid addition six times. Please note any issues on the batch log for samples that are difficult to pH adjust.

2. For 250 mL extractions: See document ***T-OE-GEN-FRM23822*** for instructions on checking the PH of samples.

a. Add approximately 12 drops of concentrated sulfuric acid to samples, Method Blank, LCS/LCSD using a disposable glass pipette. Swirl samples to mix.

b. Check pH of samples using Hydrion 1 to 2.5 range pH paper or equivalent to check if pH of <2 has been attained.

NOTE: If a pH of <2 is not observed additional concentrated sulfuric acid should be added by adding 3 to 4 drops using a disposable Pasteur pipette, swirling, and re-checking the pH with Hydrion 1 to 2.5 range pH paper or equivalent. Please see a supervisor if a pH of <2 is **not** achieved after repeating the concentrated sulfuric addition six times. Please note any issues on the batch log for samples that are difficult to pH adjust.

For full liter analyses *8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971*, *10242, 10262, 11305, 11597*: Rinse metal beaker with approximately 20 mL of methylene chloride. Pour the solvent from the metal beaker into the sodium sulfate column. For mini analyses 14243, 14244, 14245, drain the solvent layer directly into the sodium sulfate column.

P. Use a wash bottle to rinse the sodium sulfate column with approximately 20 mL of methylene chloride (5 mL for 250-mL extractions).

Q. For 1-Liter extractions

1. Attach a 3-ball Snyder column to the K-D and concentrate the extract to approximately 1-mL on a steam bath at 80º to 90ºC. At the proper rate of distillation, the balls of the column will actively chatter, but the chambers will not flood. Adjust the vertical position of the apparatus and the water temperature as needed to complete the concentration in 10 to 20 min.

2. Allow the sample to cool for 10 minutes.

3. Microsnyder the sample to slightly below 1 mL.

4. Bring the combined extract to 1.0 mL using methylene chloride.

a. Determine the final volume by placing the extract into an amber autosampler vial and comparing the level in the vial to a reference vial containing the exact targeted final volume. Add methylene chloride to the extract with a disposable pipette until exactly the same level is in both vials.

If too much solvent is added to the sample vial, remove the extract from the vial and concentrate it by microsnydering to slightly less than the targeted final volume and rebottle.

b. Cap securely and store in the freezer.

c. Record the final volume on the extraction log.

R. For 250-mL Extractions

1. Place the evaporator tube containing the solvent extract into the pre-heated (approximately 90° C) Rapid-Vap Evaporator. Set the timer for 10 minutes and speed at 75%(the speed is the rotation within the unit while the sample is evaporating). Confirm that the nitrogen is set at 15 psi (this is adjusted on the regulator attached to the nitrogen line). Allow the samples to concentrate to around 0.5 mL. Periodically rinse the sides of the RapidVap tube with methylene chloride during the concentration.

NOTE: The temperature, timer, and speed settings can be adjusted as necessary to accommodate difficult sample matrices, etc.

2. Mix the sample thoroughly in the Concentrator Tube and transfer the extract to an amber autosampler vial. The extract is quantitatively transferred from the evaporator tube using a Pasteur pipette to a 1mL amber autosampler vial using methylene chloride. The final volume of 1mL is quantified by comparing the extract auto sampler vial to a reference auto sampler vial containing exactly 1mL of methylene chloride. Cap the extract securely and store in the freezer. Record the final volume on the extraction log.

Calculations

See analysis method.

Statistical Information/Method Performance

See analysis method.

Quality Assurance/Quality Control

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. For each batch of samples extracted, a blank, an LCS, an MS, and MSD must be extracted. If insufficient volume of sample is available for MS/MSD, then an LCSD must be prepared instead. Also, if the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing must be used.

If any client, state, or agency has more stringent QC or batch requirements, these must be followed instead.

T-OE-GEN-FRM23822 Instructions for Checking pH During Extraction Procedures
T-OE-GEN-WI10864 Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876 Organic Extraction Standards Storage and Handling
T-SVOA-WI11998 Semivolatile Spiking and Calibration Standards
T-SVOA-WI9252 Parent and Alkyl Substituted PAHs and Geochemical Biomarkers by 8270C/D SIM by GC/MS
T-SVOA-WI9995 Semivolatiles in Waters and Soils by Methods 8270C/D SIM and 625.1 SIM by GC/MS

End of document

Version history

Version	Approval	Revision information
8	30.SEP.2016	
9	20.MAR.2019	

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eurofins	Always check on-line for validity. **Semivolatiles in Waters and Soils by Methods 8270C/D SIM and 625.1 SIM by GC/MS**	Level: **Work Instruction**
Document number: **T-SVOA-WI9995**		
Old Reference: **1-P-QM-WI-9015192**		
Version: **16**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date **11-NOV-2019**	Document users: **5_EUUSLA_GC/MS Semivolatiles_All**	Responsible: **5_EUUSLA_GC/MS Semivolatiles_Manager**

LIMS ID
Analysis DOD - 8357, 0038, 0039, 10010, 10137, 10138, 10725, 11915, 11917, 12969, 12970, 12971, 11913, 14243, 14244, 14245, 14298, 14367, 14962, 15104

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Revision Log

Revision: 16	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Title	New analysis	Added method 625.1 SIM
LIMS ID	New analysis	Added 15104
Reference	New analysis	Added 625.1 method reference
Reagents and Standards	Clarification	B. Added not frozen to standard temperature range

Revision: 16	**Effective Date:**	This version
Section	**Justification**	**Changes**
		B.1. Added concentration for min sep DFTPP
Procedure	New analysis	D. Added 625.1 criteria to 8270D DFTPP table E. Added note to MDL criteria table regarding 625.1; Added acceptance criteria to ICV table; revised ICV acceptance criteria F. Added 625.1 CCV acceptance criteria
Statistical Information/Method Performance	New analysis	Added statistical information for 625.1
Quality Assurance/Quality Control	New analysis	Added acceptance criteria for 625.1 to the table; added use of marginal exceedance
Table V/ Table VI	New analysis	Added tables containing 625.1 acceptance limits and a list of analytes using statistical limits.

Revision: 15	**Effective Date:**	Jul 29, 2019
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Reflects current analyses	Added 14245,14298; removed 14374
Basic Principles	Enhancement	Added more detail about EI GC/MS
Interferences	Enhancement	Added information regarding contamination sources
Sample Collection, Preservation, and Handling	Enhancement	Revised section to include all necessary information
Reagents and Standards	Consistency	Moved standard preparation information to this section from calibration section for improved flow and consistency
Calibration	Consistency	Moved information to Procedure section for improved flow and consistency
Procedure	In response to PA DEP audit finding	Added wording regarding acceptability of use of alternate fit for ICAL

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 8270D (SIM), July 2014.

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 8270C (SIM), December 1996.

3. Test Methods for Evaluating Solid Wastes, SW-846 Method 8000D, July 2014.

4. USEPA, 40 CFR Part 136, Method 625.1, December 2016. MUR Effective September 2017.

5. *Hewlett-Packard Operations Manuals.*

6. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-OE-SVOA-WI10928	Microwave Extraction by Method 3546 for Semivolatiles
T-OE-SVOA-WI10931	Separatory Funnel Extraction by Method 3510C for BNAs by 8270 SIM in Wastewater
T-OE-SVOA-WI10925	Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Solid Matrix by SIM
Q-EQA-FRM6869	Nonconformance Form
T-SVOA-WI9598	GC/MS Preventative and Corrective Maintenance
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards
QA-SOP11178	Demonstrations of Capability

Scope

This method is suitable for the determination of low-level semivolatile compounds from soils and waters by selected ion monitoring (SIM) Gas Chromatography/Mass Spectrometry (GC/MS). The analysis applies to a concentration range that spans from an MDL of 0.01 µg/L in water (0.33 µg/kg for soil) to an upper calibration concentration of 10 µg/L in water (330 µg/kg for soil). Specific compound lists and their associated MDLs/LOQs are found in the Laboratory Information Management System (LIMS) under the analysis numbers listed on the front page of this SOP.

Basic Principles

Water samples are extracted according to *T-OE-SVOA-WI10931*. Soil samples are extracted according to either *T-OE-SVOA-WI10928* or *T-OE-SVOA-WI10925*.

An environmental sample (soil, water, sludge, etc.) is solvent extracted and then analyzed by electron impact gas chromatography/mass spectrometry (EI GC/MS). A 1-microliter extract of organic compounds in solvent is injected onto a fused silica capillary column coated with a relatively non-polar stationary phase, which is enclosed in a temperature controlled oven. A carrier gas, which is ultra-pure helium, passes continuously through the column. The GC oven is temperature programmed and the organic mixture separates into its individual components as it moves along the length of the column. This separation is the function of the polarity and boiling point of the individual compounds. This column empties into a mass selective detector. When a compound reaches the detector, it is bombarded by high-energy electrons (70 eV). This causes the compounds to fragment, forming ions. By applying various voltages to the lens, the positive ions are thrust into a quadrupole mass analyzer, which selects for a given mass fragment at a given time. These selected fragments reach an electron multiplier that detects and generates a

signal for each mass fragment. The signals are amplified and sent to a computer. By analyzing for specific masses over a narrow mass range, SIM analysis allows for longer dwell times at specific masses. This allows for significantly greater sensitivity of analysis with a small reduction in specificity of analysis.

Target compounds are identified on the basis of relative retention times and spectral match to standards that are injected every 12 hours on the same system.

Interferences

Major contamination sources may include reagents, extraction media, extraction apparatus, and glassware. The analyses of laboratory reagent blanks and field blanks will provide information about the presence of interferences.

Sample matrices can have an effect on the ability of the GC/MS system to resolve the individual masses used for quantification. Samples may require dilutions or a reduction in the extraction volume/weight used in order to achieve proper target separation and determination.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; therefore, each chemical compound should be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as the use of fume hoods, lab coats, safety glasses, and gloves.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently perform daily maintenance, calibrate the instrument, change the column, clean the source, interpret chromatograms, perform calculations, review data, and enter data into the LIMS.

Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples or one blind sample. Refer to *QA-SOP11178* for more guidance on these options.

Sample Collection, Preservation, and Handling

Water samples are collected in 250mL or 1L glass amber containers with PTFE-lined lids and may be preserved with sodium thiosulfate ($Na_2S_2O_3$). They are stored at 0°C to 6°C, not frozen, prior to extraction and must be extracted within 7 days of collection.

Solid samples are collected in Solid samples are collected in glass wide-mouth jars with PTFE-lined lids and are not preserved. They are stored at 0°C to 6°C, not frozen, prior to extraction and must be extracted within 14 days of collection.

All sample extracts must be stored at ≤-10°C (freezer) and protected from light using amber glass vials. All samples, sample extracts, and standards must be stored separately and in an area free from contamination. All extracts must be analyzed within 40 days of sample extraction.

Apparatus and Equipment

1. Hewlett-Packard Model 6890 Gas Chromatograph or equivalent
2. Hewlett-Packard Model 5973 and 5975 Mass Selective Detector or equivalent
3. Hewlett-Packard ChemStation Software or equivalent
4. Thru-Put Systems Target data system or equivalent
5. Glass Class A volumetric flasks – assorted sizes
6. Hamilton Gastight syringe, or equivalent – various volumes

Reagents and Standards

A. Reagents

All reagents are stored per manufacturer guidelines unless otherwise noted. Standard/spiking concentration and reagent vendors are subject to change without notification.

1. Tune Check Solution – 500 ng/µL solution of decafluorotriphenylphosphine (DFTPP) containing pentachlorophenol, benzidine and *p,p'*-dichlorodiphenyltrichloroethane (DDT) in methylene chloride, Absolute Standards, Inc. Part #43030
2. Methylene chloride – ($MeCl_2$ or CH_2Cl_2) – Baker Ultra Resi–Analyzed
3. Internal standard solution – 2000 ppm in methylene chloride, Restek custom Catalog #A073516
4. PAH Standard – 1000 ppm solution of PAHs in methylene chloride, Absolute Standards, Inc. Part #93462
5. 8270 Surrogate standard solution – 1000 ppm solution in methylene chloride, Restek custom Catalog #A0114172
6. PAH Plus Methylnaphthalenes - 2000 ppm in methylene chloride, Phenova Catalog #AL0-101233
7. Custom BNA Mix 1 - 1000 ppm in methylene chloride, Phenova Catalog #AL0-130057
8. Custom BNA Mix 2 - 1000 ppm in methylene chloride, Phenova Catalog #AL0-130058
9. Quinoline – 1000 ppm in methylene chloride, Absolute Standards, Inc. Part #70353

10. Hexachlorobenzene – 1000 ppm in acetone, Absolute Standards, Inc. Part #70195
11. Bis(2-Chloroethyl)ether – 1000 ppm in methylene chloride, Absolute Standards, Inc. Part #70075
12. EPA Method 8070 – Nitrosamines - 2000 ppm in Methanol, Absolute Standards, Inc. Part #19222
13. EPA Method 606 – Phthalates – 2000 ppm in Methanol, Absolute Standards, Inc. Part # 19242
14. 1,4-Dioxane – 1000 ppm in methylene chloride, Absolute Standards, Inc. Part #90871
15. N-Nitrosodiphenylamine - 1000 ppm in methanol, Restek Catalog# 31429
16. Helium carrier gas, UPC grade

B. Standards

Standards must be refrigerated at 0°C to 6°C, not frozen, in amber glass vials. Standards are prepared every 6 months or sooner as needed. Do not measure volumes <20% of syringe capacity. All standards are prepared using methylene chloride unless noted otherwise. Preparation of all standards is recorded in the SEMIS folder on the shared network as outlined in *T-SVOA-WI11998*.

NOTE: Special compounds may be added to spikes and calibration standards as necessary. These compounds and concentrations are determined by the analyst and added in appropriate proportions to achieve proper concentrations. If a modification to a solution's final volume is required, adjust the volume of stock solutions added to achieve the appropriate concentrations.

1. Tune Check Solution – Prepare a 50 ppm DFTPP tuning solution (12.5 ppm for samples extracted with miniature separatory funnels) as outlined in *T-SVOA-WI11998*.

2. Internal standard

Internal standard mix is added to all standards and subsequent samples. Add 10µL of internal standard to 1mL of standard or sample extract.

a. Soils and 1000 mL water extractions are internalized at a concentration of 1 µg/mL.

Mix	Concentration (ppm)	Amount Added (µL) to 10 mL
Internal standard solution	2000	500

b. 250 mL water extractions are internalized at a concentration of 0.25 µg/mL.

Mix	Concentration (ppm)	Amount Added (µL) to 10 mL
Internal standard solution	2000	125

3. Stock standard

Mix	Concentration (ppm)	Amount Added (µL) to 10 mL
PAH Standard	1000	100
Custom SIM Surrogate	1000	100

Mix	Concentration (ppm)	Amount Added (µL) to 10 mL
Quinoline	1000	100
Hexachlorobenzene	1000	100
Bis(2-Chloroethyl)ether	1000	100
Nitrosamines	2000	50
Phthalates	2000	50
1,4-Dioxane	1000	100

4. Calibration standards

ICAL

Standard ID	Preparation	Final Volume
Level 1: LPAH0.01ppm	2 µL of 10-ppm working stock + 20 µL of 100-ppm internal standard	To 2.0 mL MeCl2
Level 2: LPAH0.05 ppm	10 µL of 10-ppm working stock + 20 µL of 100-ppm internal standard	To 2.0 mL MeCl2
Level 3: LPAH0.2 ppm	40 µL of 10-ppm working stock + 20 µL of 100-ppm internal standard	To 2.0 mL MeCl2
Level 4: LPAH0.5 ppm	250 µL of 10-ppm working stock + 50 µL of 100-ppm internal standard NOTE: this level to be used as CCV	To 5.0 mL MeCl2
Level 5: LPAH001 ppm	500 µL of 100-ppm working stock + 50 µL of 100-ppm internal standard	To 5.0 mL MeCl2
Level 6: LPAH005 ppm	500 µL of 100-ppm working stock + 10 µL of 100-ppm internal standard	To 1.0 mL MeCl2
Level 7: LPAH010 ppm	1000 µL of 100-ppm working stock + 10 µL of 100-ppm internal standard	To 1.0 mL MeCl2
MDL/LOQ standard: 0.02 ppm	2 µL of 10-ppm working stock + 10 µL of 100-ppm internal standard	To 1.0 mL MeCl2
MDL/LOQ standard: 0.005 ppm	100 µL of 0.05-ppm calibration standard + 9 µL of 100-ppm internal standard	To 1.0 mL MeCl2

ICV

Mix	Concentration (ppm)	Amount Added (µL) to 10 mL
Internal Standard	100	100
PAH Plus Methylnaphthalenes	2000	5
Custom BNA Mix 1	1000	10
Custom BNA Mix 2	1000	10
N-Nitrosodiphenylamine	1000	10

For samples extracted with miniature separatory funnels (250 mL), the calibration standards listed in the above table will be diluted 4x. The calibration range will be from 0.0125 µg/mL to 2.5 µg/mL. The MDL standard and ICV will also be diluted 4x.

One of the calibration standards must be at a concentration at or below the limit of quantitation (LOQ). The other concentrations correspond to the expected range of concentrations found in samples or should define the working range of the GC/MS system.

The concentration of the MDL standard may require modification dependent upon the current MDL values.

Calibration

Calibration is accomplished using an internal standard calibration technique. Calibration standards at five or more concentration levels are analyzed. See Procedure E for the initial calibration process and criteria and see Procedure F for the continuing calibration process and criteria.

Procedure

A. Standard preparation

Solutions are used to standardize the GC/MS system every 12 hours. See the Reagents and Standards section of this SOP or *T-SVOA-WI11998* for standard preparation. Calibration solutions may be used up to the labeled expiration date or until component degradation is observed. Degradation is determined by the inability to pass continuing calibration checks or by observations of unacceptable chromatography.

Internal standard mix is added to all standards and subsequent samples as indicated in the Reagents and Standards section of this SOP. Using a 25 µL syringe, add 10 µL of internal standard to 1 mL of sample extract or standard. See Table IV for the list of compounds calibrated for and the internal standard that is assigned to each.

B. Daily maintenance

Refer to *T-SVOA-WI9598* for this procedure

C. Instrument conditions

1. The GC/MS system must be capable of meeting the following specifications:

Mass range:	35 to 500 amu
Scan time:	1 scan/sec
GC column:	30 m x 0.25 mm x 0.5 µm film Restek Rxi – 5 or equivalent
Injector temperature and mode:	250° to 300°C; splitless
Transfer line temperature:	250° to 300°C
Detector temperature:	300°C
EI condition:	70 eV
Mass scan:	Capable of SIM scanning (see manufacturer's instructions)
Carrier gas:	Helium at approximately 30 cm/sec.

GC Oven temperature program: Initial temperature – 35°
Initial hold time – 1.82 minutes
GC Ramp #1 – 20°C/minute to 310°C
GC Ramp #2 – 4°C/minute to 325°C
Final hold time – 4.30 minutes

NOTE: It is not necessary to use the exact parameters listed above. Equivalent columns and conditions may be used to improve the linearity, sensitivity, overall chromatography, and performance required by the method on each GC/MS system.

2. Prior to analysis by SIM (Selective Ion Monitoring) a check standard must be analyzed in the full scan mode to determine where the specific start and stop times are for each of the groups. Each time column maintenance is performed, the scan times are reviewed to ensure that all ions are included. The GC/MS is configured in the selected ion monitoring (SIM) mode with a total cycle time (including voltage reset time) of 1 second or less. Set the Low Res to "N" and the Start Time for each group. In the m/z field, enter the ions for each group from the following tables:

GROUP 1 (Dwell – 60 msec)			
Compound	***1.1.1.1 Type***	Quant Ion (m/z)	Monitor Ion (m/z)
1,4-Dioxane	Target	88	58
N-Nitrosodimethylamine	Target	74	42

GROUP 2 (Dwell – 40 msec)			
Compound	***1.1.1.2 Type***	Quant Ion (m/z)	Monitor Ion (m/z)
Quinoline	Target	129	102
Benzenethiol	Target	110	66
1,4-Dichlorobenzene-d4	ISTD	152	150
Naphthalene-d8	ISTD	136	68
Naphthalene	Target	128	129
Bis(2-chloroethyl)ether	Target	93	63

GROUP 3 (Dwell – 40-50 msec)			
Compound	***Type***	Quant Ion (m/z)	Monitor Ion (m/z)
Dimethylphthalate	Target	163	194
2-Methylnaphthalene	Target	142	141
1-Methylnaphthalene	Target	142	141
1-Methylnaphthalene-d10	Surrogate	152	
Acenaphthylene	Target	152	76
Acenaphthene-d10	ISTD	164	162
Acenaphthene	Target	154	152

GROUP 4 (Dwell – 25-30 msec)			
Compound	***Type***	Quant Ion (m/z)	Monitor Ion (m/z)
Dibenzofuran	Target	168	139
Diethylphthalate	Target	149	177
Fluorene	Target	166	165
Hexachlorobenzene	Target	284	142
N-Nitrosodiphenylamine	Target	169	168
Phenanthrene-d10	ISTD	188	94
Phenanthrene	Target	178	176
Anthracene	Target	178	176

GROUP 5 (Dwell – 50 msec)			
Compound	***Type***	Quant Ion (m/z)	Monitor Ion (m/z)
Di-n-butylphthalate	Target	149	150
Fluoranthene	Target	202	101
Pyrene	Target	202	101
Flouranthene-d10	Surrogate	212	106

GROUP 6 (Dwell – 40 msec)			
Compound	***Type***	Quant Ion (m/z)	Monitor Ion (m/z)
Butylbenzylphthalate	Target	149	91
Benzo(a)anthracene	Target	228	226
Chrysene-d12	ISTD	240	236
Chrysene	Target	228	226
Bis(2-ethylhexyl)phthalate	Target	149	167
Di-n-octylphthalate	Target	149	150
Benzo(b)fluoranthene	Target	252	253
Benzo(k)fluoranthene	Target	252	253
Benzo(e)pyrene	Target	252	253
Benzo(a)pyrene	Target	252	253
Perylene-d12	ISTD	264	260
Benzo(a)pyrene-d12	Surrogate	265	132
Perylene	Target	252	253

GROUP 7 (Dwell – 100 msec)			
Compound	***Type***	Quant Ion (m/z)	Monitor Ion (m/z)
Indeno(1,2,3-cd)pyrene	Target	276	138
Dibenz(a,h)anthracene	Target	278	139
Benzo(g,h,i>perylene	Target	276	138

NOTE: Each program must be identical for the Temperature and Pressure programs so that the peak retention times are the same.

D. Tuning

1. The DFTPP tune check standard is used to assess GC column performance and injection port inertness as well as mass spectrometer performance. The GC/MS system's tune is checked by inspecting the mass spectrum of the DFTPP peak and column performance and injection port inertness is evaluated with pentachlorophenol, benzidine, and DDT.

2. The GC/MS should be tuned using a 50 ng/µL solution of DFTPP containing decafluorotriphenylphosphine, pentachlorophenol, benzidine, and DDT. This solution is prepared as indicated in *T-SVOA-WI11998*. See the tables below for acceptance criteria and corrective actions.

8270D/625.1

Frequency	**Acceptance Criteria**	**Corrective Action**
Prior to initial calibration and every 12 hours prior to continuing calibration standard	1. Criteria in Table II 2. DDT breakdown ≤20%* 3. Tailing factors: - Benzidine ≤2** - Pentachlorophenol ≤2**	1. Re-tune. Analysis cannot proceed until tune meets criteria. 2. More aggressive injection port maintenance. 3. Clean the source. 4. Change the column.

***NOTE:** DDT breakdown greater than 20% may be acceptable if you are calibrating for polynuclear aromatic hydrocarbon (PAH) compounds only. Consult supervisor when this situation occurs.

** For analysis by method 625.1 the tailing factors must be <2.

8270C

Frequency	**Acceptance Criteria**	**Corrective Action**
Prior to initial calibration and every 12 hours prior to continuing calibration standard	1. Criteria in Table I 2. DDT breakdown&n≤20%* 3. Tailing factors: - Benzidine ≤3 - Pentachlorophenol ≤5	1. Re-tune. Analysis cannot proceed until tune meets criteria. 2. More aggressive injection port maintenance. 3. Clean the source.

Frequency	Acceptance Criteria	Corrective Action
		4. Change the column.

*__NOTE:__ DDT breakdown greater than 20% may be acceptable if you are calibrating for polynuclear aromatic hydrocarbon (PAH) compounds only. Consult supervisor when this situation occurs.

3. Use only the background-subtracted spectrum of the following when evaluating the DFTPP:

A three scan average of the apex of the scan, the apex of the scan -1, and the apex of the scan +1.

NOTE: All standards, samples, and associated quality control samples with a particular tune must use the identical conditions of the mass spectrometer.

E. Initial calibration (ICAL)

1. The initial calibration consists of analyzing standards at 6 concentration levels (0.05, 0.2, 0.5, 1, 5, and 10 ng/µL). Analysis of 8270D soil and 1L water extraction has an additional calibration point at 0.01 ng/µL. Response factors are produced for each level. An average response factor is then generated for each compound and surrogate. The relative standard deviation (%RSD) of the response factors determines the suitability of the average relative response factor for calculation of analyte concentration. At the end of the calibration standard injections, inject the Method Detection Limit (MDL) standard and an initial calibration verification (ICV) standard. See the tables below for acceptance criteria and corrective actions.

8270D/625.1

ICAL Frequency	Acceptance Criteria	Corrective Action
1. Initially establish with 7 levels of standards. 2. When % drift in the daily continuing calibration check standard fails criteria.	1. All compounds must have a %RSD ≤20%. If this criterion is met, then calculate concentrations based upon the average response factor fit. 2. The relative retention time of each target analyte in each calibration standard should agree within 0.06 relative retention time units. 3. %RSD of the area for each internal standard must be ≤30%. 4. Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer-peaks is <25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.	1. For any analyte with a % RSD >20%, a first order linear regression may be used provided the correlation coefficient (CC;r) of the linear regression is ≥0.995 or the coefficient of determination (COD; r2) is ≥0.99.* 2. Re-inject any levels that appear to be outliers due to an injection error. 3. Perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-calibrate.

*The %Error is measured between the calculated and expected amounts of an analyte at each calibration level to determine the calibration function acceptability for linear curves. The % Error should be ≤30% for all standards. For some data uses, ≤50% may be acceptable for the lowest calibration level.

8270C

ICAL Frequency	Acceptance Criteria	Corrective Action
1. Initially establish with at least 6 levels of standards. 2. When % drift in the daily continuing calibration check standard fails criteria.	1. All compounds should have a % RSD ≤15%. If this criterion is met, then calculate concentrations based upon the average response factor fit. 2. The relative retention time of each target analyte in each calibration standard should agree within 0.06 relative retention time units. 3. %RSD of the area for each internal standard must be ≤30%. 4. Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer-peaks is <25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.	1. For any target analyte with a %RSD >15% and ≤50%, a first order linear regression may be used provided the correlation coefficient (CC;r) of the linear regression is ≥0.995 or the coefficient of determination (COD; r2) is ≥0.99.* 2. Re-inject any levels that appear to be outliers due to an injection error. 3. Perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-calibrate.

*If the %RSD for any target analyte exceeds 50%, your supervisor is to be consulted immediately.

MDL Frequency	Acceptance Criteria	Corrective Action
Immediately following an initial calibration and before sample analysis	1. The system must be able to detect all analytes in the MDL solution.	1. If any analytes are not detected in the MDL standard, analysis can proceed if the analyte is detected at or below its MDL in a higher concentration level. 2. If the system does not detect the analyte(s), then the tuning and/or calibration procedure must be repeated under conditions that will yield a detection for the analyte(s) or the MDL must be raised for the analyte (s). 3. Perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-calibrate.

NOTE: 625.1 does not require the analysis of an MDL standard as part of the initial calibration.

ICV Frequency	Acceptance Criteria	Corrective Action
		1. Re-prep and re-analyze the ICV.

Immediately following an initial calibration and before sample analysis	1. The ICV must be prepared using a second source standard 2. %Drift for each analyte ≤30.** 3. The EICP area for each internal standard must fall within the window of -50% to +100% of the areas from the mid-level calibration standard produced during the initial calibration.4. Surrogate standards must be included in the processing list for analysis 625.1 and must meet the same criteria as target analytes.	2. If the recovery for any analyte fails these criteria low, the analyte cannot be analyzed for under the calibration until a new calibration has been established or a new ICV is analyzed. 3. If the recovery for any analyte fails these criteria high, the analyte may be analyzed for but any samples with detections should be re-analyzed under a valid ICAL or will be reported with a qualifying comment.* 4. Perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-calibrate.

*Notification to the data user occurs in the case narrative that is submitted with the data package. Your supervisor must be consulted.

** For analysis by 625.1 the calculated percent recoveries of each analyte must be compared against the acceptance criteria (Q) in Table 6 of method 625.1. Since all acceptance criteria are 70-130% or wider, an in-house acceptance criteria of 70-130% can be set for all analytes. Any compounds that fail this in-house criteria of 70-130% can then be compared against the 625.1 method criteria in Table 6.

F. Continuing calibrations

Perform a continuing calibration verification (CCV) by injecting a calibration standard near the mid-point of the ICAL. See the table below for acceptance criteria and corrective actions.

Frequency	Acceptance Criteria	Corrective Action
1. Every 12 hours. 2. The CCV is analyzed each day a curve is not analyzed. The CCV is analyzed after DFTPP.	1. For 8270D each compound must meet the minimum response factor criteria listed in Table III. 2. %Drift for each analyte ≤20%.** 3. The relative retention times of the internal standards must be within 10 seconds of the retention times from the mid-level calibration standard of the last initial calibration. The exception would be in the case of column maintenance. 4. The EICP area for each internal standard must fall within the window of -50% to +100% of the areas from the mid-level calibration standard produced during the last initial calibration.	1. If the %Drift for any analyte is >20% high and it is not detected in samples, data can be reported.* 2. If the %Drift for any analyte is >20% low, perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-inject DFTPP and the calibration standard. 3. If the %Drift is still outside acceptance criteria, re-calibrate. 4. If two consecutive CCVs fail acceptance criteria, re-calibrate.

	5. Structural isomers that produce very similar mass spectra are identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved when the height of the valley between two isomer peaks is <25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.	

*Notification to the data user occurs in the case narrative that is submitted with the data package. Your supervisor must be consulted.
** 625.1 allows %Drift for each analyte to be ≤30%.

G. Analysis of Samples

1. All sample extracts are stored at = -10°C and protected from light from the time of sample extraction.

2. Prior to sample analysis, add 10 µL of internal standard to each 1.0 mL of sample extract.

3. Analyze a predetermined aliquot of each sample extract under the same conditions used for the initial and continuing calibrations.

4. At the conclusion of data acquisition, use the same software to tentatively identify peaks within the retention time window of interest. Examine the ion abundances of components of the chromatogram. If the ion abundance of the target ion used for quantitation exceeds the calibration range, dilute the aliquot and reanalyze. When preparing dilutions, add sufficient internal standard to maintain the same concentration as that of the ICAL.

a. Dilution criteria

1) Initial dilutions are recommended in the following situations:

i. More than three internal standard areas are less than -50%.

ii. Either of the last two internal standard areas are less than -80%.

iii. The analyst's judgment of a sample extract's color or viscosity indicates possible matrix interference.

2) Secondary dilutions

Are required to bring all target compounds into the calibration range of the GC/MS.

E. Qualitative Analysis:

A compound is identified by comparison of the following parameters with those of a standard of this suspected compound (standard reference spectra). The reference mass spectrum used for this comparison should be generated by the laboratory using the conditions of the method. In order to verify identification, the following criteria must be met:

1. The sample component relative retention time should compare within ±0.06 RRT units of the RRT of the standard component.

2. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 20% relative intensity if less than three such ions occur in the reference spectrum.

3. The intensities of the characteristic ions of the compound must maximize in the same scan or within one scan of each other.

4. The relative intensities of the characteristic ions:

a. 8270C/D - The relative intensities of the characteristic ions must agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%.)

b. 625.1 - The relative intensities of the characteristic ions must agree within 50% to 200% (1/2 to 2 times) for the quantitation and secondary m/z's in the reference mass spectrum stored in the data system. For example, if a peak has an intensity of 20% relative to the base peak, the analyte is identified if the intensity of the peak in the sample is in the range of 10% to 40% of the base peak. Analyst discretion is used to determine compound identification.

5. The above criteria apply to detections greater than or equal to the LOQ. For detections between the MDL and the LOQ, the above criteria and analyst discretion are used to determine compound identification.

F. Quantitative Analysis:

When a compound has been identified, quantitation is based on the internal standard technique and the integrated abundance from the extracted ion current profile (EICP) of the primary characteristic ion.

Calculations

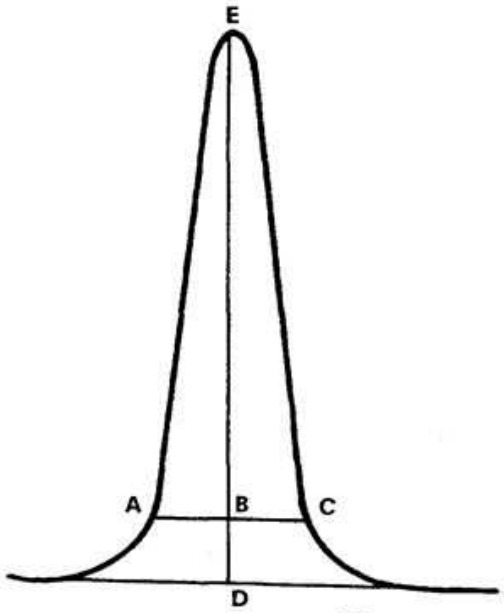
A. DDT breakdown:

$$\%\ DDT\ Breakdown = \frac{DDE\ TIC\ AREA + DDD\ TIC\ AREA}{DDE\ TIC\ AREA + DDD\ TIC\ AREA + DDT\ TIC\ AREA} \times 100$$

Where:

DDE and DDD = The breakdown products of DDT
TIC = Total Ion Chromatogram

B. Tailing factor:



TAILING FACTOR= $\frac{BC}{AB}$

Example calculation: Peak Height = DE = 100 mm
10% Peak Height = BD = 10 mm
Peak Width at 10% Peak Height = AC = 23 mm
AB = 11 mm
BC = 12 mm

Therefore: Tailing Factor = $\frac{12}{11}$ = 1.1

C. Relative response factor (RRF):

$$RRF = \frac{[A(x) \times C(is)]}{[A(is) \times C(x)]}$$

Where:

A(x) = Area of the quantitation ion for the compound being measured
C(is) = Concentration of specific internal standard
A(is) = Area of the quantitation ion for the specific internal standard
C(x) = Concentration of the compound being measured

D. Percent relative standard deviation:

$$\%\ RSD = \frac{Standard\ Deviation(SD)}{Avg\ RF} \times 100$$

Where:

$$SD = \sqrt{\frac{\sum RF - avg\ RF}{n(\#\ injections) - 1}} \quad and \quad Avg\ RF = \frac{\sum RF}{n}$$

E. Percent drift:

$$\%\ Drift = \frac{C(i) - C(c)}{C(i)} \times 100$$

Where:

C(i) = Calibration check compound standard concentration
C(c) = Measured concentration using selected quantification method

F. Concentration on column:

$$\overline{RRF} : Amt = Rsp/m1$$

1st Order (linear) regression : Amt = b + Rsp/m1

Where:

Amt = Concentration of the compound being measured [C(x)]
Concentration of the referenced internal standard [C(is)]

Rsp = Area of the characteristic ion for the compound being measured [A(x)]
Area of the characteristic ion for the referenced internal standard [A(is)]

m1 =1st degree slope which is calculated by the data system based on the curve established using the points of the initial calibration

NOTE: When calculating concentration using the average fit, m1 is equivalent to the average RRF.

b = Y (ordinate) intercept

G. Concentration in sample:

1. Aqueous:

$$Concentration\ (\mu g/L) = CoC * DF * Uf * \frac{Vt}{(Vo * Vi)}$$

Where:

CoC = On-column concentration in ng/µL for the compound being measured (as calculated in section F)
DF = Dilution factor
Uf = Unit correction factor
Vt =Final extract volume in µL
Vo =Sample volume in mL
Vi =Volume injected in µL

2. Non-aqueous:

$$Concentration\ (\mu g/kg) = CoC * DF * (GpcCleanup + 1) * Uf * \frac{Vt}{(Vi * Ws)}$$

Where:

CoC = On-column concentration in ng/µL for the compound being measured (as calculated in section F)
DF = Dilution factor
GPC Cleanup = Numerical representation of whether or not a sample was run through the GPC cleanup process (No = 0, Yes = 1)
Uf =Unit correction factor
Vt =Final extract volume in µL
Ws =Sample weight in g
Vi =Volume injected in µL
NOTE: The soil sample concentrations are converted to dry weight in the LIMS system before reporting. Refer to Calculation Section H.

H. Percent Moisture:

$$\%\ moisture = \frac{g\ of\ wet\ sample - g\ of\ dry\ sample}{g\ of\ wet\ sample}\ x\ 100$$

$$\%\ solid = \frac{(100 - \%\ moisure)}{100}$$

I. Dry weight result:

Dry weight result =(wet result/percent moisture)/ 100%

J. Relative Retention Time (RRT):

$$RRT = [RTC \div RTI]_{CCV} - [RTC \div RTI]_{SAMPLE}$$

Where:

RTI =Retention time of internal standard
RTC =Retention time of compound

K. Percent recovery:

% Recovery = Concentration found÷ Concentration spiked x 100

L. Matrix Spike (MS) recovery:

MS recovery = (SSR - SR)÷ SA x 100

Where:

SSR =Spike sample result
SR =Sample result
SA =Spike added

M. Relative Percent Difference (RPD):

$$RPD = \left| MSR - MSDR \right| \div \tfrac{1}{2}(MSR + MSDR) \times 100$$

Where:

RPD =Relative percent difference
MSR =Matrix spike recovery

Statistical Information/Method Performance

The surrogate recoveries will be compared to statistically generated limits for acceptance criteria for all methods. The LCS and MS recoveries will be compared to statistically generated limits for 8270C/D and for all 625.1 analytes not contained in Table 6 of the 625.1 method and this SOP. For analytes contained in Table 6 of the 625.1 method, the LCS and MS recoveries will be compared to these limits. See tables V of this SOP for a list of analytes that use the laboratory's statistical limits. The current data is stored in the LIMS under the analysis number(s) listed in the header of this SOP. The historical data for MDLs, MS/D, LCS/D, and measurement of uncertainty is reviewed at least annually

and updated if necessary. Refer to the QA/QC section of this SOP and the criteria listed throughout this procedure for additional information on the performance of this method.

Quality Assurance/Quality Control

Each extraction batch of ≤20 samples must contain a method blank, a laboratory control sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), and a matrix spike duplicate(MSD) or a laboratory control sample/laboratory control sample duplicate (LCS/LCSD). Additional QC samples may be required to meet project or state certification requirements. The LCS/D and MS/D are spiked at a concentration of 1 ppm.

All samples are spiked with surrogates at a concentration of 1 ppm by the organic extraction group to evaluate the extraction process. Prior to analysis each sample extract is spiked with an internal standard mix. See the table below for acceptance criteria and corrective actions.

Quality Control Item	Acceptance Criteria	Corrective Action
Internal Standards	1. Peak area within -50% to +100% of the area in the associated reference standard. 2. Retention time (RT) within 30 seconds of RT for associated reference standard.	1. Check instrument for possible problems and then reanalyze samples. 2. If re-injection meets the criteria, report this injection. 3. If re-injection still shows same problem, report first injection and qualify data with a comment.**
Method Blank	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. All target compounds must be less than the reporting limit of the associated samples. 4. For 625.1 the method blank must be analyzed immediately after the LCS and before the MS/D.	1. Inspect system for possible problems and reanalyze. 2. If the surrogates are out of spec high the data can be used. (Unless project requirements dictate otherwise). ** 3. If the method blank contains target analytes and the associated samples do not contain these analytes, no corrective action is required. 4. If the target analytes in the blank are also in the associated samples at a concentration <10x that in the blank, the samples are re-extracted unless the detection does not interfere with project data requirements. 5. Phthalates may be detected in the method blank and data reported as long as the phthalate detection is < LOQ. (Unless project requirements dictate otherwise)**

Quality Control Item	Acceptance Criteria	Corrective Action
		6. If the surrogates are out of spec low and there aren't detections in the associated samples, the data can be used.*/**
Laboratory Control Sample/Laboratory Control Sample Duplicate	1. % Recoveries within QC acceptance limits. Refer to the analysis numbers in the header of this document in LIMS for acceptance limits. These are reviewed and updated on a semiannual basis. 2. RPDs within QC limits.	1. If recoveries are above QC limits, data is usable if the target analytes that recovered above QC limits are not detected in samples.** 2. If non-compliant, check for calculation or preparation errors. 3. If no errors found, check system for problems and reanalyze. 4. If LCS/LCSD still out of spec, consult supervisor immediately. Samples may need to be re-extracted. 5. If RPDs fail but recoveries are within QC limits no further action needed. 6. For 8270 methods, marginal exceedance limits, as defined in the NELAC standards, may be used if the defined requirements have been met. Marginal exceedance cannot be used for 625.1.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	1. % Recoveries within QC acceptance limits. Refer to the analysis numbers in the header of this document in LIMS for acceptance limits. These are reviewed and updated on a semiannual basis. 2. RPDs within QC limits.	1. If LCS within QC limits, proceed with sample analysis. 2. If most recoveries or RPDs out of spec, consult supervisor.
Surrogates	All recoveries must be within acceptance limits. Refer to the analysis numbers in the header of this document in LIMS for acceptance limits. These are reviewed and updated on a semiannual basis.	1. If non-compliant, check for calculation or preparation errors. 2. If no errors found, check analytical system for problems and reanalyze the affected samples. If no problem is found, re-extract and reanalyze the affected samples. 3. If surrogates are out of spec high and no targets are detected in the sample no corrective action is required.**

* Requires approval of supervisor and completion of Nonconformance Form *Q-EQA-FRM6869*.
**Notification to the data user occurs in the case narrative that is submitted with the data package.

The lower limit of quantitation (LLOQ) is verified annually through the extraction and analysis of an LCS at 0.5 to 2 times the established LLOQ. The LLOQ is performed on similar analytical instruments such that all are included, at a minimum, within a 3 year time period. Until the laboratory has sufficient data to determine the acceptance limits, the LLOQ criteria is ± 20% of the statistically determined LCS limits.

Table I

DFTPP Key Ion Abundance Criteria (8270C)

Mass	Ion Abundance Criteria
51	30% to 60% of mass 198
68	less than 2% of mass 69
70	less than 2% of mass 69
127	40% to 60% of mass 198
197	less than 1% of mass 198
198	base peak, 100% relative abundance
199	5% to 9% of mass 198
275	10% to 30% of mass 198
365	greater than 1% of mass 198
441	present but less than mass 443
442	greater than 40% of mass 198
443	17% to 23% of mass 442

Table II

DFTPP Key Ion Abundance Criteria (8270D)

Mass	Ion Abundance Criteria
51	10% to 80% of mass 198
68	less than 2% of mass 69
70	less than 2% of mass 69
127	10% to 80% of mass 198
197	less than 2% of mass 198
198	base peak, or >50% mass 442
199	5% to 9% of mass 198
275	10% to 60% of mass 198

365	greater than 1% of mass 198
441	present but less than 24% of mass 442
442	Base peak, or >50% of mass 198
443	15% to 24% of mass 442

Table III

Recommended Minimum Response Factor Criteria for Initial and Continuing Calibration Verification (8270D)

Semivolatile Compounds	Minimum Response Factor (RF)
Naphthalene	0.700
2-Methylnaphthalene	0.400
Dimethylphthalate	0.010
Acenaphthylene	0.900
Acenaphthene	0.900
Dibenzofuran	0.800
Diethylphthalate	0.010
Fluorene	0.900
N-Nitrosodiphenylamine	0.010
Hexachlorobenzene	0.100
Phenanthrene	0.700
Anthracene	0.700
Di-n-butylphthalate	0.010
Fluoranthene	0.600
Pyrene	0.600
Butylbenzylphthalate	0.010
Benzo(a)anthracene	0.800
Chrysene	0.700
Benzo(a)anthracene	0.800
Bis(2-ethylhexyl)phthalate	0.010
Di-n-octlyphthalate	0.010
Benzo(b)fluoranthene	0.700
Benzo(k)fluoranthene	0.700
Benzo(a)pyrene	0.700
Indeno(1,2,3-cd)pyrene	0.500

Recommended Minimum Response Factor Criteria for Initial and Continuing Calibration Verification (8270D)

Semivolatile Compounds	Minimum Response Factor (RF)
Dibenz(a,h)anthracene	0.400
Benzo(g,h,i)perylene	0.500

Table IV

Semivolatile Internal Standard with Corresponding Analytes Assigned for Quantitation

1,4-Dichlorobenzene-d_4	Naphthalene-d_8	Acenaphthene-d_{10}
1,4-Dioxane	Quinoline	Acenaphthene
Benzenethiol	2-Methylnaphthalene	Acenaphthylene
N-Nitrosodimethylamine	Naphthalene	Diethyl phthalate
	Bis(2-chloroethyl)ether	Dimethyl phthalate
	1-Methylnaphthalene	Fluorene
	1-Methylnaphthalene-d10 (surr)	Dibenzofuran
Phenanthrene-d_{10}	Chrysene-d_{12}	Perylene-d_{12}
Anthracene	Pyrene	Benzo(b)fluoranthene
Phenanthrene	Benzo(a)anthracene	Benzo(k)fluoranthene
Di-n-butyl phthalate	Bis(2-ethylhexyl) phthalate	Benzo(g,h,i)perylene
Fluoranthene	Butyl benzyl phthalate	Benzo(a)pyrene
Hexachlorobenzene	Chrysene	Benzo(a)pyrene-d12 (surr)
N-Nitrosodiphenylamine		Dibenz(a,h)anthracene
Fluoranthene-d10 (surr)		Indeno(1,2,3-cd)pyrene
		Di-n-octylphthalate
		Benzo(e)pyrene
		Perylene

(surr) = surrogate

Table V

625.1 Analytes that use statistical limits

1,4-Dioxane
1-Methylnaphthalene
2-Methylnaphthalene
Dibenzofuran
N-Nitrosodimethylamine

Table VI

Table 6 – QC Acceptance Criteria – Method 625 [1]					
Analyte	**Range for Q (%) [2]**	**Limit for s (%) [3]**	**Range for X (%) [3]**	**Range for P_1, P_2(%) [3]**	**Limit for RPD (%)**
Acenaphthene	70-130	29	60-132	47-145	48
Acenaphthylene	60-130	45	54-126	33-145	74
Anthracene	58-130	40	43-120	27-133	66
Benzo(a)anthracene	42-133	32	42-133	33-143	53
Benzo(b)fluoranthene	42-140	43	42-140	24-159	71
Benzo(k)fluoranthene	25-146	38	25-146	11-162	63
Benzo(a)pyrene	32-148	43	32-148	17-163	72
Benzo(ghi)perylene	13-195	61	10-195	10-219	97
Benzyl butyl phthalate	43-140	36	10-140	10-152	60
bis(2-Chloroethyl)ether	52-130	65	43-126	12-158	108
bis(2-Ethylhexyl) phthalate	43-137	50	29-137	10-158	82
Chrysene	44-140	53	44-140	17-168	87
Dibenz(a,h)anthracene	13-200	75	10-200	10-227	126
Di-n-butyl phthalate	52-130	28	10-120	10-120	47
Diethyl phthalate	47-130	60	10-120	10-120	100
Dimethyl phthalate	50-130	110	10-120	10-120	183
Di-n-octyl phthalate	21-132	42	19-132	10-146	69
Fluoranthene	47-130	40	43-121	26-137	66
Fluorene	70-130	23	70-120	59-121	38
Hexachlorobenzene	38-142	33	10-142	10-152	55
Indeno(1,2,3-cd)pyrene	13-151	60	10-151	10-171	99
Naphthalene	70-130	39	36-120	21-133	65

Phenanthrene	67-130	24	65-120	54-120	39
Pyrene	70-130	30	70-120	52-120	49

[1] Acceptance criteria are based upon method performance data in Table 7 and from EPA Method 1625. Where necessary, limits for recovery have been broadened to assure applicability to concentrations below those used to develop Table 7.
[2] Test concentration = 100 µg/mL
[3] Test concentration = 100 µg/L
Q = Calibration verification
s = Standard deviation for four recovery measurements in the DOC test.
X = Average recovery for four recovery measurements in the DOC test.
P_1, P_2 = MS/MSD recovery.
RPD = MS/MSD relative percent difference.

Table adapted from EPA method 625.1

Q-EQA-FRM6869 Nonconformance Form
QA-SOP11178 Demonstrations of Capability
T-OE-SVOA-WI10925 Sonic Probe Extraction Procedure by EPA 3550C in Solids for the Determination of Semivolatiles by SIM
T-OE-SVOA-WI10928 Microwave Extraction by Method 3546 for Semivolatiles
T-OE-SVOA-WI10931 Separatory Funnel Extraction by Method 3510C for BNAs by 8270 SIM in Wastewater
T-SVOA-WI11998 Semivolatile Spiking and Calibration Standards
T-SVOA-WI9594 GC/MS Semivolatile Audit Process
T-SVOA-WI9598 GC/MS Preventative and Corrective Maintenance

End of document

Version history

Version	Approval	Revision information
14	21.MAR.2019	
15	15.JUL.2019	
16	11.NOV.2019	

eurofins	Always check on-line for validity. **Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS**	Level: **Work Instruction**
Document number: **T-SVOA-WI9617**		
Old Reference: **1-P-QM-WI-9015100**		
Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date **26-APR-2019**	Document users: **5_EUUSLA_GC/MS Semivolatiles_All**	Responsible: **5_EUUSLA_GC/MS Semivolatiles_Manager**

LIMS ID
Analysis 10461, 10462, 10726, 13624, 14241, 14242, 14250, 14252, 14297, 14345, 14365, 14366

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Revision Log

	Revision: 10	**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Procedure F	Reflects current practice	Reworded corrective action section for clarity and fixed CC;r typographical error

	Revision: 9	**Effective Date:** Nov 16, 2018
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
References	Most current version	Updated revision number for Method 8000D
References	Added current test method	Added Test Method 8270E

	Revision: 9	**Effective Date:** Nov 16, 2018
Section	**Justification**	**Changes**
LIMS ID	Added analysis numbers	Added current eLIMS analysis numbers
Procedure B	Enhancement	Added amount of internal to add if 0.5 mL in vial
Procedure E	Reformatting	DDT breakdown calculation moved to Calculations section
Procedure F	Correction	Changed minimum number of calibration standards from 6 to 5 unless quadratic fit is used
Procedure F	Updated to reflect method	Removed requirement to run a standard at or below the MDL. Added requirement to calibrate at or below the LOQ
Procedure F	Enhancement	Added calibration standard range for mini-sep analysis
Procedure F	Method 8270E exception	Added exception for 8270E min RRFs
Procedure F	Correction	%RSD for average fit sign changed from = to ≤
Procedure F	Method update	Updated alternate fit verification requirements to 8270E requirements
Procedure G	Clarification	Clarified that CCV must be run using a standard near the midpoint of the calibration
Procedure F	Correction	Removed alt fit verification requirements from "corrective action" as it is already in "acceptance criteria"
Procedure H	Enhancement	Added secondary ion relative intensity criteria
Calculations	Enhancement	Clarified the terms used by Target when calculating concentration using a linear regression model
Quality Assurance/Quality Control	Enhancement	Added that sample detections 10x higher than blank detections are OK per method
Quality Assurance/ Quality Control	Method 8270E requirement	Added requirement to analyze an instrument blank in any 12-hour period in which no method blank is analyzed
Quality Assurance/ Quality Control A	Enhancement	Stipulated that initial dilution criteria are recommendations

Reference

1. SW-846 Test Method 8270E: Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Rev. 6, June 2018.

2. SW-846 Test Method 8270D: Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, Rev. 5, February 2015.

3. Test Methods for Evaluating Solid Wastes, SW-846 Method 8000C, Rev. 3, March 2003.

4. Test Methods for Evaluating Solid Wastes, SW-846 Method 8000D, Rev. 5, July 2018.

5. *Federal Register*, Vol. 57, No. 227, November 24, 1992, p. 55114 (TCLP).

6. *Federal Register*, Vol. 57, No. 160, August 18, 1992, p. 37203 (CCW).

7. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Q-EQA-FRM6869	Nonconformance Form
T-SVOA-WI9598	GC/MS Preventative and Corrective Maintenance
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards
QA-SOP11178	Demonstrations of Capability

Scope

This method is suitable for the determination of the concentration of certain semivolatile organic compounds (priority pollutant list, target compound list, Appendix IX list, TCLP list, and CCW list) found in soils, tissues, waters, and leachates. Typical limits of quantitation (LOQ) achieved are 33 µg/kg for soils, 132 µg/kg for tissues, 1 µg/L for waters and 0.002 mg/L for leachates. Specific compound lists and associated method detection limits (MDLs) and LOQ can be found in the Laboratory Information Management System (LIMS) under the analysis numbers listed in the header of this SOP.

Basic Principles

A 0.5 or 1-microliter mixture of organic compounds in methylene chloride is injected onto a fused silica capillary column coated with a relatively non-polar stationary phase, which is enclosed in a temperature controlled oven. A carrier gas, ultra pure helium, passes continuously through the column. The GC oven is temperature programmed and the organic mixture separates into its individual components as it moves along the length of the column. This separation is a function of the polarity and boiling point of the individual compounds. The column empties into a mass selective detector. When a compound reaches the detector, it is bombarded by high energy electrons (70 eV). This causes the compounds to fragment, forming ions. By applying various voltages to lenses in the area where the ions are formed, the positive ions are thrust into a quadrupole mass analyzer, which selects for a given mass fragment at a given time. These selected fragments reach an electron multiplier, which detects and generates a signal for each mass fragment. The signals are amplified and sent to a computer making storage and manipulation of the data possible. Target compounds are identified on the basis of relative retention times and spectral match to standards. Standards are injected every 12 hours on each system used for analysis.

Quantification is achieved via use of the internal standard calibration technique. The average relative response factor of a multi-point calibration is used for quantification when the appropriate criteria are met.

Interferences

Method interferences may be caused by impurities in solvents, reagents, and glassware, or other hardware used in the processing of samples. All glassware is solvent rinsed before use and a method blank is performed with each extraction batch to demonstrate that the extraction system is free of contamination.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound and reagent should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means are available such as fume hoods, safety glasses, lab coats, and gloves.

All solvent waste generated from this analysis must be collected for recycling (if applicable) or must be disposed of in designated containers. These are then transferred to a lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) must be disposed of in the normal solid waste collection containers or sharps containers, as applicable.

Personnel Training and Qualifications
Education Requirement: Degree in science or relevant experience.

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently perform daily maintenance, column and source changing procedures, calibration techniques, interpret chromatograms, calculation, data review, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples or one blind sample. Refer to QA-SOP11178 for more guidance on these options.

Sample Collection, Preservation, and Handling
Water samples may be preserved with sodium thiosulfate ($Na_2S_2O_3$) and must be extracted within 7 days of collection. Solid samples are not preserved and must be extracted within 14 days of collection.

Samples are stored at 0º to 6ºC, not frozen. Extracts must be analyzed within 40 days of extraction and are stored in amber vials at = -10C (freezer).

Apparatus and Equipment
1. 25-µL syringe

2. Hewlett-Packard Model 5890 (Series I and II) or Hewlett-Packard/Agilent 6890 Gas Chromatograph or equivalent

3. Hewlett-Packard Models 5971, 5972, and Hewlett-Packard/Agilent 5973, 5975 Mass Selective Detector or equivalent

4. Thru-Put Systems Target Acquisition Software/Oracle Database or equivalent

Reagents and Standards

A. Standard/spiking concentration and reagent vendors are subject to change without notification.

B. Reagents

1. Methylene chloride, pesticide grade. Store at room temperature.

2. UPC (ultra pure carrier) helium for carrier gas.

C. Standards

1. Documentation of all stocks and calibration standards is maintained in the Standards Database (electronic standard preparation notebook) or in a standards preparation logbook.

2. 50 ng/µL (12.5 ng/µL for 250 mL aqueous analyses) Solution of decafluorotriphenylphosphine (DFTPP) containing pentachlorophenol, benzidine and DDT, prepared from Absolute Standards, Inc., Part #43030 in methylene chloride or equivalent. Store at 0º to 6ºC, not frozen, for up to 6 months.

3. Supelco Equity Semivolatile Internal Standard Mix, Part #46955-U or equivalent, 1000 µg/mL in methylene chloride. Ampulated solutions are maintained under refrigeration (0º to 6ºC, not frozen) until consumed or manufacturer determined expiration date. Working solution is maintained at room temperature and is replenished daily from ampulated solutions. For 250 mL aqueous analyses Supelco Equity Semivolatile Internal Stanadard Mix is diluted 4x to make a 250 µg/mL in methylene chloride solution. This solution is maintained under refrigeration (0º to 6ºC, not frozen) for up to 6 months.

4. Refer to *T-SVOA-WI11998* for the preparation and storage of calibration, check, and spiking solutions.

Calibration

See Procedure F for initial calibration processing and Procedure G for continuing calibration check processing.

Procedure

A. Standard preparation – These solutions are used to standardize the GC/MS system every 12 hours and are prepared approximately every 20-30 days or more frequently if needed based on consumption. See *T-SVOA-WI11998* for standard preparation. Calibration standard solutions may be used up to the labeled expiration date or until component degradation is observed.

B. Internal standard mix is added to all standards and subsequent samples at a concentration of 20 µg/mL (5 µg/mL for 250 mL aqueous analyses). Using a 25-µL syringe, 20 µL of Supelco Equity Semivolatile Internal Standard Mix or equivalent, 1000 µg/mL (250 µg/mL for 250 mL aqueous analyses) in methylene chloride are added to the 1 mL of standard or sample extract. If only 0.5 mL of sample is in the vial, 10 µL of internal spiking solution is added to the sample.

C. Daily maintenance – Refer to *T-SVOA-WI9598* for this procedure.

D. Instrument conditions

Equip a GC/MS (such as referenced under Apparatus and Equipment) in one of the two following manners:

1. For a 5890/5971 or 5972 and 6890/5973 or 5975

a. Column – 30M × 0.25 mm ID, 1.0 um df, J&W Scientific DB-5MS or equivalent

b. Injector – Split/splitless operated in splitless mode

c. Injector Temp – 275°C

d. Detector Temp – 300°C

e. Gas – Helium at approximately 1.5 mL/min, constant flow mode

f. Oven Temp – 45°C for 3 minutes, ramp at 8°C/minute to 225°C, then ramp at 12°C/minute to 300°C and hold for 7.5 minutes.

2. For a 6890/5973 or 5975

a. Column – 20M × 0.18 mm ID, 0.18 um df, J&W Scientific DB-5MS or equivalent

b. Injector – Split/splitless operated in split mode, 30:1 split

c. Injector Temp – 275°C

d. Detector Temp – 280°C

e. Gas – Helium at approximately 1.0 mL/min, constant flow mode

f. Oven Temp – 40°C for 1 minute, ramp at 25°C/minute to 100°C, then ramp at 30°C/minute to 280°C, followed by another ramp at 25°C/minute to 320°C, hold for 2 minutes.

NOTE: It is not necessary to use the exact parameters listed above. Equivalent columns and conditions that give the performance required by the method are acceptable.

E. Tuning

The GC/MS must be tuned using a 50 ng/µL (12.5 ng/µL for 250 mL aqueous analyses) solution of DFTPP containing pentachlorophenol, benzidine, and DDT.

8270D Tuning Criteria		
Frequency	Acceptance Criteria	Corrective Action
Every 12 hours	1. Criteria in Table I 2. DDT breakdown =20%* 3. Tailing factors: · Benzidine =2 · Pentachlorophenol =2	1. Retune. Analysis cannot proceed until tune meets criteria 2. More aggressive injection port maintenance 3. Clean the source 4. Change the column

***NOTE:** DDT breakdown greater than 20 percent may be acceptable if you are calibrating for polynuclear aromatic hydrocarbon compounds only. Consult supervisor when this situation occurs.

8270E Tuning Criteria		
Frequency	Acceptance Criteria	Corrective Action
Before every initial calibration	1. Criteria in Table I 2. DDT breakdown =20%* 3. Tailing factors: · Benzidine =2 · Pentachlorophenol =2	1. Retune. Initial calibration cannot proceed until tune meets criteria 2. More aggressive injection port maintenance 3. Clean the source 4. Change the column

Use only the background-subtracted spectrum of the following when evaluating the DFTPP:

A three scan average of the apex of the scan, the apex of the scan –1 and the apex of the scan +1.

NOTE: All standards, samples, and associated quality control samples with a particular tune must use the identical conditions of the mass spectrometer.

F. Initial calibration (ICAL)

1. Perform standardization by analyzing at least five levels of calibration standards ranging from 0.5 µg/mL to 120 µg/mL or from 0.125 µg/mL to 30 µg/mL for mini-sep waters analysis. (Refer to *T-SVOA-WI11998* for the preparation of calibration standards.) Six levels of calibration standards must be used if a quadratic (second-order) type calibration fit is used. Use the internal standard calibration technique to generate an average relative response factor for each compound. Table II lists the six internal standards used for the method and the target compounds that are associated with each internal standard.

2. The low calibration standard used must be at or below the LOQ.

3. Initial Calibration Verification (ICV) standard is also analyzed with each initial calibration. The ICV is made from a second source standard and has an acceptance window of 70% to 130%.

Frequency	Acceptance Criteria	Corrective Action
Initially and when the daily calibration standard fails criteria. Initially establish with at least five levels of standards.	1. Minimum response factors must be met in all levels of the calibration – especially in the lowest level of the calibration (see table IV).** 2. %RSD for each compound should be less than or equal to 20%. If more than 10% of the compounds in the ICAL exceed 20% RSD and/or also do not meet the minimum correlation coefficient for alternate fits (ie, the correlation coefficient is <0.990) then the analysis cannot proceed. 3. For any compound on a linear or quadratic fit the % error is measured	1. Any target analyte with a %RSD of ≤ 20% should use the average RRF. For any analyte in which the %RSD >20%, use a first degree (linear) fit provided the correlation coefficient (CC; r) is ≥ 0.995 or the coefficient of determination (COD;r^2) is ≥ 0.99. If the linear fit fails to meet this criteria, then a second order (quadratic) fit may be used provided the coefficient of determination is ≥ 0.99. If use of both the linear fit and the quadratic fit is acceptable using this criteria for any given analyte, then use the fit with the smallest negative y-intercept. When using a quadratic fit, if the y-intercept quantifies to be greater than the MDL, consult your supervisor

	between the calculated and expected amounts of an analyte at each calibration level to determine the calibration function acceptability for linear and non-linear curves. The % error should be ≤ 50% for the low calibration point. For calibration points above the LOQ the % error should be ≤ 30%. 4. The relative retention times of the target compounds must agree within 0.06 relative retention time units. The exception would be in the case of system maintenance. 5. Structural isomers that produce very similar mass spectra are identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is <25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.	immediately or recalibrate. See below for corrective action if the coefficient of determination for a quadratic fit is <0.99.* 2. More aggressive system maintenance, and recalibrate

*See USEPA Method 8000D for the calculations associated with non-linear fit types.

**Minimum response factors are not required to be met for method 8270E. They are provided for guidance.

With supervisory approval, the following problematic compounds can be allowed to fail the 0.99 coefficient of determination criteria for a quadratic fit:

1,4-Phenylenediamine
4-Aminobiphenyl
3,3'-Dimethylbenzidine
4,4'-Methylenebis(2-chloroaniline)
4-Nitroquinoline-1-oxide
1,4-Naphthoquinone
methapyrilene

If the COD is less than 0.99 for any other compound, the system should be inspected for problems and recalibrated. Supervisory approval is required for exceptions to these guidelines.

NOTE: Quadratic fits <u>are not</u> permitted when analyzing samples from South Carolina.

G. Continuing Calibration Verification (CCV)

Frequency	Acceptance Criteria	Corrective Action
1. Every 12 hours 2. Check standard area	1. Target analytes should meet the minimum response factor criteria (see Table IV).*	1. More aggressive system maintenance

analyzed near the midpoint of the calibration.	2. The maximum % drift for all target analytes is 20%. No more than 20% of the target analytes can be greater than 20% drift. All target analytes that exceed 20% drift must be less than or equal to 50% drift. 3. The relative retention times of the target compounds must agree within 0.06 relative retention time units. The exception would be for the case of system maintenance. 4. The EICP area for each internal standard must fall within the window of -50% to +100% from the areas of the mid-level standard produced during the last initial calibration. 5. Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is <25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs. The resolution should be verified on the mid-point concentration of the ICAL as well as the check standard.	2. In cases where compounds fail, they may still be reported as non-detects if it can be demonstrated that there was adequate sensitivity to detect the compound at the applicable quantitation limit. For situations when the failed compound is present, the concentrations must be reported as estimated values. 3. Recalibrate

*Minimum response factors are not required to be met for method 8270E. They are provided for guidance.

In the event that two consecutive continuing calibration check standards fail for the list of target analytes being quantified, then after the appropriate system maintenance has been performed, two consecutive continuing calibration check standards must pass criteria, before analysis can continue. If the analytical system cannot pass two consecutive checks, then the system must be recalibrated.

H. Qualitative analysis

A compound is identified by comparison of the following parameters with those of a standard of this suspected compound (standard reference spectra). In order to verify identification, the following criteria must be met:

1. The intensities of the characteristic ions of the compound must maximize in the same scan or within one scan of each other.

2. The sample component relative retention time must compare within ±0.06 RRT units of the RRT of the standard component.

3. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum.

4. The primary and secondary ions can be found in Table III.

5. The relative intensities of the qualifier ion(s) should agree within 30% of the relative intensities of these ions in the reference spectrum. The reference mass spectrum used for this comparison should be generated by the laboratory using the conditions of the method.

NOTE: N-Nitrosodiphenylamine decomposes in the gas chromatographic inlet and cannot be separated from diphenylamine. For this reason, it is acceptable to report the combined result for both n-nitrosodiphenylamine and diphenylamine for either of these compounds as a combined concentration.

NOTE: 1,2-Diphenylhydrazine is unstable even at room temperature and readily converts to azobenzene. Given the stability problems, it would be acceptable to calibrate for 1,2-diphenylhydrazine using azobenzene. Under these poor

compound separation circumstances the results for either of these compounds should be reported as a combined concentration.

I. Quantitative analysis

Once a compound has been identified, quantitation is based on the internal standard technique and the integrated abundance from the extracted ion current profile (EICP) of the primary characteristic ion. The list of primary characteristic ions is listed in Table III. See Calculations section for concentration calculations.

Calculations

A. Calculation of DDT breakdown

$$\%\ DDT\ Breakdown = \frac{DDE\ TIC\ AREA + DDD\ TIC\ AREA}{DDE\ TIC\ AREA + DDD\ TIC\ AREA + DDT\ TIC\ AREA} \times 100$$

Where:

DDE and DDD = The breakdown products of DDT

TIC = Total Ion Chromatogram

B. Calibration calculations

1. Calculation of the relative response factor (RRF):

$$RRF = \frac{[A(x) \times C(is)]}{[A(is) \times C(x)]}$$

Where:

A(x) = Area of the characteristic ion for the compound being measured
A(is) = Area of the characteristic ion for the specific internal standard
C(x) = Concentration of the compound being measured

C(is) = Concentration of specific internal standard

2. Regression equation

- 1st Order (linear) regression: Y = M(X) + B

  Target (data processing software) rearranges the equation as:
  Y = (X/M) + B
  where M = 1/(1st degree slope)

- 2nd Order (quadratic) regression: Y = B + M(X) + CX2

Where:

Y = Conc Std

$$X = \frac{\text{ConcInst}}{\text{Area Std}} \times \frac{\text{Area}}{\text{AreaIstd}}$$

M = 1st degree slope

C = 2nd degree slope

B = Y intercept

3. Calculation of the percent drift:

$$\%\ Drift = \frac{C(i) - C(c)}{C(i)} \times 100$$

Where:

C(i) = Calibration check compound standard concentration

C(c) = Measured concentration using selected quantification method

4. Calculation of the percent relative standard deviation (%RSD):

$$\%RSD = \frac{SD}{\overline{RF}} \times 100$$

Where:

SD = Standard deviation

$\overline{RF}$ = Average response factor

C. Concentration calculations

1. Waters:

$$Concentration\ (\mu g/L) = \frac{A(x) \times I(s) \times V(t) \times D_f}{A(is) \times RRF \times V(o) \times V(i)}$$

Where:

A(x) = Area of characteristic ion for compound being measured

I(s) = Amount of internal standard injected (ng)

V(t) = Volume of concentrated extract in microliters (µL)

Df = Dilution factor

A(is) = Area of characteristic ion for the internal standard

RRF = Relative response factor for the compound being measured

V(i) = Volume of extract injected (µL)

V(o) = Volume of water extracted (mL)

2. Soils:

$$Concentration\ (\mu g / kg) = \frac{A(x) \times I(s) \times V(t) \times G \times D_f}{A(is) \times RRF \times W(s) \times V(i) \times D}$$

Where:

A(x) = Area of characteristic ion for compound being measured

I(s) = Amount of internal standard injected (ng)

V(t) = Volume of concentrated extract in microliters

Df = Dilution factor

A(is) = Area of characteristic ion for the internal standard

RRF = Relative Response factor for the compound being measured

V(i) = Volume of extract injected (µL)

W(s) = Weight of sample extracted or diluted in grams

D = The percent solids (100 - % moisture)/100

G = 1 if extract did not require GPC cleanup

G = 2 if extract required GPC cleanup

D. QC Calculations

1. Percent Recovery:

% Recovery = Concentration found ÷ Concentration spiked x 100

2. Calculations for MS/MSD:
Matrix spike recovery = SSR x SR ÷ SA x 100

Where:

SSR = Spike sample result
SR = Sample result
SA = Spike added

3. Relative Percent Difference (RPD):

$$RPD = \{|MSR \times MSDR| \div \tfrac{1}{2}(MSR \times MSDR)\} \times 100$$

Where:

RPD = Relative percent difference
MSR = Matrix Spike Recovery
MSDR = Matrix Spike Dup Recovery

Calculation of the % Error:

$$\%\ Error = \frac{x(i) - x'(i)}{} \times 100$$

$x(i)$

Where:

$x'(i)$ = Measured amount of analyte at calibration level i, in mass or concentration units
$x(i)$ = True amount of analyte at calibration level i, in mass or concentration units

Statistical Information/Method Performance

The LCS/MS and surrogate recoveries and RPD are compared to statistically generated limits for acceptance criteria. The current data is stored in the LIMS under the analysis numbers listed in the header of this SOP. The historical data for MDLs, MS/MSD, LCS/D, and measurement of uncertainty is reviewed at least annually and updated if necessary. Refer to the Quality Assurance/Quality Control section of this SOP and the criteria listed throughout this procedure for additional information on the performance of this method.

Quality Assurance/Quality Control

Each extraction batch must contain a method blank, a laboratory control sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD) or a laboratory control sample/laboratory control sample duplicate (LCS/LCSD). Refer to *T-SVOA-WI11998* for the preparation of quality control spikes. Additional QC samples may be required to meet project or state certification requirements.

Quality Control Item	Acceptance Criteria	Corrective Action
Internal Standards	1. Peak area within -50% to +100% of the area in the associated reference standard. 2. Retention time (RT) within 30 seconds of RT for associated reference standard.	1. Check instrument for possible problems and then reanalyze samples. 2. If reinjection meets the criteria, report this injection. 3. If reinjection still shows same problem, report first injection and qualify data with a comment.
Method Blank	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. All target compounds must be less than the reporting limit for the associated samples.	1. Inspect system for possible problems and reanalyze. 2. If the surrogates are out of spec high data can be used. (Unless project requirements dictate otherwise).* 3. If the method blank contains target analytes and the associated samples do not contain these compounds, no corrective action is required. If the target compounds in the blank are also in the associated samples, the samples should be reextracted unless it does not interfere with project data requirements or if sample detections are at a level 10x higher than the detections in the blank.

Quality Control Item	Acceptance Criteria	Corrective Action
Instrument Blank**	1. Must run after the CCV if no clean method blank is analyzed at the beginning of a 12-hour analytical period. 2. Must meet internal standard criteria. 3. All target compounds must be less than the reporting limit for the associated samples.	1. Inspect system for possible problems and reanalyze. 2. If the instrument blank contains target analytes and the associated samples do not contain these compounds, no corrective action is required. If the target compounds in the blank are also in the associated samples, the samples should be reextracted unless it does not interfere with project data requirements or if sample detections are at a level 10x higher than the detections in the blank.
Laboratory Control Sample/Laboratory Control Sample Duplicate	All percent recoveries within QC limits. Refer to the GC/MS Semivolatile SOP manual for QC windows. These are reviewed and updated on a semiannual basis.	1. If non-compliant, check for calculation or preparation errors. 2. If no errors found, check system for problems and reanalyze. 3. If LCS/LCSD still out of spec, consult supervisor immediately. Samples may need to be re-extracted. 4. If recoveries are above QC limits, data may be usable if the compounds that recovered above QC limits are not detected in samples.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	1. % Recoveries within QC limits. Refer to the GC/MS Semivolatile SOP manual for QC windows. These are reviewed and updated on a semiannual basis. . 2. RPDs within QC limits.	1. If LCS within QC limits, proceed with sample analysis. 2. If most recoveries or RPDs out of spec, consult supervisor.
Surrogates	All recoveries must be within QC limits. Refer to the GC/MS Semivolatile SOP manual for surrogate windows. These are updated on a semiannual basis.	1. If non-compliant, check for calculation or preparation errors. 2. If no errors found, check system for problems and reanalyze. If no problem is found, reextract and reanalyze. If surrogates are out of spec high and no targets are detected in the sample no corrective action is required.

*Requires approval of supervisor and completion of Non-Conformance *Q-EQA-FRM6869*.

**Method blank or instrument blank in each 12-hour analytical period required for 8270E.

The lower limit of quantitation (LLOQ) is verified annually through the extraction and analysis of an LCS at 0.5 to 2 times the established LLOQ. The LLOQ is performed on similar analytical instruments such that all are included, at a minimum, within a 3 year time period. Until the laboratory has sufficient data to determine the acceptance limits, the LLOQ criteria is ± 20% of the statistically determined LCS limits.

A. Dilution Criteria

1. Initial dilutions are recommended in the following situations:

a. More than three internal standard areas are less than -50%.

b. Either of the last two internal standard areas are less than -80%.

c. Prescreen data or analyst's judgement of a sample extract's color or viscosity, indicate a possible matrix interference.

2. Secondary dilutions:

Are required to bring all target compounds in the calibration range of the GC/MS.

Table I

DFTPP Key Ions and Ion Abundance Criteria

Mass	Ion Abundance Criteria
51	10% to 80% of mass 198
68	<2% of mass 69
70	<2% of mass 69
127	10% to 80% of mass 198
197	<2% of mass 198
198	Base peak, or >50% of mass 442
199	5% to 9% of mass 198
275	10% to 60% of mass 198
365	>1% of mass 198
441	Present but less than 24% of mass 442
442	Base peak, or >50% of mass 198
443	15% to 24% of mass 442

Table II
Semivolatile Internal Standard with Corresponding Analytes Assigned for Quantitation

1,4-Dichlorobenzene-d_4	Naphthalene-d_8	Acenaphthene-d_{10}
Acrylamide		
Aniline	Acetophenone	Acenaphthene

Benzyl alcohol	Benzoic acid	Acenaphthylene
Bis(2-chloroethyl) ether	Bis(2-chloroethoxy)methane	1-Chloronaphthalene
Bis(2-chloroisopropyl) ether	4-Chloroaniline	2-Chloronaphthalene
2-Chlorophenol	4-Chloro-3-methylphenol	4-Chlorophenyl phenyl ether
1,3-Dichlorobenzene	2,4-Dichlorophenol	Dibenzofuran
1,4-Dichlorobenzene	2,6-Dichlorophenol	Diethyl phthalate
1,2-Dichlorobenzene	α,α-Dimethylphenylamine	Dimethyl phthalate
Ethyl methanesulfonate	2,4-Dimethylphenol	2,4-Dinitrophenol
2-Fluorophenol (surr)	Hexachlorobutadiene	2,4-Dinitrotoluene
Hexachloroethane	Isophorone	2,6-Dinitrotoluene
Methyl methanesulfonate	2-Methylnaphthalene	Fluorene
2-Methylphenol	Naphthalene	2-Fluorobiphenyl (surr)
4-Methylphenol	Nitrobenzene	Hexachlorocyclopentadiene
N-Nitrosodimethylamine	Nitrobenzene-d5 (surr)	1-Naphthylamine
N-Nitroso-di-n-propyl amine	2-Nitrophenol	2-Naphthylamine
Phenol	N-Nitrosodi-n-butylamine	2-Nitroaniline
Phenol-d6 (surr)	N-Nitrosopiperidine	3-Nitroaniline
2-Picoline	1,2,4-Trichlorobenzene	4-Nitroaniline
1,4-Dioxane	1-Methylnaphthalene	4-Nitrophenol
Pyridine	O,O,O-triethylphosphorothioate	Pentachlorobenzene
		1,2,3,4-Tetrachlorobenzene
		1,2,3,5-Tetrachlorobenzene
Acetophenone	Hexachlorpropene	1,2,4,5-Tetrachlorobenzene
o-Toluidine	1,4-Phenylenediamine	2,3,4,6-Tetrachlorophenol
N-Nitrosomethylethylamine	Safrole	2,4,6-Tribromophenol (surr)
N-Nitrosodiethylamine	(2-Bromoethyl)benzene	2,4,6-Trichlorophenol
N-Nitrosopyrrolidine	Caprolactam	2,4,5-Trichlorophenol
N-Nitrosomorpholine	1, 3, 5 – Trichlorobenzene	1,1'-Biphenyl
N,N-dimethyl formamide	1, 2, 3 – Trichlorobenzene	Diphenyl ether
N,N-dimethyl acetamide	1, 2, 3, 4 – Tetrachlorobenzene	Isosafrole
Benzaldehyde	1 – Chloro-4-Nitrobenzene	1,4-Naphthoquinone
	2-chlorobenzaldehyde	1,4-Dinitrobenzene
		1,3-Dinitrobenzene
		Thionazin
		5-Nitro-o-toluidine
(surr) = surrogate		2-chlorobenzalmalononitrile

Table II (continued)

Phenanthrene-d_{10}	Pyrene-d_{10}	Perylene-d_{12}
4-Aminobiphenyl	Benzidine	Benzo(b)fluoranthene
Anthracene	Benzo(a)anthracene	Benzo(k)fluoranthene
4-Bromophenyl phenyl ether	Bis(2-ethylhexyl) phthalate	Benzo(g,h,i)perylene
Di-n-butyl phthalate	Butyl benzyl phthalate	Benzo(a)pyrene
4,6-Dinitro-2-methylphenol	Chrysene	Dibenz(a,j)acridine
Fluoranthene	3,3'-Dichlorobenzidine	Dibenz(a,h)anthracene
Hexachlorobenzene	p-Dimethylaminoazobenzene	Indeno(1,2,3-cd)pyrene
N-Nitrosodiphenylamine	Pyrene	Di-n-octylphthalate
Octachlorostyrene		
Pentachlorophenol	Terphenyl-d_{14} (surr)	3-Methylcholanthrene
Pentachloronitrobenzene	7,12-Dimethylbenz(a)anthracene	
Phenacetin	Chlorobenzilate	
Phenanthrene	2-Acetylaminofluorene	

Pronamide
1-Nitronaphthalene
1,2-Diphenylhydrazine
Carbazole
Tetraethyldithiopyrophosphate
1,3,5-Trinitrobenzene
Diallate trans/cis
Phorate
Dimethoate
Methyl parathion
Parathion
4-Nitroquinoline-1-oxide
Methapyrilene
Isodrin
Atrazine

(surr) = surrogate
Benzophenone
3,3'-Dimethylbenzidine
4,4'-Methylenebis(2-Chloroaniline)
3-Quinuclidinyl benzilate

Table III
Characteristic Ions for Semivolatile Compounds

1.1.1 Compound	Primary Ion	Secondary Ions
2-Picoline	93	66,92
Aniline	93	66,65
Phenol	94	65,66
Bis(2-chloroethyl) ether	93	63,95
2-Chlorophenol	128	64,130
1,3-Dichlorobenzene	146	148, 113
1,4-Dichlorobenzene-d_4 (IS)	152	150,115
1,4-Dichlorobenzene	146	148, 113
Benzyl alcohol	108	79,77
1,2-Dichlorobenzene	146	148, 113
N-Nitrosomethylethylamine	88	42,43,56
Bis(2-chloroisopropyl) ether	45	77, 121, 79
Methyl methanesulfonate	80	79,65,95
N-Nitrosodi-n-propylamine	70	42,101,130
Hexachloroethane	117	201,199
Nitrobenzene	77	123,65
Isophorone	82	95,138
N-Nitrosodiethylamine	102	42,57,44,56
2-Nitrophenol	139	109,65
2,4-Dimethylphenol	107	122, 121
Bis(2-chloroethoxy)methane	93	95,123
Benzoic acid	105	122,77
2,4-Dichlorophenol	162	164,98

Ethyl methanesulfonate	109	79,97,45,65
1,2,4-Trichlorobenzene	180	182,145
Naphthalene-d_8 (IS)	136	68
Naphthalene	128	129,127
Hexachlorobutadiene	225	223,227
4-Chloro-3-methylphenol	107	144,142
2-Methylnaphthalene	142	141, 115
2-Methylphenol	108	107,77,79,90
Hexachloropropene	213	211, 215, 117, 141
Hexachlorocyclopentadiene	237	235,272
N-Nitrosopyrrolidine	100	41,42,68,69
Acetophenone	105	71,51,120
4-Methylphenol	108	107,77,79,90
2,4,6-Trichlorophenol	196	198,200

Table III (continued)

1.1.2 Compound	Primary Ion	Secondary Ions
o-Toluidine	106	107,77,51,79
3-Methylphenol (as 4-Methylphenol)	108	107,77,79,90
2-Chloronaphthalene	162	127,164
N-Nitrosopiperidine	114	42,55,56,41
1,4-Phenylenediamine	108	80,53,54,52
1-Chloronaphthalene	162	127,164
2-Nitroaniline	138	92, 65
Dimethyl phthalate	163	194,164
Acenaphthylene	152	151,153
2,6-Dinitrotoluene	165	63,89, 121
Phthalic anhydride	104	76,148
3-Nitroaniline	138	108,92
Acenaphthene-d_{10} (IS)	164	162,160
Acenaphthene	153	154, 152
2,4-Dinitrophenol	184	63, 154, 107
2,6-Dinitrophenol	162	164,126,98,63
4-Chloroaniline	127	129,65,92
Isosafrole	162	131,104,77,51
Dibenzofuran	168	139
2,4-Dinitrotoluene	165	63,89, 182
4-Nitrophenol	109	139,65
2-Naphthylamine	143	115,116
1,4-Naphthoquinone	158	104,102,76,130
Diethyl phthalate	149	177,150
Fluorene	166	165,167
N-Nitrosodi-n-butylamine	84	57,41,116,158
4-Chlorophenyl phenyl ether	204	206,141
4,6-Dinitro-2-methylphenol	198	51, 105, 182, 77
N-Nitrosodiphenylamine	169	168,167
Safrole	162	104,77,103,135
Diphenylamine	169	168,167
1,2,4,5-Tetrachlorobenzene	216	214,179,143,218

1-Naphthylamine	143	115,89,63
4-Bromophenyl phenyl ether	248	250,141
2,4,5-Trichlorophenol	196	198,97,132,200
Hexachlorobenzene	283	142,249
Pentachlorophenol	266	264,268
5-Nitro-o-toluidine	152	77,79,106,94
Thionazin	107	96,97,143,79

Table III (continued)

1.1.3 Compound	Primary Ion	Secondary Ions
4-Nitroaniline	138	65,108,92,80
Phenanthrene-d_{10} (IS)	188	94,80
Phenanthrene	178	179,176
Anthracene	178	176,179
1,4-Dinitrobenzene	168	75,50,76,92
1,3-Dinitrobenzene	168	76,50,75,92
Diallate (cis or trans)	86	234,43,70
Pentachlorobenzene	250	252,248,215,254
5-Nitro-o-anisidine	168	79,52,138,153,77
Pentachloronitrobenzene	237	142,214,249,295
4-Nitroquinoline-1-oxide	190	160, 116, 114
Di-n-butyl phthalate	149	150,104
2,3,4,6-Tetrachlorophenol	232	131,230,166,234
Fluoranthene	202	101, 203, 100
1,3,5-Trinitrobenzene	213	74,75,120,91
Benzidine	184	92,185
Pyrene	202	101,203
Phorate	75	121,97,93,260
Phenacetin	108	179,109,137,80
Dimethoate	87	93,125,143,229
4-Aminobiphenyl	169	168,170,115
Pronamide	173	175,145,109,147
Dinoseb	211	163,147,117,240
Disulfoton	88	97,89,142,186
Butyl benzyl phthalate	149	91,206
Methyl parathion	109	125,263,79,93
Dimethylaminoazobenzene	225	120,77,148,42
Benz(a)anthracene	228	229,226
Chrysene-d_{12} (IS)	240	120,236
3,3'-Dichlorobenzidine	252	254,126
Chrysene	228	226,229
Parathion	109	97,291, 186
Bis(2-ethylhexyl) phthalate	149	167,279
3,3'-Dimethylbenzidine	212	106,196,180
Methapyrilene	97	58, 72, 191, 261
Isodrin	193	66, 195, 263, 265,
Di-n-octyl phthalate	149	167,43, 150
2-Aminoanthraquinone	223	167, 195, 139
Aramite	185	191,319,334,197,321

Table III (continued)

1.1.4 Compound	Primary Ion	Secondary Ions
Benzo(b)fluoranthene	252	253,125
Benzo(k)fluoranthene	252	253,125
Chlorobenzilate	139	251, 253, 111, 141
Benzo(a)pyrene	252	253,125
Perylene-d_{12} (IS)	264	260,265
7,12-Dimethylbenz(a)anthracene	256	241,239,120
2-Acetylaminofluorene	181	180,223,152
4,4'-Methylenebis(2-chloroaniline)	231	266, 140, 195
3-Methylcholanthrene	268	252,253,126,134
Indeno(1,2,3-cd)pyrene	276	138,227
Dibenz(a,h)anthracene	278	139,279
Benzo(g,h,i)perylene	276	138,277
1,2-Diphenylhydrazine	77	105, 182, 51
Endosulfan I	195	33
2-Fluorobiphenyl (surr)	172	171
2-Fluorophenol (surr)	112	64, 92
Nitrobenzene-d_5 (surr)	82	128,54
N-Nitrosodimethylamine	74	42,44
Phenol-d_6 (surr)	99	42,71
Terphenyl-d_{14} (surr)	244	122,212
2,4,6-Tribromophenol (surr)	330	332,141
N,N-dimethyl formamide	73	44,42
N,N-dimethyl acetamide	87	72,44,42
(2-Bromoethyl)benzene	184	77,91,105,186
Atrazine	200	173,215
Benzaldehyde	77	105, 106
Caprolacatam	113	55,56
1,1-Biphenyl	154	153,152,76
Carbazole	167	166,139
1,3,5-Trichlorobenzene	180	182,145,109
1,2,3-Trichlorobenzene	180	182,145,109
1,2,3,4-Tetrachlorobenzene	216	214,218,179
1-Chloro-4-Nitrobenzene	157	111,75,99

IS = internal standard
surr = surrogate

Table III (continued)

1.1.5 Compound	Primary Ion	Secondary Ions
Acrylamide	71	55, 44
Octachlorostyrene	308	343, 380, 273

1,2,3,5-tetrachlorobenzene	216	214, 218, 179, 143
1,2,3,4-tetrachlorobenzene	216	214, 218, 179, 143
2-chlorobenzaldehyde	139	111, 140, 76
Benzophenone	105	182, 77, 51
3-Quinuclidinyl benzilate	183	126, 337, 110
2-chlorobenzalmalononitrile	153	188, 126

Table IV
Recommended Minimum Response Factor Criteria for Initial and Continuing Calibration Verification Using the Suggested Ions from Table III

Semivolatile Compounds	Minimum Response Factor (RF)
Benzaldehyde	0.010
Phenol	0.800
Bis(2-chloroethyl)ether	0.700
2-Chlorophenol	0.800
2-Methylphenol	0.700
2,2'-Oxybis-(1-chloropropane)	0.010
Acetophenone	0.010
4-Methylphenol	0.600
N-Nitroso-di-n-propylamine	0.500
Hexachloroethane	0.300
Nitrobenzene	0.200
Isophorone	0.400
2-Nitrophenol	0.100
2,4-Dimethylphenol	0.200
Bis(2-chloroethoxy)methane	0.300
2,4-Dichlorophenol	0.200
Naphthalene	0.700
4-Chloroaniline	0.010
Caprolactam	0.010
4-Chloro-3-methylphenol	0.200
2-Methylnaphthalene	0.400

Semivolatile Compounds	Minimum Response Factor (RF)
Hexachlorocyclopentadiene	0.050

Table IV (continued)

Semivolatile Compounds	Minimum Response Factor (RF)
2,4,6-Trichlorophenol	0.200
2,4,5-Trichlorophenol	0.200
1,1'-Biphenyl	0.010
2-Chloronaphthalene	0.800
2-Nitroaniline	0.010
Dimethylphthalate	0.010
2,6-Drintrotoluene	0.200
Acenaphthylene	0.900
3-Nitroaniline	0.010
Acenaphthene	0.900
2,4-Dintirophenol	0.010
4-Nitrophenol	0.010
Dibenzofuran	0.800
2,4Dinitrotoluene	0.200
Diethylphthalate	0.010
1,2,4,5-Tetrachlorobenzene	0.010
4-Chlorophenyl-phenylether	0.400
Fluorene	0.900
4-Nitroaniline	0.010
4,6-Dinitro-2-methylphenol	0.010
4-Bromophenyl-phenylether	0.100
N-Nitrosodiphenylamine	0.010
Hexachlorobenzene	0.100

Table IV (continued)

Semivolatile Compounds	Minimum Response Factor (RF)
Atrazine	0.010

Pentachlorophenol	0.050
Phenanthrene	0.700
Anthracene	0.700
Carbazole	0.010
Di-n-butylphthalate	0.010
Fluoranthene	0.600
Pyrene	0.600
Butylbenzylphthalate	0.010
3,3'-Bichlorobenzidine	0.010
Benzo(a)anthracene	0.800
Chrysene	0.700
Bis(2-ethylhexyl)phthalate	0.010
Di-n-octlyphthalate	0.010
Benzo(b)fluoranthene	0.700
Benzo(k)fluoranthene	0.700
Benzo(a)pyrene	0.700
Indeno(1,2,3-cd)pyrene	0.500
Dibenz(a,h)anthracene	0.400
Benzo(g,h,i)perylene	0.500
2,3,4,6-Tetrachlorophenol	0.010

Q-EQA-FRM6869 Nonconformance Form
QA-SOP11178 Demonstrations of Capability
T-SVOA-WI11998 Semivolatile Spiking and Calibration Standards
T-SVOA-WI9598 GC/MS Preventative and Corrective Maintenance

End of document

Version history

Version	Approval	Revision information
8	15.AUG.2017	
9	16.NOV.2018	
10	26.APR.2019	

eurofins	Always check on-line for validity. **Total and Amenable Cyanide Distillation in Waters and Solids by SW-846 9012A/B, EPA 335.1/3/4, and SM 4500-CN G-1999/2011**	Level: **Work Instruction**
Document number: **T-WC-WI10085**		
Old Reference: **1-P-QM-WI-9011694**		
Version: **19**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **15-OCT-2018**	Document users: **6_EUUSLA_ Instrumental Water Quality _Prep Analyst, 6_EUUSLA_ Instrumental Water Quality _Prep Verifie**	Responsible: **5_EUUSLA_Instrumental Water Quality_Manager**

LIMS ID
Analysis 0492, 1548, 5896, 5897, 8256, 0956, 0958

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Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Procedure
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 19		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM -QMA-9017356	Removed revision logs up to the previous version
Procedure A.2, A.4 and B.4.b.	Clarification	Expounded on the need to pipette the spiking solution directly onto the sand or solid material before adding any reagents.
Reference	Update	Updated Standard Methods versions
Title	Update	Updated Title to include Method References

Revision: 19	**Effective Date:** This version	
Interferences	Update	Replaced ETQ number with D4 number
Reagents and Standards	Update	Replaced ETQ number with D4 number
Reference	Addition	Added LabCrest Midi-Cyanide Distillation System Operation Manual.

Revision: 18	**Effective Date:** Feb 12, 2015	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM -QMA-9017356	Removed revision logs up to the previous version
Procedure B.11.	Clarification	Step 11 was removed and the section was renumber accordingly. Sample Support performs this step during the preservation check of the sample.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 9012A, December 1996.

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 9012B, August 2002.

3. Method 335.4, Methods for Chemical Analysis of Water and Wastes USEPA 600 Revision 1.0, 1993

4. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 4500 CN G-1999.

5. Standard Methods for the Examination of Water and Wastewater, Method 4500-CN G-2011.

6. Method 335.3, Methods for Chemical Analysis of Water and Wastes USEPA 600.

7. Method 335.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

8. LabCrest Midi-Dist Cyanide Distillation System Operation Manual.

9. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
Analysis #0237, 1123, 1549, 5895, 5898, 8255,	

0241, 4814, 0961, 0957, 0959	Determination of Total and Amenable Cyanide in Water, Wastewater, and Soils, Free Cyanide in Water and Wastewater, Reactive Cyanide of Solids, and Weak and Dissociable Cyanide in Waters and Soils
1-P-QM-FOR-9007828	Bottles and Analyses for Preservation Check and Subsampling
1-P-QM-QMA-9017328	Reagents and Standards

Scope

This method covers the determination of cyanide in solids and waters. The amenable cyanide pretreatment is applicable to any water or waste where the dissociable cyanide content of the sample is to be determined. This procedure is a preparation for colorimetric determination of cyanide by automated flow analyzer. Analysis 0492 is used for liquid samples referencing EPA methods, analysis 5896 is used for solid samples, analysis 1548 is for amenable cyanide in liquids, and analysis 5897 is for amenable cyanide in solid samples. Analysis 8256 is used for liquid samples requiring Method SW-846 9012A. Analysis 0956 and 0958 are used for liquid or solid samples referencing CT RCP or MA MCP requirements.

Basic Principles

The total cyanide is a measure of all cyanides converted to HCN by liberation from an acidified sample by distillation followed by absorption in a NaOH scrubber. The cyanide ion in the absorbing solution is then determined by automated UV colorimetry. For amenable cyanide, a portion of the sample is pretreated with chlorine to release the dissociable cyanide. Both treated and untreated portions of the sample are distilled and analyzed, and the difference between the two results is the cyanide amenable to chlorination.

Reference Modifications

Chlorine interference is removed by the addition of ascorbic acid, except for amenable cyanide samples. The residual chlorine in amenable cyanide samples is removed with a H_2O_2 solution and a $Na_2S_2O_3$ solution.

There are no procedural differences between EPA 335.1, or 3 and EPA 335.4.

There are no procedural differences between amenable cyanide by EPA 335.1, 3, or 4 and SM20 4500-CN-G.

Interferences

Sulfides adversely affect the procedure because sulfide will convert CN to CNS at high pH. Prior to distillation, the sample is checked and treated for residual chlorine and sulfide refer to S-SS-WI10695. When water samples are treated for sulfide, they must be distilled separately from other samples. This treated batch must have its own QC, including an LCS, LCSD, and a prep blank. The calibration standards must also be distilled in this manner. Test by placing a drop of sample on lead acetate paper. If darkening occurs, add 5 mL zinc acetate solution to the sodium hydroxide in the scrubber. The testing and treating procedure is performed by Department 4027 for solid samples. For water samples, the sample preservation group tests and treats for sulfide using lead carbonate to eliminate the sulfide interference.

Oxidizing agents, primarily chlorine, will decompose cyanides. For water samples, test by placing a drop of the sample on potassium iodide starch paper. A bluish color indicates the presence of oxidizing agents. Add a few crystals of ascorbic acid to the sample, stir, and retest. Repeat until no bluish color occurs. Add an additional 0.2 ± .02 g ascorbic acid to each liter of sample volume. This procedure is performed by the sample preservation group for water samples.

High results may be obtained for samples that contain nitrate and/or nitrite. During distillation, NO_3 and NO_2 will form nitrous oxide, combining with some organic compounds to form oximes that decompose under test conditions to form HCN. The possible interference of nitrate and nitrite is eliminated by pretreatment with sulfamic acid.

Some unidentified organic chemicals may oxidize or form breakdown products during chlorination giving higher results for cyanide after treatment than before.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Always use caution when handling any chemicals, solvents, solutions, or reagents. Avoid inhalation and contact. Take special care when handling the concentrated sulfuric acid and the sodium hydroxide solution. Check the vacuum hoses each time distillations are finished to ensure that no leaks are evident and that the hoses vent into the hood. The amenable cyanide

pretreatment must be done in the hood, with the hood on. Inspect the glassware before use. Discard or send for repair any glassware that is chipped, flawed, or broken.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability (DOC).

Analysts are considered proficient when they have successfully completed a DOC. DOC consists of four check standards that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. DOC is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling

Samples may be collected in glass or plastic containers. Samples are preserved to pH >12 with NaOH and stored at 0° to 6°C, not frozen, from time of collection to analysis. . Holding time is 14 days from collection to analysis.

Apparatus and Equipment

1. Reflux distillation apparatus, (Figure 1)

2. pH meter

3. Analytical balance, pan balance, or equivalent. Refer to LOM-SOP-LAB-208.

4. Adjustable hand-held automatic pipette or equivalent.

5. Stir plate

Reagents and Standards

NOTE: All chemicals used must be ACS reagent grade unless otherwise noted.

See QA-SOP11188 for the appropriate labeling and documentation of reagent and standard preparation.

Different volumes or weights may be used in the preparation of reagents or standards as long as the ratios remain equivalent.

1. Potassium iodide starch paper

2. Lead acetate paper

3. Sulfuric acid, (50%), H_2SO_4

Sulfuric acid, concentrated	1000 mL

a. Carefully add 1000 mL of concentrated sulfuric acid (H_2SO_4) to approximately 1000 mL of chilled reagent water.

b. Dilute to 2000 mL.

c. Prepare every 6 months.

d. Store in glass container at room temperature.

4. Magnesium chloride reagent

a. Dissolve 510 ± 5 g of $MgCl_2 \cdot 6H_2O$ in reagent water and dilute to 1 L.

b. Prepare every 6 months.

c. Store in glass container at room temperature.

5. Sodium hydroxide (1 N)

a. Dissolve 40 ± 0.4 g of NaOH pellets in approximately 800-mL reagent water.

b. Dilute to 1 L.

c. Prepare yearly.

d. Store in glass container at room temperature.

6. Sodium hydroxide solution, 0.25 N

Sodium hydroxide (NaOH)	20 ± 0.5 g

a. Slowly add 20 ± 0.5 g of NaOH to 1600 mL reagent water and mix.

b. Dilute to 2 L with reagent water.

c. Prepare every 6 months.

d. Store in glass container at room temperature.

7. Sulfamic acid

a. Dissolve 40 ± 0.5 g of sulfamic acid in reagent water.

b. Dilute to 1 L.

c. Prepare every 6 months.

d. Store at room temperature in glass container.

8. Zinc acetate

a. Dissolve 110 ± 1 g zinc acetate in reagent water.

b. Dilute to 500 mL.

c. Prepare every 6 months.

d. Store at room temperature in glass container.

9. Calcium hypochlorite

a. Dissolve 5 ± 0.1 g of calcium hypochlorite ($Ca[OCl]_2$) in reagent water.

b. Dilute to 100 mL with reagent water.

c. Prepare every month.

d. Store in the dark at room temperature in an amber glass container.

10. Ascorbic acid – Purchased. Store at room temperature. See label for expiration date.

11. Stock standard for quality control (1000 mg/L CN^-)

Potassium cyanide (KCN)	1.255 ± 0.005 g
Potassium hydroxide (KOH)	1 ± 0.05 g

a. Dissolve 1.255 ± 0.005 g of KCN in 400 mL reagent water containing 1 ± 0.05 g of KOH.

b. Dilute to 500 mL with reagent water (1.00 mg CN-/mL).

c. Prepare every 30 days.

d. Keep refrigerated at 4 ± 2ºC in an amber glass bottle.

12. KCN spiking solution, 20 mg/L

Place approximately 45 mL reagent water in a 50-mL Class A volumetric flask containing 1 mL 1N NaOH.

Based on the true value of the cyanide stock standard (standardized weekly), add the appropriate amount of standard to the solution to obtain a concentration of 20 mg/L. Dilute to 50 mL with reagent water. Prepare fresh daily in a volumetric kept at room temperature.

NOTE: Calculate the compensated amount of spiking solution to be used:

$$\frac{1000}{CN - mg / L} = Amount\ of\ solution\ added$$

Example: If the value of the stock standard is 1,025 mg/L, pipette .96 mL of solution using a calibrated autopipette.

13. Distilled ICV (for analyses 0956, 0958) – Pipette 0.375 mL of 20 mg/L KCN spiking solution into a 50-mL volumetric flask. Dilute to 50 mL with reagent water. Prepare fresh daily. True Value = .15 mg/L.

14. Hydrogen peroxide (3%), H_2O_2 – Purchased. Store at room temperature. See label for expiration date.

15. Sodium thiosulfate solution (500 g/L), $Na_2S_2O_3$

a. Dissolve 5 g $Na_2S_2O_3$ per 10 mL reagent water.

b. Prepare every 30 days.

c. Store in plastic container at room temperature.

16. Sea sand, purchased, stored at room temperature.

Procedure

NOTE: Do not pipette directly from sample containers with glass pipettes.

A. Amenable cyanide pretreatment, if requested

1. Measure out a 50-mL aliquot, or a volume diluted to 50 mL, of sample into a 120 mL plastic container if the sample is a solid, weigh out 2.0 ± 0.2 g and place in the beaker along with 50 mL of reagent water.

NOTE: Use the same volume or weight of sample that is prepared for analysis 0492 or 5896.

2. Prepare a laboratory control sample (LCS) and when required, a lab control sample duplicate (LCSD), by spiking 50 mL of reagent water with 0.5 mL of the spiking solution (20 mg/L CN^-). A solid LCS is prepared by weighing out 0.9 to 1.1 g of sand, and spiking with 0.5 mL of the spiking solution (20 mg/L CN^-). Pipette the spiking solution directly into the sand prior to adding other reagents.

3. Prepare the batch blank (PB) by pouring 50 mL of reagent water into a 150-mL beaker. A solid PBS is prepared by weighing out 2.0 ± 0.2 g of sand and adding 50 mL of reagent water.

4. Prepare a matrix spike (R) for every 10 samples by taking equal portions of sample and spiking one portion with 0.5 mL of the spiking solution (20 mg/L CN^-). For solids, pipette the spiking solution directly into the sample prior to adding other reagents.

5. Prepare a duplicate (D) every 10 samples by preparing equal portions of sample.

6. Begin stirring sample on a stir plate in an operating fume hood.

7. Add enough calcium hypochlorite solution dropwise to turn the potassium iodide starch paper dark blue (indicating an excess of chlorine) while maintaining the pH of the solution between 11 and 12 with sodium hydroxide.

NOTE: Addition of the calcium hypochlorite must be performed in an operating fume hood (Analysis 1548, 5897)

8. Maintain the excess residual chlorine for 1 hour, continuing agitation. Check the sample every 15 minutes and, if necessary, add additional hypochlorite solution. If you do add more calcium hypochlorite, be sure to check the pH to be between 11 and 12. If necessary, adjust with NaOH.

9. After 1 hour, remove residual chlorine by addition of 8 drops of H_2O_2 (3%), followed by 4 drops $Na_2S_2O_3$ solution (500 g/L). Test with KI-starch paper until there is no color change.

10. Distill the samples and associated QC samples, and subsample into a properly labeled vials.

B. Distillation

1. Measure out 50.0 mL of 0.25N NaOH solution in a Class A graduated cylinder. Place the solution in the scrubber tube.

2. Set up the distillation apparatus, see Figure 1,Vacuum grease may be used if an adequate seal cannot be obtained.

3. Place 50 mL of sample or an aliquot diluted to 50 mL with reagent water in the reaction tube. (Note in the databook the reason[s] why less sample was taken). If the sample is a solid, weigh 2 ± 0.2 g (note in the databook the reason[s] why less sample was taken, if necessary) and place in the reaction tube along with 0.25N NaOH.

NOTE: For soil samples for account 13419 weigh 5.0 +/- 0.2 g.

4. Turn “ON” coolant flow to the Microtip condensers and the vacuum. Adjust the vacuum to allow approximately 3 bubbles per second to appear in the reaction tube.

a. LCS water samples, spike the LCS (and LCSD when required) with 0.5 mL of the KCN spiking solution (20 mg/L CN^-) and the matrix spike[s] with 0.5 mL of the KCN spiking solution.

b. Solid samples, the LCS [and LCSD when required] is prepared by weighing out 0.9 to 1.1 g of sand with a known CN^- concentration. The sand is then spiked directly with 0.5 mL of KCN spiking solution. The PBS is prepared by weighing out 2.0 ± 0.2 g of sand. For the matrix spike, 0.5 mL of KCN spiking solution is added directly to the sample.

NOTE: For account 13419 weigh 5.0 +/- 0.2 grams for both the PBS and LCS. The amount of spiking solution remains unchanged,

5. Add 5 mL of sulfamic acid solution through the air inlet tube. Allow to mix 3 minutes.

6. Slowly add 5 mL of 50% sulfuric acid solution through the air inlet tube. Allow to mix for 5 minutes.

7. Add 2 mL of the magnesium chloride solution through the air inlet tube.

8. Turn “ON” the heating block and set the timer to 105 minutes. This allows a warm-up time of 15 minutes and a reflux time of 90 minutes. Heat the solution to boiling, taking care to prevent the solution from backing up into the air inlet tube. This can be done by adjusting the vacuum valve on the front of the unit.

9. After the set time, the heat will turn off automatically. Allow the airflow and coolant in the condensers to continue at least another 15 minutes.

10. After cooling, disconnect the air inlet and outlet tube from the scrubber tube.

11. Subsample the final solution into one 40-mL vial. Label the vial with a sample label (Bottle #83), CN^-, and the date of distillation.

12. The subsampled vials containing the distillate of pretreated samples being analyzed for amenable cyanide must be marked *Amen. CN^-* and labeled with the same information as in step 13.

Store the vial of each sample in the Water Quality subsample refrigerator. If the sample requires locked storage, create a chain of custody and return all subsamples to the locked storage area.

Statistical Information/Method Performance

Refer to Analysis #0237, 1123, 1549, 5895, 5898, 8255, 0241, 4814, 0961, 0957, 0959.

Quality Assurance/Quality Control

A. Total cyanide (0492, 5896, 8256, 0956, 0958)

1. An LCS must be prepared daily or every 20 samples (whichever is more frequent).

2. Based upon client requirements, when appropriate, a laboratory control standard duplicate (LCSD).

3. A blank must be prepared daily or every 20 samples (whichever is more frequent).

4. One sample must be prepared in duplicate every 10 samples, except for analyses 0956 and 0958 which is every 20 samples. A field blank may not be used as the duplicate.

5. A matrix spike must be prepared every 10 samples, except for analyses 0956 and 0958 which is every 20 samples.

B. Amenable cyanide (1548, 5897)

1. An LCS must be prepared daily or every 20 samples (whichever is more frequent

2. Based upon client requirements, when appropriate, a laboratory control standard duplicate (LCSD).

3. A blank must be prepared daily or every 20 samples (whichever is more frequent).

4. One duplicate must be prepared every 10 samples (of a similar matrix). The duplicate is treated exactly like the background sample.

5. A matrix spike must be prepared every 10 samples.

6. The first 10 samples along with the duplicate and spike will be labeled with an *A* at the end of the batch number. Samples beyond ten along with the second spike and duplicate will be labeled with a *B* at the end of the batch number.

End of document

Version history

Version	Approval	Revision information
18	12.FEB.2015	
19	01.OCT.2018	

eurofins	Always check on-line for validity. **#1443 Specific Gravity by SM 2710F-1997, #6569 Bulk Density by ASTM E868-82 Sec 9.9**	Level: **Work Instruction**
Document number: **T-WC-WI10421**		
Old Reference: **1-P-QM-WI-9013131**		
Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **11-DEC-2018**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

LIMS ID
1443, 6569

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Revision Log

Revision:	10	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356		Removed revision logs up to the previous version
Throughout Document	Reflect re-identification of documents in D4		Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers
Title	Method reference update		Removed "modified" from ASTM reference
Cross-Reference	Higher level documents are not required to be referenced		Removed : 1-P-QM-QMA-9017372 1-P-QM-QMA-9015389 1-P-QM-QMA-9021767 1-P-QM-QMA-9017313

Revision:	10	**Effective Date:**	This version
			QA-SOP11896 1-P-QM-PRO-
Reference Modifications		Correction factors are unnecessary. Samples can't be leveled in graduated cylinder	Noted that correction factors for specific gravity do not affect the reported data. Samples are tamped gently, not leveled
Procedure A.11.		Current practice	Samples are analyzed at room temperature
Procedure A.12.		Correction	Changed "Step 4" to "Step 5".
Procedure A.15., B.10.		Method requirement	Added steps for analyzing a matrix duplicate
Procedure B.5.		Current practice	Samples are analyzed at room temperature
Calculation		Correction	Changed "Step B.6" to "Step B.7".

Revision:	9	**Effective Date: 04/02/15**	
Section		**Justification**	**Changes**
Revision Log		Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document		Updated references	Replaced 1-P-QM-QMA-9017363 with 1-P-QM-QMA-9015389 Replaced 1-P-QM-QMA-9017372 with 1-P-QM-QMA-9021767

Reference

A. Specific Gravity (Liquids) Reference

1. *Standard Methods for the Examination of Water and Wastewater*, 2710 F-1997.

2. *Chemical Hygiene Plan*, current version.

B. Bulk Density (Solids) Reference

1. ASTM E 868-82, "*Conducting Performance Tests on Mechanical Conveying Equipment Used in Resource Recovery Systems*," Sec. 9.9, "*Measuring Bulk Density of Material*."

2. *Chemical Hygiene Plan*, current version.

Scope

1. Specific Gravity (Liquids analysis 1443) – This method is applicable to the measurement of specific gravity of liquid samples.

2. Bulk Density (Solids analysis 6569) – This method is also applicable to the measurement of bulk density of solid and semisolid samples. Because air spaces may be present in solid and semisolid samples, they are reported as bulk density in g/cc units.

Basic Principles
Specific gravity is reported as the ratio of the weight of a measured volume of liquid sample to the weight of an equal volume of reagent water.

Bulk density is reported for solids or semisolids as the weight of a given volume of material measured without compressing the material.

Reference Modifications
Specific Gravity analysis 1443 uses room temperature of reagent water and sample. The correction factors listed in Table 2710:I do not affect the data reported.

The Bulk Density analysis 6569 is modified for use with a graduated cylinder, which precludes leveling the sample, and gentle tamping is used.

Interferences
Not applicable to this procedure.

Safety Precautions and Waste Handling
All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management and pollution prevention.

Personnel Training and Qualifications
All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Analysts are considered proficient when they have successfully demonstrated competency under supervision of a group leader or other trained analyst. Documentation of this training is in each individual's training records.

Sample Collection, Preservation, and Handling
This analysis is performed at room temperature on unpreserved samples. This analysis has no holding time.

Apparatus and Equipment

1. Analytical or pan balance

2. Graduated cylinders

Reagents and Standards

Not applicable to this procedure.

Calibration

A balance calibration check and leveling check must be performed each day before use.

Procedure

NOTE: LLENS is an electronic notebook that integrates a PC with an analytical balance to collect data directly from the balance. It also organizes the data, performs calculations and transmits the final results to the central computer system.

Use LLENS for specific gravity/bulk density whenever possible to facilitate data transfers according to the most recent version of T-WC-WI10359.

A. Specific Gravity (Liquids) Procedure

1. Set up the batch in the LLENS.

2. Print a LLENS batch worksheet and record all requested information.

3. Place a clean, dry graduated cylinder on a zeroed balance.

   NOTE: The size of the cylinder depends on the volume of sample to be measured. Low viscosity liquids with little or no suspended or settled solids can be analyzed using a 25-mL graduate. For high viscosity samples with large quantities of suspended and/or settled solids, use a larger cylinder.

4. Record the tare weight of the cylinder.

5. Fill the graduated cylinder with reagent water to a predetermined volume.

   a. Use a funnel or Pasteur pipette to keep the water off the sides of the cylinder.

   b. Do not allow air bubbles to form inside the column of water.

6. Record the volume.

7. Place the graduated cylinder on the zeroed balance.

8. Record the weight of the graduated cylinder and reagent water.

9. Empty the graduated cylinder, shake excess water from the cylinder, and dry it with an absorbent paper towel.

10. Place this same clean, dry graduated cylinder back on the zeroed balance.

    a. Check the new tare weight of the empty cylinder against the first tare weight from Step 3.

    b. Continue to dry the cylinder until the weights agree to ±0.01 g.

    c. Record this second tare weight.

11. Allow sample to come to room temperature prior to analysis.

12. Fill this graduated cylinder with sample to the same volume as in Step 5.

    a. Use a funnel or Pasteur pipette if necessary to keep the sample off the sides of the cylinder.

    b. Do not allow air bubbles to form inside the column.

13. Place the graduated cylinder on the zeroed balance.

14. Record the weight of the graduated cylinder and sample.

15. If sample volume permits, analyze a second equal portion of a sample as a matrix duplicate.

B. Bulk Density (Solids) Procedure

1. Set up the batch in the LLENS.

2. Print a LLENS batch worksheet and record all requested information.

3. Place a clean, dry graduated cylinder on a zeroed balance.

NOTE: Use a graduated cylinder of such a size that no particles in the sample are larger than ½ the diameter of the cylinder. In most cases, a 50- or 100-mL cylinder is sufficient.

4. Record this tare weight.

5. Allow sample to come to room temperature prior to analysis.

6. Fill the graduated cylinder by adding a little sample at a time and gently tamping the cylinder to level, but not compact, the sample material.

7. Record the volume.
8. Place the graduated cylinder on the zeroed balance.
9. Record the weight of the graduated cylinder and the sample.
10. If sample volume permits, analyze a second equal portion of a sample as a matrix duplicate.

Calculations

A. Specific Gravity (Liquids) Calculation:

$$\text{Specific gravity} = \frac{B\,(\text{in grams})}{C\,(\text{in grams})}$$

B is the weight of the cylinder and the sample recorded in Step A.13. minus the cylinder tare weight recorded in Step A.10.c.

C is the weight of the cylinder and the reagent water recorded in Step A.8. minus the cylinder tare weight recorded in Step A.4.

B. Bulk Density (Solids) Calculation

$$\text{Bulk Density } (g/cc) = \frac{B\,(\text{in grams})}{A\,(\text{in mL})}$$

B is the weight of the cylinder and the sample recorded in Step B.8 minus the cylinder tare weight recorded in Step B.4.

A is the volume of the sample recorded in Step B.7.

Statistical Information/Method Performance

The quality control acceptance windows are generated annually by following the procedure outlined in QA-SOP11896.

Quality Assurance/Quality Control

1. Batch size is limited to 20 samples or less.

2. When sample volume permits, a matrix sample duplicate must be analyzed with each group of not more than 10 samples.

3. See LIMS for current quality control (QC) acceptance windows.

4. Follow guidelines in T-WC-WI10360 for outlier QC data.

5. No other quality assurance procedures are available for this analysis.

End of document

Version history

Version	Approval	Revision information
9	02.APR.2015	
10	27.NOV.2018	

eurofins	Always check on-line for validity. **Flash Point for Liquids and Solids by ASTM Method D93-07, ASTM D93-90 or SW-846 1010A**	Level: **Work Instruction**
Document number: **T-WC-WI10612**		
Old Reference: **1-P-QM-WI-9035589**		
Version: **2**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **30-JUL-2018**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

LIMS ID
Analysis 0430

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Revision Log

Revision: 02		**Effective Date:** This version
Section	**Justification**	**Changes**
Title	Not needed for the title Current references	Removed "ERPIMS" from title Added ASTM D93-90 and SW-846 1010A
Reference	Current reference	Added SW 846 1010A
Cross-Reference	Higher level documents are not required to be referenced	Removed references 1-P-QM-QMA-9017314 and 1-P-QM-QMA-9021767
Procedure 3a.	Current Practice	Replaced "short time" with "approximately 15 minutes" Added a caution to avoid freezing standards
Procedure 3e.	Current Practice	Added "approximately 30 minutes" when freezing samples

Revision: 02		**Effective Date:** This version
		Added a caution to avoid freezing the samples
Procedure 8.	Enhancement	Replaced 1.0 second with approximately 1 second.

Revision: 01		**Effective Date:** 11/20/15
Section	**Justification**	**Changes**
		New

Reference

1. Annual Book of ASTM Standards, Method D93-07.
2. Annual Book of ASTM Standards, Method D93-90.
3. Test Methods for Evaluating Solid Wastes, SW-846 Method 1010A, November 2004.
4. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-WC-WI10360	Quality Control Data for Wet Chemistry

Scope

This method covers the determination of flash point by Pensky-Martens closed-cup tester of fuel oils, lube oils, suspensions of solids, liquids that tend to form surface film under test conditions, and other liquids over a temperature range of 20° to 700°F.

Procedure A is the default procedure for this analysis. Procedure B applies to samples whose viscosity would prevent them from being uniformly heated under Procedure A. Procedure C is used when flashpoint is requested for a solid sample.

Basic Principles

A sample is heated in a closed cup at a slow, constant rate while also being stirred at a specified rate. A small flame is lowered into the cup at regular intervals. The flash point is the lowest temperature corrected to a barometric pressure of 760 mm Hg at which introduction of the test flame causes the vapor above the sample to ignite. The barometric pressure used in the calculation is the ambient pressure for the lab at the time of the test.

Interferences

Flash point may not be accurate on materials not stored in sealed-glass or metal containers. This is due to the possibility of diffusion of volatile material through the walls of plastic containers.

Samples containing volatile, halogenated compounds, and/or large volumes of water may not give a well-defined flash.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

A fire extinguisher must be easily accessible to the operator of the flash point apparatus. Some liquid mixtures have a potential to superheat prior to their flash point and may boil out of the apparatus in flames. Show special precautions during the initial application of the test flame to a sample. Samples containing low-flashing material can give a strong flash when the test flame is first applied. p-xylene is extremely flammable and harmful if inhaled. Dispose of p-xylene in the solvent waste can.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, proficiency is measured through an Initial Demonstration of Capability (IDOC) which consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for the annual DOC and can include four laboratory control samples or one blind sample.

Sample Collection, Preservation, and Handling

Collect samples for flash point in glass or metal containers and store at 0° - 6°C, not frozen, until analyzed. Holding time is not specified. Do not store in gas-permeable containers. Do not open containers unnecessarily to avoid loss of volatile material.

Apparatus and Equipment

1. Pensky-Martens closed-cup flash tester

2. ASTM standard thermometer (20° to 230°F) for low range temperatures

3. ASTM standard thermometer (50° to 392°F) for medium range temperatures

4. ASTM standard thermometer (200° to 700°F) for high range temperatures

Reagents and Standards

p-xlene – purchased, store at room temperature and re-evaluate yearly. Use as purchased for LCS.

Calibration

The stir rate must be checked each day the analysis is performed and recorded in the raw data logbook.

Adjust the stir rate to between 90 and 120rpm (15 to 20 revolutions per 10 seconds).

Thermometers must be calibrated periodically against a NIST traceable thermometer.

Procedure

A. Procedure A – liquid samples

1. Adjust the test flame and support flame to the size of the bead on the post next to the test flame (4mm in diameter) and adjust the stir rate to between 90 and 120 rpm (15 to 20 revolutions per 10 seconds).

2. Thoroughly clean and dry all parts of the cup prior to testing a sample. Make sure no cleaning solvent is present.

3. Fill the cup with the sample to be tested to the level indicated by the filling mark, and reassemble the apparatus in the standard operating configuration described in ASTM D 93.

a. For the Laboratory Control Standards (LCS/D), fill the cup to the filling mark with *p*-xylene (as purchased) and refrigerate for approximately 15 minutes prior to analysis. Do not allow the standards to freeze.

b. Analyze a sample matrix duplicate that flashes above the LOQ, each day the analysis is performed and with each group of not more than 10 samples.

c. When sample volume does not permit, or samples do not meet the above requirement of flashing above the LOQ, then a p-xylene LCSD must be analyzed to demonstrate method precision.

d. For samples with more than one layer, analyze the surface layer or oil/water emulsion layer. Document the layer analyzed.

e. Place samples known to flash below 75°F in the cup, cover with aluminum foil, and place in a freezer for approximately 30 minutes prior to an analysis. Do not allow samples to freeze.

4. Engage the locking device.

5. Insert the thermometer.

6. Heat sample at a rate of 9° to 11°F/min.

NOTE: For samples with high suspensions of solids and for highly viscous materials, see Procedure B. Analyst will need to make technical decision.

7. Stop the stirrer during each test flame application.

8. Apply test flame on every other degree Fahrenheit by lowering the test flame into the vapor space of the cup in ½ second, holding the test flame in place for approximately 1 second, and then quickly releasing the controls.

NOTE: If the approximate flash point of a sample is known, the test flame need not be applied until the temperature is within 30° to 50°F of this point.

9. The observed flash point is the temperature, recorded to the nearest degree Fahrenheit, at the time the test flame application causes a distinct flash inside the test chamber.

Do not confuse the true flash point with the "enhanced" flame (bluish halo surrounding the test flame during applications preceding the one that causes the actual flash).

10. If the flash has not occurred by 220°F, quickly switch to the medium- or high-range thermometer.

11. If the test flame extinguishes due to nonflammable vapors, continue the analysis for at least 20°F to be sure the flame continues to extinguish.

12. Always continue the analysis until at least 150°F.

13. Add Comment #50 when entering analysis results into the LIMS. Edit this comment to include either an enhanced temperature for samples that flashed or the temperature at which the test flame first consistently extinguished. Also, include the temperature at which the analysis ended.

B. Procedure B - viscous samples

For samples with high suspensions of solids and for highly viscous materials, follow Procedure A using the following modifications:

1. Increase stir rate to 250 ± 10 rpm.

2. Decrease heating rate to 2° to 3°F/min.

C. Solid samples

Since EPA does not have an official method for the Flash Point determination of solid samples, analyze solid samples using Procedure A with the following modifications:

1. Do not attempt to stir the sample at any time during the Flash Point analysis, as stirring a solid may damage the Pensky-Martens closed-cup flash tester.

2. Report the results with the following disclaimer (Comment #171):

The Pensky Martens closed cup apparatus is designed to determine the flash point of a liquid sample. The sample submitted could not be mixed well enough to obtain uniform heating. The temperature being measured was that of the material near the top of the cup. The material at the bottom of the cup would have a higher temperature. The temperature reported may not be accurate.

Calculations

Corrected flash point = F + 0.06 (760-P)

Where:

F = Observed flash point in degrees Fahrenheit

P = Ambient barometric pressure, mm Hg

Statistical Information/Method Performance

The practical limit of quantitation is 50°F.

The acceptable range for the p-xylene LCS is 78.5 to 83.49°F.

Quality Assurance/Quality Control

The barometric pressure must be recorded each day the analysis is performed.

Batch size is limited to 20 samples or less.

A LCS of *p*-xylene must be analyzed with each batch of not more than 20 samples.

When sample volume permits, analyze a sample matrix duplicate that flashes above the LOQ, each day the analysis is performed and with each group of not more than 10 samples. When sample volume does not permit, or samples do not meet the above requirement of flashing above the LOQ, then a *p*-xylene LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: a non-program deleted duplicate or an LCSD.

See LIMS for current quality control acceptance limits. Follow guidelines in *T-WC-WI10360* for outlier QC data.

A second sample matrix duplicate is not required unless a batch contains an NPDES sample(s) from South Carolina and the batch contains more than 10 samples.

T-WC-WI10360 Quality Control Data for Wet Chemistry

End of document

Version history

Version	Approval	Revision information
1	20.NOV.2015	
2	16.JUL.2018	

eurofins	Always check on-line for validity. **Particle Size Distribution of Soils and Solids/Grain Size Classification by ASTM D422-63 (reapproved 2007)**	Level: **Work Instruction**
Document number: **T-WC-WI11514**		
Old Reference: **1-P-QM-WI-9014165**		
Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date **24-JAN-2019**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

LIMS ID
Analysis 7103, 11604

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Table I

Revision Log

Revision 10		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Reference	Reflect current active method	Added ASTM D422
Cross Reference/throughout document	Reflect current designations in ETQ	Updated to ETQ designation
Reagents and Standards	No longer used	Removed item #2 n-hexane

Revision 10	**Effective Date:** This version	
Procedure B:NOTE;	New requirement	Added that hydrometer will be calibrated yearly by certified vendor.
Procedure F	No longer used	Removed oil extraction section F from SOP
Entire document	Reflect current forms being used	Added form *T-WC-FRM11472* (form to use when only analysis 7103)

Revision: 9	**Effective Date:** Aug 18, 2014	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Document Title	Clarification	Add 63 (reapproved 2007) to the method
Reference 1.	Clarification	Added 63 (reapproved 2007)
Cross Reference	No longer referenced in procedure	Deleted Analysis #1443, 6569, 1-P-QM-QMA-9015389 and 1 -P-QM-QMA-9021767
Personnel Training and Qualifications	Requirement	Added requirement of documenting observation of analyst
Sample Collection, Preservation, Handling	Requirement	Added no hold time and sample storage temp
Procedure B. NOTE	Reflect current process	Took out reference to check hydrometer annually

Reference

1. ASTM D422-63 (reapproved 2007), Standard Test Method for Particle-Size Analysis of Soil

2. ASTM D422, Standard Test Method for Particle-Size Analysis of Soil

3. ASTM D421 - 85, *Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants*.

4. ASTM E868 - 82, "*Conducting Performance Tests on Mechanical Conveying Equipment Used in Resource Recovery Systems*," Sec 9.9, "*Measuring Bulk Density of Material*."

5. Method 160.3, *EPA Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020.

6. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
S-SS-WI10697	Moisture (Gravimetric)
T-WC-FRM11472	#7103 Particle Size Distribution
T-WC-FRM11473	#7103 Particle Size Distribution / #11604 Grain Size Classification
Q-EQA-WI6815	ETM System Probe Calibration
T-WC-WI9901	Equipment Muffle Furnaces and Ovens
QA-SOP11880	Balance, Syringe, Pipette Verification
QA-SOP11188	Reagents and Standards

Scope

This procedure is applicable to the determination of the distribution of particle sizes in soils and solids. Particle sizes in the range 75 to 0.075 mm are determined by sieving. Distribution of particle sizes smaller than 0.075 mm is determined by a sedimentation process using a hydrometer.

Basic Principles

The process determines the particle sizes and distribution in a soil/solid sample. The sample is dried, ground, and sieved using sieves of different sizes. Particle sizes in the range 75 to 0.075 mm are determined by sieving. Distribution of particle sizes smaller than 0.075 mm is determined by a sedimentation process using a hydrometer.

Interferences

When high levels of organic material are present in the soil (material with a specific gravity less than one), the hydrometer readings are subject to error. After air-drying the sample, remove as much of the organic material (leaves, roots, sticks, etc.) as possible.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP.

Analysts are considered proficient when they have successfully demonstrated competency under supervision of a supervisor or other trained analyst. Documentation of this training is in each analyst's training records.

Sample Collection, Preservation, and Handling

There is no holding time for this analysis. Samples are stored at 0 to 6°C; not frozen.

1. Place the sample as received in a glass baking dish. Allow to air dry at room temperature for approximately 24 hours or until thoroughly dried. Use enough sample so that the material needed to pass through the No. 8 sieve is approximately 100 g or more.

2. Break and grind the dried sample using the rubber-covered pestle. Continue to do so until the sample is reduced to a fine material. **Do not break rocks that are part of the sample matrix as this is likely to affect the sample sedimentation process.**

All information needs to be recorded on Form *T-WC-FRM11472* (analysis 7103 only) or Form *T-WC-FRM11473* (analyses 7103 and 11604) as soon as the sample preparation is started.

Apparatus and Equipment

1. Analytical balance, pan balance, or equivalent

2. Mechanically operated sieving device

3. Mechanically operated stirring device

4. Hydrometer - graduated to read in specific gravity of the suspension

5. Sedimentation cylinder – 1000-mL

6. Thermometer - accurate to 0.5°C
7. Sieves - Numbers 4, 6, 8, 16, 30, 50, 100, 200, 0.75", 1.5", and 3"
8. Sieve pan
9. Rubber covered pestle, or equivalent
10. Beakers – 150-mL and 250-mL
11. Specimen collection cups (120-mL), or equivalent
12. Glass baking dishes, or equivalent
13. Glass stir rod, or equivalent
14. Oven maintained at 110° ± 5°C; adjust as needed to stay in this range
15. Whatman Grade 3 filter paper - 6 micron pore size
16. Buchner funnel

Reagents and Standards

Alternate weights may be used as long as the final concentrations remain the same. Refer to *QA-SOP11188* for the proper labeling and documentation of reagents preparations.

1. Sodium hexametaphosphate solution

    a. Using a 1000-mL volumetric flask, dissolve 40 g of sodium hexametaphosphate in reagent water.

    b. Dilute to final volume once dissolved

    c. Store at room temperature in a glass or plastic container

    d. Solution expires one month from date of preparation.

Calibration

Balances must be calibrated each day before use. Refer to *QA-SOP11880*.

Procedure

A. The sieved analysis of the portion retained on the No. 8 sieve.

Check to be sure that the balance has been calibrated each day before use.

1. Tare the sieving pan, No. 8, No. 6, No. 4, 0.75", 1.5", and the 3" sieved consecutively (to 0.01 g) using a pan balance.

2. Using the prepared sample, place the sample in the tared sieves and begin the sieving operation using the mechanical sieving device. Agitate for approximately one minute. Continue sieving until no more than 1% of the residue on each sieve passes that sieve during 1 minute of sieving.

NOTE: If sample particle size is too great to pass through the sieve, continue to break and grind as needed. Do not break stones or rocks that are part of the sample matrix.

3. Determine the mass retained (Mr) on the 3" sieve. Weigh on the balance and record the combined sieve and sample weight. Continue sieving with the remaining sieves recording all determined sample masses on the sieves.

To calculate the mass retained:

$$M_r = \text{Tare} + \text{sample weight value} - \text{the tare weight value}$$

4. Retain the sample collected in the sieving pan after weighing.

a. Weigh approximately 50 g of sample into a 250-mL beaker.

b. Place approximately 30 g or more of the remaining sample into a specimen cup, for use when performing the moisture and bulk density analyses.

B. Hydrometer analysis

NOTE: The hydrometer used in the process will be calibrated on an annually basis by a certified vendor.
The hydrometer must be visually inspected for any cracks or breaks before each use.

1. Using the sample in the 250-mL beaker add 125 mL of sodium hexametaphosphate solution. Stir the soil-water slurry until it is thoroughly moistened. Cover and label beaker with sample number. Allow this slurry to soak for at least 16 hours, but not to exceed 24 hours.

2. At the end of the soaking period, transfer the soil-water slurry into a dispersion cup using room temperature reagent water. Be sure to rinse all residue from the beaker into the dispersion cup.

NOTE: Extra care needs to be taken when rinsing the sample into another container or when using any apparatus. **All particles need to be rinsed into the new container or a loss in sample weight is possible to occur.**

3. Stir for one minute using the stirring apparatus. **Rinse stirring apparatus well into dispersion cup to prevent loss of sample.**

4. Transfer the soil-water slurry into a glass sedimentation cylinder, rinsing well. Add room temperature reagent water until the total volume is 1000 mL.

5. Cover the open end of the cylinder with parafilm, then placing the palm of the hand over the end, invert the cylinder and agitate for a period of one minute. Place the cylinder in a location where it will not be disturbed or moved during the sedimentation readings (for 24 hours).

6. Remove the parafilm and immediately begin the hydrometer readings, recording the temperature reading after each suspension. Record the readings at the following intervals (measured from the beginning of sedimentation): 2, 5,15, 30, 60, 250, and 1440 minutes. Insert the hydrometer about 20 to 25 seconds before the reading is due to the approximate depth. Clean the hydrometer between readings by placing it into reagent water and twisting with a spinning motion.

NOTE: The basic temperature to be maintained for the hydrometer test is 68°F (20°C). Small variations of temperature do not introduce differences that are of practical significance.

C. Final sieving analysis of the portion of sample passing the No. 8 sieve.

1. After taking the final hydrometer reading, pour the suspension through a No. 200 sieve and rinse with reagent water until the wash water is clear.

2. Transfer the remaining sample from the sieve into a 150-mL beaker, rinsing well with room temperature reagent water and dry in an oven at 110° ± 5°C for at the least 12 hours or longer.

3. After the sample has dried and no liquid is remaining. Remove from the oven and allow to cool. When the sample has reached room temperature use a glass stir rod to scrape the beaker and crush the harden residue into fine particles.

4. Tare the collection pan, the No. 200, No. 100, No. 50, No. 30, and No. 6 sieves consecutively (to 0.01 g) using a pan balance.

5. Place the oven-dried sample into the sieves and cover. The sieves need to be covered at this point of agitation due to the fine and lightweight particle sizes. Agitate for approximately 5 minutes to allow the fine particles to pass within the sieves.

6. Determine the mass retained (Mr) on each sieve by weighing and recording the combined weight of the sieve and the sample.

D. Moisture analysis

Using approximately 5 g of sample from the specimen collection cup (Procedure: Section A.4.b.) Perform a moisture analysis according to the Lancaster Laboratories analysis 0111. Record all information on form *T-WC-FRM11472* or *T-WC-FRM11473*.

E. Bulk density analysis

1. Weigh out approximately 15 g of sample from the specimen collection cup (Procedure A.4.b.).

2. Tare a 100 mL volumetric flask and record data on form *T-WC-FRM11472* or *T-WC-FRM11473*.

3. Add sample to tared flask.

4. Add approximately 50 mL reagent water and agitate flask until soil is thoroughly mixed.

5. Remove air bubbles by inserting a vacuum tube inside the neck of flask being careful not touch the contents of the flask.

6. Once air bubbles are removed, bring mixture to a final volume of 100 mL using reagent water.

7. Reweigh the flask and its contents and record the reading on the data sheet (form *T-WC-FRM11472* or form *T-WC-FRM11473*)

F. Grain Size Classification (analysis #11604)

To report the % Gravel, % Sand, % Silt, and % Clay fractions electronically, a separate grain size classification scan with the % passing at each type as a separate piece will be determined and recorded on form *T-WC-FRM11473*. See below for further information on % classification. For sediments that do not have sufficient sample volume to perform the hydrometer portion of the test, the sum of the % Silt and Clay can be reported as one aggregate value. The classifications are entered as Analysis #11604.

1. % Gravel – determined by the amount of particles passing 3-in. and retained on No. 4 sieve (size 4.75-mm).

2. % Sand - determined by the amount of particles passing No. 4 sieve (size 4.75-mm) and retained on No. 200 sieve (size 0.075-mm).

3. % Silt – determined by the amount of particles passing 0.074 to 0.005-mm.

4. % Clay – determined by the amount of particles smaller than 0.005-mm.

Calculations

A spreadsheet using Excel, or an equivalent, has been prepared to facilitate the calculation of data, the plotting of the graph, and the interpolation of the hydrometer results from the graph. It is possible for data to be reported directly from the spreadsheets; however, the plotted hydrometer data may be more accurate than the computer interpolations. Refer to this spreadsheet for the appropriate tables to hand calculate data.

Use the mass retained (Mr) values recorder for each sieve as Mr8, Mr6, Mr4, etc. to determine the percent passing each sieve.

To calculate the mass retained:

Mr = Tare + sample weight value - the tare weight value

A. Sieve analysis values for the portion coarser than the No. 8 sieve

1. Mt = Mc + Mf

Where:

Mt = total mass

Mc = mass of the coarse material

Mf = mass of the fine material

2. P8 = Mf/Mt x 100

Where:

P8 = percentage passing No. 8 sieve

3.

$$P6 = \frac{Mf + Mr8}{Mt} \times 100$$

Where:

P6 = percentage passing No. 6 sieve

Mr8 = mass retained on No. 8 sieve

4.

$$P4 = \frac{Mf + Mr8 + Mr6}{Mt} \times 100$$

Where:

Mr6 = mass retained on the No. 6 sieve

P4 = percentage passing No. 4 sieve

5. Continue calculations as above for the 0.75", 1.5", and 3" sieves.

B. Percentages of soil in suspension

1. Hf = Os/As

Hygroscopic moisture correction factor

Where:

Hf = hygroscopic moisture correction factor

As = air dry mass of the soil

Os = oven dry mass of the soil = (oven dry weight minus the tare weight)

2. Percentages of soil in suspension

a. Calculate the oven dry mass of soil used in the hydrometer analysis by multiplying the air-dry mass of the soil used in the hydrometer analysis by the moisture correction factor.

b.

$$W = \frac{oven\ dry\ mass\ in\ hydrometer}{P8} \times 100$$

Where:

W = oven dry mass of soil in a total test sample represented by the mass of the soil dispersed, in grams

P8 = percentage passing the No. 8 sieve (from calculation A.2.)

c. P = [(100,000/W) x G/(G-G1)] x (R-G1)

Where:

G = specific gravity of the soil

G1 = specific gravity of the liquid in which the soil was suspended (use 1)

W = oven dry mass of soil in a total test sample represented by the mass of the soil dispersed, in grams

P = percentage of soil remaining in suspension at the level at which the hydrometer measures the density of the suspension

R = Hydrometer reading with composite correction applied

d.

$$D = K\sqrt{L/T}$$

Where:

D = diameter of the particle (in mm)

K = constant using the temperature of the suspension and the specific gravity of the soil particles (see the Excel spreadsheet or equivalent for the Analysis #7103, for the specific “K” values to use)

L = distance from the surface of the suspension to the level at which the density of the suspension is being measured (the effective depth from Table I)

T = interval of time from the beginning of sedimentation to the taking of the reading in minutes

C. Sieve analysis values of the portion finer than the No. 8 sieve

1. Calculate the percentage of particles retained on the No. 8 sieve as follows:

$$Pr8 = 100\text{-}P8$$

Where:

Pr8 = percentage of particles retained on the No. 8 sieve

P8 = percentage of particles passing the No.8 sieve (from calculation A.2.)

2. Calculate the mass retained on the No. 8 sieve represented by the sample volume used in the hydrometer analysis as follows:

$$Mf8 = \frac{Pr8 \times W}{100}$$

Where:

Mf8 = mass retained on the No. 8 sieve represented by the sample volume used in the hydrometer analysis

W = oven dry mass of the soil in a total test sample represented by the mass of the soil dispersed (as calculated in B.2.b.)

3. Calculate the mass passing the No. 200 sieve as follows:

Mp200 = W - (Mr200 + Mr100 + Mr50 + Mr30 + Mr16 + Mf8)

Where:

Mp200 = mass passing the No. 200 sieve

Mr200, 100, 50, etc. = mass retained on the sieves used for the portion finer than the No. 8 sieve

Mf8 = mass retained on the No. 8 sieve represented by the mass of the soil used in the hydrometer analysis

W = oven dry mass of the soil in a total test sample represented by the mass of the soil dispersed (as calculated in B.2.b.)

4.

$$P200 = \frac{Mp200}{W} \times 100$$

Where:

P200 = percentage passing the No. 200 sieve

Mp200 = mass passing the No. 200 sieve (use calculation from C.3.)

W = oven dry mass of the soil in a total test sample represented by the mass of the soil dispersed (as calculated in B.2.b.)

5.

$$P100 = \frac{Mp200 + Mr200}{W} \times 100$$

Where:

P100 = percentage passing the No. 100 sieve

Mr200 = mass retained on the No. 200 sieve

Mp200 = mass passing the No. 200 sieve (use calculation from C.3.)

W = oven dry mass of the soil in a total test sample represented by the mass of the soil dispersed (as calculated in B.2.b.)

6.

$$P50 = \frac{Mp200 + Mr200 + Mr100}{W} \times 100$$

Where:

P50 = percentage passing the No. 50 sieve

Mr100 = mass retained on the No. 100 sieve

Mp200 = mass passing the No. 200 sieve

Mr200 = mass retained on the No. 200 sieve

W = oven dry mass of the soil in a total test sample represented by the mass of the soil dispersed (as calculated in B.2.b.)

7. Continue calculations as above for the No. 30 and No. 16 sieves.

D. Prepare a graph of the test results on a logarithmic scale, plotting the diameter of the particles as the abscissa and the percentages smaller than the corresponding diameters as the ordinate. Report (from the graph or directly from the tabulated data) the percentage of particles passing the 3", 1.5", 0.75", No. 4, No. 6, No. 8, No. 16, No. 30, No. 50, No. 100, and No. 200 sieves. Report the hydrometer results (from the graph) as the percentage passing 0.050 mm, 0.020 mm, 0.005 mm, 0.002 mm, and 0.001 mm.

Statistical Information/Method Performance

Not applicable to this procedure.

Quality Assurance/Quality Control

When possible, perform duplicate analyses for particle size on a routine basis.

Batch size is limited to 20 samples or less.

Table I

Values of Effective Depth Based on Hydrometer and Sedimentation Cylinder of Specific Sizes[A]

Hydrometer 151H	
Actual Hydrometer Reading	**Effective Depth, L, cm**
1.000	16.3
1.001	16.0
1.002	15.8
1.003	15.5
1.004	15.2
1.005	15.0
1.006	14.7
1.007	14.4
1.008	14.2
1.009	13.9
1.010	13.7
1.011	13.4
1.012	13.1
1.013	12.9
1.014	12.6
1.015	12.3
1.016	12.1
1.017	11.8
1.018	11.5
1.019	11.3
1.020	11.0
1.021	10.7
1.022	10.5
1.023	10.2
1.024	10.0
1.025	9.7
1.026	9.4
1.027	9.2
1.028	8.9
1.029	8.6
1.030	8.4
1.031	8.1
1.032	7.8
1.033	7.6
1.034	7.3
1.035	7.0
1.036	6.8
1.037	6.5
1.038	6.2

[A]Values of effective depth are calculated from the equation:

$$L = L1 + \tfrac{1}{2} \times \left[L2 - \left(\frac{V_B}{A} \right) \right]$$

Where:

L = effective depth, cm

L1 = distance along the stem of the hydrometer from the top of the bulb to the mark for a hydrometer reading, cm

L_2 = overall length of the hydrometer bulb, cm

V_B = volume of hydrometer bulb, cm^3, and

A = cross-sectional area of sedimentation cylinder, cm^2

Values used in calculating the values in Table I are as follows:

For hydrometer 151H:

L_2= 14.0 cm

V_b = 67.0 cm^3

A = 27.8 cm^2

L1 = 10.5 cm for a reading of 1.000

= 2.3 cm for a reading of 1.031

Q-EQA-WI6815 ETM System Probe Calibration
QA-SOP11188 Reagents and Standards
QA-SOP11880 Balance, Syringe, Pipette, and Labware Verification
S-SS-WI10697 % Moisture Calculation and % Solids Calculation (Gravimetric) by SM 2540 G-1997 and SM 2540 G-2011

T-WC-FRM11472 #7103 Particle Size Distribution
T-WC-FRM11473 #7103 Particle Size Distribution/#11604 Grain Size Classification
T-WC-WI9901 Equipment Muffle Furnaces and Ovens

End of document

Version history

Version	Approval	Revision information
9	18.AUG.2014	
10	17.JAN.2019	

eurofins	Always check on-line for validity. **Preparation of Solids by EPA 7471A or B for Mercury Analysis**	Level: **Work Instruction**
Document number: **T-MET-WI11948**		
Old Reference: **1-P-QM-WI-9015161**		
Version: **20**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **09-MAR-2019**	Document users: **6_EUUSLA_Metals_Hg Prep, 6_EUUSLA_Metals_Hg Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

LIMS ID
Analysis DOD - 5711, 10638

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Revision Log

Revision:	20	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Throughout SOP	Update		Updated SOP references to D4 titles
Procedure	Reflects current procedure		Added step 15 about Hydroxlamine

Revision:	19	**Effective Date:**	**19-JUL-2016**
Section	**Justification**		**Changes**
Revision Log			Removed revision logs up to the previous version

Revision:	19	**Effective Date:**	**19-JUL-2016**
	Formatting requirement 1-P-QM-QMA-9017356		
Document Title	Enhancement		Add method. Change title to: Preparation of Solids by EPA 7471A or B for Mercury Analysis
Reference	No change in chemistry		Removed the word Modified.
Purpose	Optional section. Information is contained within the scope		Removed section.
Definitions	Optional section which is unnecessary		Removed section.
Reagents and Standards	Enhancement		Added 40ppb Hg water standard and 100ppb Hg soil standard.
Procedure	Reflects current procedure Clarification Clarification		Added digestion of wipes. Added text pertaining to bringing temp to 95ºC and then time the 2 minutes. Added text pertaining to carefully swirl container after addition of KMNO4.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471A, Rev. 1, September 1994.
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471B, Rev. 2, February 2007
3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI7965	Mercury in Aqueous, Solid and Tissue Samples by Cold Vapor AA
T-MET-WI9084	Working Instructions for Preparation of Mercury Solutions and Standards

Scope

This procedure is used to prepare soil, sediment, sludge, oil, tissue and wipe samples for the measurement of mercury by atomic absorption cold vapor technique following SW-846 7471A or 7471B protocol. If this dissolution procedure is not sufficient to dissolve a specific matrix type or sample, then this method is not applicable for that matrix. Samples that require additional homogenization are addressed on a case-by-case basis and homogenized by the Sample Support Group (Department 6055).

Basic Principles

Samples are digested with aqua regia and potassium permanganate to oxidize mercury compounds to mercuric ions and eliminate possible interference from sulfide. Samples high in chlorides require additional permanganate. At the time of analysis, excess permanganate is reduced with sodium chloride/hydroxylamine hydrochloride. Mercuric ions are reduced to mercury metal using stannous chloride. Mercury measurement is performed using mercury cold vapor technique.

Reference Modifications

To increase efficiency, polypropylene containers are used in place of BOD bottles. Prior to analysis (after excess potassium permanganate is reduced with sodium chloride/hydroxylamine hydrochloride solution) samples are adjusted to 100 mL in volumetric flasks. This allows aliquots to be taken as required for analysis; aliquots cannot be taken when BOD bottles are used. No impact on the quality of the data generated using this modification has been observed.

Interferences

Not applicable to this procedure.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO3) – This acid can cause skin burns. Add nitric acid to samples in a hood or use the designated dispensing equipment to avoid exposure to toxic fumes.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCI with concentrated H2SO4 to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure.

Proficiency is measured through an Initial Demonstration of Capability (IDOC) that consists of four laboratory control samples (LCS) that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four LCS's or one blind sample.

Sample Collection, Preservation, and Handling

Samples are collected in either glass or plastic containers with no preservatives. They must be stored at 0° to 6°C, not frozen and digested and analyzed within 28 days of collection.

Digested samples are stored in plastic containers at room temperature. Store samples, standards, and digested samples separately.

Apparatus and Equipment

1. Polypropylene containers (digestion vessels) - Certified clean and Class A equivalent

2. Balance, capable of reading 0.1 mg

3. Polypropylene covers, (digestion vessel covers)

4. Chemware Ultra-Pure PTFE boiling stones, or equivalent

5. Environmental Express Hotblock (block digestor), adjustable and capable of maintaining a temperature of 95º ± 1°C

6. LLENS (Lancaster Laboratories Electronic Notebook System) - the computer program that integrates a PC with an analytical balance to collect data directly from the balance. The program organizes the data and transmits the readings to the laboratory information management system (LIMS).

Reagents and Standards

A. Store all prepared standards and reagents in glass or polyethylene bottles at room temperature. Label the bottle with the solution name, lot number, date prepared, the expiration date, the initials of the person preparing the solution, and the storage conditions.

B. Standard/ spiking concentration and reagent vendors are subject to change without notification.

C. Reagents - Follow manufacturer's storage conditions and expiration date. If no expiration date is provided, re-evaluate annually or set a one year expiration date. Use the following or equivalent:

1. Hydrochloric acid, 36.5% to 38.0% HCl, Fisher Trace Metal Grade reagent, 1.194 g/mL
2. Nitric acid, 70.0% to 71.0% HNO3, Fisher Trace Metal Grade reagent, 1.428 g/mL
3. Potassium permanganate, KMNO4, Baker Analyzed reagent, ACS.
4. Sodium chloride, NaCl, J.T. Baker, Certified ACS.
5. Hydroxylamine hydrochloride, NH2OH·HCl, J.T. Baker, Certified ACS.
6. 1000 mg/L Hg standard solution, Baker analyzed reagent.

D. Working instructions for the preparation of mercury solutions and standards are contained within ***T-MET-WI9084***. This form includes shelf life and storage conditions.

1. Hg intermediate standard (10 mg/L).
2. Hg intermediate standard (1.0 mg/L).
3. 40 ppb Hg Water Standard.
4. 100 ppb Hg Soil Standard.
5. Potassium permanganate solution (5%).
6. Aqua regia.
7. Sodium chloride/hydroxylamine hydrochloride solution.

E. Adjust all additions according to final solution volume if larger or smaller volumes are needed. Thoroughly mix the solution after diluting to volume.

Calibration

Not applicable to this procedure.

Block Digestor Instructions

1. Turn block digestor on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. Press and hold STAR (*) key.

4. The display shows the Set Point Temperature.

5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 95° ± 1°C sample temperature.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

Procedure

1. Turn block digestor on and allow block to reach the Control Point setting that provides 95° ± 1°C sample temperature.

2. Weigh three aliquots, ~ 0.2000g each, taken from three different areas (combined 0.6000 to 0.6500 g to the nearest 0.0001 g) of a well mixed, as-received sample into a polypropylene digestion vessel.

   a. Add 0.6000g to 0.6499g of Chemware Ultra-Pure PTFE boiling stones to the vessel for the method blank and LCS.

   b. Enter the blank weight as 0.6000 with final volume of 100.0000.and the LCS weight as 1.0000 with final volume 100.0000 in the LLENS.

3. Matrix exceptions:

   a. Samples with a liquid consistency: increase weight to 1 g (1.00 to 1.05 g).

   b. Oil samples: weigh 0.2000 g to 0.2500 g (to the nearest 0.0001 g) of sample and add 0.2000g to 0.2499g of Teflon Chips to the blank and LCS container. Enter the blank weight

as 0.2000 to 100.0000 final volume and the LCS weight as 1.0000 to 100.0000 final volume in the LLENS.

c. Wipes: one blank media each must be used for the batch preparation blank, the LCS, and the laboratory control sample duplicate (LCSD). Use reagent water to rinse any particulate matter from the wipe container into the vessel containing the wipe before digesting. Digest wipes in their own batch.

d. Tissue samples: spike the LCS, LCSD in the same manner as the matrix spike and matrix spike duplicate (Refer to ***T-MET-WI9084***). Digest tissue samples in their own batch.

4. For sample batch quality control preparation, spiking procedures and concentration levels see ***T-MET-WI9084***.

5. All spiking must be performed prior to starting the digestion procedure.

6. Add about 5 mL reagent water and about 5 mL of aqua regia solution.

7. Place sample containers in block digestor, bring to 95ºC ± 1°C and heat approximately 2 minutes. (Place a calibrated thermometer in batch blank container.)

8. Remove sample containers from block and allow to cool.

9. Add 50 mL of reagent water and 15 mL of 5% KMnO4 solution and mix by carefully swirling the container.

a. Add additional portions of 5% KMnO4 solution (in 5-mL increments, up to as much as 25mL), if necessary, until the purple color persists for at least 15 minutes.

b. Add the same amount of KMnO4 solution to entire digestion batch.

c If the maximum amount of 25mL of 5% KMnO4 solution was added and the purple color did not persist for at least 15 minutes, then contact group leader, further dilutions are required. A comment must be placed on the batch sheet documenting the reason for the dilution.

10. Transfer sample containers to block digestor.

11. Place a calibrated thermometer in batch blank container.

12. Put a polypropylene cover on each container.

13. When the thermometer indicates 95° ± 1°C, continue heating for 30 minutes.

14. Remove sample containers from digestion block and allow to cool.

15. Add 6 mL of sodium chloride/hydroxylamine hydrochloride solution to reduce excess permanganate. Adjust volume to the 100 mL mark with reagent water, seal container with screw cap and mix.

16. The sample is now ready for analysis.

Calculations
Not applicable to this procedure.

Statistical Information/Method Performance
Not applicable to this procedure.

Quality Assurance/Quality Control
Each digestion batch (up to 20 samples) must contain a method blank (PB), LCS and either an unspiked background sample (U), duplicate (D), matrix spike (R), matrix spike duplicate (M) or an LCS/LCSD. Refer to ***T-MET-WI7965*** for sample batch quality control requirements, acceptance criteria and corrective action.

T-MET-WI7965 Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA
T-MET-WI9084 Preparation of Mercury Solutions and Standards

End of document

Version history

Version	Approval	Revision information
19	19.JUL.2016	
20	06.MAR.2019	

eurofins	Always check on-line for validity. **Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA**	Level: **Work Instruction**
Document number: **T-MET-WI7965**		
Old Reference: **1-P-QM-WI-9015067**		
Version: **18**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **12-AUG-2019**	Document users: **6_EUUSLA_Metals_Hg Analysis, 6_EUUSLA_Metals_Hg Analysis Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

LIMS ID
Analysis DOD - 0259, 0159

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Revision Log

Revision	18	**Effective Date**: This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version

Cross Reference	New procedure	Added EPA 245.1 digestion SOP 26740
Procedure A.	New procedure	Added EPA 245.1 digestion SOP 26740
Procedure B.2.a.	Method Requirement	EPA 245.1 samples must be analyzed under their own calibration

Revision	17	**Effective Date:**	March 4, 2019
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Table I	Method Requirement		|PB| requirement to be < 2.2x MDL. ICB requirement to be < MDL.
Sample Analysis	Addition		Added filtration information as well as filtering the prep blank and laboratory control sample if a sample within the batch needs filtered.
Throughout	Clarification		Removed MCL from SOP. Reference the Compliance SOP *QA-SOP11886*
Procedure B.1.d.	Addition		Added information about removing cassettes.
Procedure B.2.b.	Update		Updated section to reflect use of Sequence Editor.
Sample Analysis A.1.a.	Removal		Removed preparation steps that are included in the Preparation procedure.
Sample Analysis A.3.b.	Addition		Added required steps for overnight shutdown to include cassettes.
QA/QC	Clarification/Enhancement		Clarified MSA requirements. Removed quarterly requirement for IDL studies.
Throughout	Clarification/Enhancement		Reorganized sections.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471B, February 2007.

3. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471A, September 1994

4 Method 245.1 (rev. 3), Determination of Mercury in Water by Cold Vapor Atomic Absorption Spectroscopy, USEPA 600/R-94/111 May 1994.

5. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI11948	Preparation of Solids by EPA 7471A or B for Mercury Analysis
T-MET-WI11924	Digestion of Aqueous Samples by SW-846 Method 7470A
T-MET-WI26740	Digestion of Aqueous Samples for Mercury by EPA 245.1
Q-EQA-FRM6869	Nonconformance Form

eurofins	Always check on-line for validity. **Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA**	Level: **Work Instruction**
Document number: **T-MET-WI7965**		
Old Reference: **1-P-QM-WI-9015067**		
Version: **18**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **12-AUG-2019**	Document users: **6_EUUSLA_Metals_Hg Analysis, 6_EUUSLA_Metals_Hg Analysis Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

Document	Document Title
T-MET-WI9084	Working Instructions for Preparation of Mercury Solutions and Standards
QA-SOP11178	Demonstrations of Capability
QA-SOP11901	Instrument Maintenance and Calibration
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896	Establishing Control Limits
QA-SOP11886	Processing Regulatory Compliance (i.e. SDWA, NPDES) Samples

Scope

This method is used for determination of mercury in aqueous and solid samples. The optimum concentration range for this method is 0.2 to 5.0 ppb.

Matrices - EPA 7470A and EPA 245.1 are applicable to water analysis. EPA 7471A and EPA 7471B are applicable to soil and tissue analysis. EPA 245.1 is applicable to water analysis.

Limits of Quantitation (LOQs) are based on annual statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS, and are subject to change without notification.

Basic Principles

The Leeman Labs Mercury Analyzer utilizes continuous flow technology with drying of the sample vapor for the analysis of mercury by automated vapor generation. The reaction for the mercury analysis is a simple reduction reaction. The mercury is reduced with stannous chloride to liberate mercury metal and Tin (IV) chloride. An inert gas is used to sweep the volatile mercury into the absorption cell in the optical path of the atomic absorption spectrophotometer. The dry vapor enters one path of the optical cell, which has been optimized for fast response (small diameter), and sensitivity (long length).

Mercury is measured using a solid state detector with a wide dynamic range and a mercury source that delivers a stable source of emission at 254 nm. The signal is referenced to the simultaneous absorbance of the pure carrier gas flowing through the second optical path under identical conditions.

Definitions

1. Low Level Check Standard
2. MSA – Method of Standard Additions
3. SPLP - Synthetic Precipitation Leaching Procedure
4. TCLP – Toxicity Characteristic Leaching Procedure
5. QC Type Designators:

a. U or US – unspiked background sample

b. D – Sample Duplicate

c. R – sample spike

d. M – Sample spike duplicate

e. PB/PBW/ PBS –Preparation Blank (Water/ Solid). Equivalent to a Method Blank (MB)

Interferences

Potassium permanganate is added to samples to eliminate possible interference from sulfide. Concentrations as high as 20 mg/L of sulfide as sodium sulfide do not interfere with the recovery of added inorganic mercury from reagent water.

Samples high in chlorides require additional permanganate (as much as 25 mL) because, during the oxidation step, chlorides are converted to free chlorine, which also absorbs radiation of 253.7 nm. Take care to ensure that free chlorine is absent before the mercury is reduced and swept into the cell by using an excess of hydroxylamine sulfate (or chloride) reagent.

Copper has been reported to interfere; however, copper concentrations as high as 10 mg/kg had no effect on recovery of mercury from spiked samples.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO3) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes.

Sulfuric acid (H2SO4) – This acid is a strong oxidizing agent and can cause severe burns. Sulfuric acid spills are extremely slippery, adding to the danger. Always use in a fume hood. Never mix with concentrated HCl or concentrated KMNO4 to avoid a violent reaction (explosive splattering and extreme heat).

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCI with concentrated H2SO4 to avoid a violent reaction. Always use in a fume hood.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds. Samples that contain dust may be hazardous. Open in a fume hood.

Samples that may contain cyanide require special precautions to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the system to set up sequences, perform the calculations, interpret raw data, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples or one blind sample. Refer to *QA-SOP11178* for more guidance on these options.

Sample Collection, Preservation, and Handling

Aqueous samples are collected in plastic or glass containers, preserved to a pH of <2 with nitric acid. Samples must be analyzed within 28 days of collection.
NOTE: Regulatory Drinking Water samples (EW) are collected in 1-L plastic or glass containers and must be analyzed by EPA 245.1. Drinking water samples are not analyzed for dissolved mercury.

Solid samples are collected in glass containers and stored at 0° to 6°C not frozen. Samples must be analyzed within 28 days of collection.

Dissolved Mercury: Samples to be analyzed for soluble mercury requiring filtration at the lab must be submitted unpreserved. The sample is run through a 0.45 micron filter within 5 days of receipt and then for aqueous samples**,** samples are collected in plastic containers and preserved to a pH of <2 with HNO3.

Store sample digestates in plastic bottles at room temperature. Store standards and digestates separately.

Apparatus and Equipment

1. Hydra II Mercury Analyzer

2. Leeman Labs Envoy software – a windows based program to help navigate the software.

Reagents and Standards

A. Store all standards and reagents in polyethylene or glass containers at room temperature. Label the container with the solution name, lot number, date prepared, the expiration date, the initials of the person preparing the solution, and the storage conditions.

NOTE: Standard/ spiking concentration and reagent vendors are subject to change without notification.

B. Reagents use the following or equivalent:

1. Nitric acid, 70.0% to 71.0% HNO3, Fisher Trace Metal Grade reagent, 1.428 g/mL; Store in glass container at room temperature. Follow manufacturer's expiration date.

2. Sodium chloride, NaCl, J.T. Baker, Certified ACS. Store in plastic container at room temperature. Follow manufacturer's expiration date.

3. Hydroxylamine hydrochloride, NH2OH·HCl, J.T. Baker, Certified ACS. Store in plastic container at room temperature. Follow manufacturer's expiration date.

4. Reagent Water

5. Stannous chloride solution, 10% SnCl, Baker Analyzed reagent, ACS. Store in plastic container at room temperature. Follow manufacturer's expiration date.

6. Hydrochloric acid, HCl, 36.5% to 38.0%, Fisher Trace Metal Grade reagent, 1.194 g/mL or equivalent. Store in glass container at room temperature. Follow manufacturer's expiration date.

C. For the preparation of calibration blanks, ICBs, CCBs, calibration standards, ICVs, CCVs, CRAs, Method Blanks, LCSs and Matrix Spikes solutions, see Form *T-MET-WI9084*.

D. General solutions - See Form *T-MET-WI9084*.

Calibration

Leeman Labs Hydra II Mercury Analyzer

1. The software program has been developed to check the correlation coefficient of the curve, run appropriate ICV and CCVs at proper intervals, and check the percent recoveries of the ICV and CCVs.

2. Due to the instrument software limitations, the calibration blank is included in the correlation coefficient calculation.

3. A recalibration and reread of any associated samples is required for any checks that fall outside the windows.

4. For the frequency, acceptance criteria and corrective action see Table I and Table II.

5. For the preparation of calibration standards, see *T-MET-WI9084*.

6. The calibration is part of each run from Sequence Editor from the LIMS.

Procedure

A. Sample Digestion

1. Aqueous samples are digested by EPA 7471A/B according to SOP *T-MET-WI11924*.

2. Aqueous samples are digested by EPA 245.1 according to SOP *T-MET-WI26740*.

2. Solid samples are digested according to SOP *T-MET-WI11948*.

B. Leeman Labs Hydra II Mercury Analyzer Operation

1. Instrument Setup

a. Turn ON the power to the instrument (switch in the back) and computer.

b. Ensure that Argon supply is set to 15 psi.
c. Double click the Envoy icon on the desktop to initialize the instrument software.

d. Put on the peristaltic pump cassettes. Do not over tighten. At the end of shift, remove them from the pump.

e. Place levers in the 1 o-clock position to avoid stalling the pump.

f. Check that the rinse bottle is full and Luer connections are tight. Only a 'light' finger tightening is required. Refill the rinse tank with a 2.0% Hydrochloric Acid (HCl) solution. For preparation of 2.0% HCl solution, see *T-MET-WI9084*.

g. Check that the 10% stannous chloride bottle is full and Luer connections are tight. Only a 'light' finger tightening is required. For preparation of 10% stannous chloride, see *T-MET-WI9084*.

h. Click the start icon on the Tool Bar to turn on the peristaltic pump and set the gas flow to method programmed conditions.

i. Check to see that the lamp, pump and gas turn on. If necessary, open the Method/Instrument Control Panel and turn them on and set appropriate parameters.

j. When the pump is turning, tighten the cassettes by lowering the levers to a horizontal position. Allow 10 minutes for lamp and pump equilibration.

k. Inspect all system connections for leaks.

l. The system is now ready to be optimized for automated analysis.

2. Autosampler and Run Setup

a. Create the run sequence using Sequence Editor found in the IDAT menu in eLIMS. Water samples by SW-846 7470A, soil samples by SW-846 7471A/B, and water samples by EPA 245.1 are run under a separate calibration.

b. Click on the Sequence Menu, then Open, and then choose your sequence file created from Sequence Editor

c. Each row represents a cup location on one of the racks and its graphical representation updates in the lower "Rack" graphic whenever the Update button is clicked

d. Edit the sequence, if needed. The samples, standards, and Quality Control samples are automatically populated by Sequence Editor.

e. Click the "Update" button to when all samples are entered to populate the navigation tree to the left with the proposed run sequence.

Sample Analysis

1. Filtering Samples

a. Samples that are cloudy or have particulate suspended in solution must be filtered prior to analysis.

b. Using the Filter Mate filtration device, filter the samples and if the filtrate remains cloudy, filter again. Difficult matrix samples or samples with limited volume must be filtered using a 10-mL sterile disposable syringe fitted with a 0.45 um PTFE syringe filter.

c. If any samples are filtered, the PB and the LCS on the batch must be filtered.

d. Document all filtrations on the run cover sheet.

2. Dilutions

a. Dilute samples with appropriate matrix matching solution when necessary to yield a response that falls within the calibration range.

b. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

3. Analysis of samples with Leeman Labs Hydra II Mercury Analyzer

a. Click the "Run Sequence" icon to start the run. If a dialog appears after the Run Sequence icon is clicked, follow the instructions of those prompts to resolve issues before running the sequence.

b. The system adds Stannous chloride to the samples via a "Y" connection in the pump tubing. The peristaltic pump then carries the sample/stannous mix to the liquid gas separator. Argon gas is bubbled through the liquid and used to transport the volatile mercury into the detector. The mercury is reduced with stannous chloride to liberate mercury metal and Tin (IV) chloride.

NOTE: Detailed instructions for the complete instrument setup are found in the Leeman Labs Hydra II Automated Mercury Analyzer Manual.

4. Overnight Shutdown

a. Click on the "sleep" icon to stop argon flow and pump

b. In sleep mode the pump is cycled on periodically to relieve pressure points where the rollers contact the tubing.

c. Remove peristaltic pump cassettes

Never leave bottle of reductant and rinse connected to the instrument if the pump clamps are released because siphoning can occur and cause damage to the instrument.

5. Long-term shutdown (more than 3 days of no operation).

a. Place reductant tubing and rinse tubing into a beaker of reagent water.

b. Run pump until system is flushed of reagents. Send autosampler tip to air.

c. Remove reductant and rinse tubing from beaker to allow the aspirating of air.

d. Run pump until system is flushed of liquid. Some liquid does remain in the liquid/gas separator.

e. Turn OFF the pump.

f. Close Envoy program and power down the instrument.

g. Shut OFF the power to the computer and monitor.

h. Shut down argon gas flow.

Calculations

1. Final Result

   a. Water sample

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Volume}}$$

   b. Solid sample (mg/kg)

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Weight (grams)}}$$

2. Relative percent different (RPD)

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

S = first sample value

D = duplicate sample value

3. Spike recovery

$$\%\ Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = spiked sample result

SR = sample result

SA = spike added

4. Correlation Coefficient

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\left(\sum X^2 - \frac{(\sum X)^2}{N}\right)\left(\sum Y^2 - \frac{(\sum Y)^2}{N}\right)}}$$

Where :

X = the known concentration

Y = the instrument response

N = the total number of data points

5. Serial Dilution

$$\%\ Difference = \frac{(5 \times SDR) - SR}{SR} \times 100$$

Where:

SDR = serial dilution result

SR = sample result

6. Methods of standard additions (MSA)

Take 4 identical aliquots of the same sample. Leave one unspiked. Spike the other 3 aliquots with different levels of a standard solution. Add blank solution to sample aliquots so that the final volume is the same for all. Use small volumes of spiking solution to avoid diluting the sample more than 10%. Analyze the 4 aliquots and record the instrument readings in absorbance. Use the readings and spike values to find the slope and x- and y- intercepts. The x- intercept is the result.

$$\text{Slope} = m = \frac{\sum x_i y_i - (\sum x_i \sum y_i)/n}{\sum x_i^2 - (\sum x_i)^2/n}$$

$$\text{Y-Intercept} = b = \bar{y} - m\bar{x}$$

$$\text{Result} = -\frac{b}{m}$$

$$\text{Correlation Coefficient} = r = \frac{\sum\{(x_i - \bar{x})(y_i - \bar{y})\}}{\sqrt{\left[\sum (x_i - \bar{x})^2\right]\left[\sum (y_i - \bar{y})^2\right]}}$$

The correlation coefficient (r) for the least squares fit must be ³0.995. If the r value is <0.995, the MSA must be repeated at the same dilution. If the r value is again low, the result with the higher r

value is verified and both are flagged with a "+" in the data package. If the r value is <0.990, the sample is run at an interference dilution to overcome matrix effects. This usually requires a raised limit of quantitation. If a client requests a particular limit of quantitation that prohibits further dilution, then the sample is repeated at the same dilution and the best of the two results is verified.

Statistical Information/Method Performance

Generate MDLs and LOQs according to *QA-SOP11892*. The department supervisor maintains annual study data.

QC limits for MS/MSD, and LCS/LCSD are established through statistical analysis of historical data. The limits are maintained in the LIMS for the relevant analysis numbers.

The department supervisor requests that a Quality Assurance Specialist update to the LIMS as needed. Update the department database via a download from the LIMS.

Quality Assurance/Quality Control

Batch Quality Control

1. For the preparation and concentrations of Batch Quality Control see *T-MET-WI9084*.

2. For the frequency, acceptance criteria and corrective action see tables III and IV.

3. For EPA 7470A, 7471A, and 7471B, a digestion batch is up to 20 samples. Each batch must contain a PB, LCS, U, D, MS and MSD (an LCSD is used if there is insufficient sample for an MSD).

4. For EPA 245.1 Rev 3, a digestion batch is up to 10 samples. Each batch must contain a PB, LCS, US, D, and MS (an LCSD is used if there is insufficient sample for an MSD).

Data Review

A. Raw Data Quality Checks

1. Confirm that the batch and cover sheets are correctly labeled, dated, and signed where necessary.

2. Review the batch sheet, project notes and lab notes with the incomplete list for special comments and due dates.

3. Check that the run protocol has been selected correctly.

4. Refer to the calculation section of this SOP for calculations used for Hg analysis.

5. Refer to Tables I and II for instrument calibration and verification frequency, acceptance criteria and corrective action.

6. Refer to Tables III and IV for batch QC frequency, acceptance criteria and corrective action. For information on statistical limits see *QA-SOP11896*.

7. Each analytical run must have a QC review attached. All samples on the run must be listed on the QC review with notation as to whether the sample was verified or needed to be redigested/reanalyzed. The verifier must document on the QC review if any sample(s) were selected/deselected.

8. For spike levels of run and batch QC, see *T-MET-WI9084*.

9. LOQs are available to analysts in the LIMS.

10. Check to make sure that all results are within the calibrations range. If a sample reading is above the calibration range, then reread the sample at an appropriate dilution.

11. Check that the negative value of NDs are greater than negative the LOQ. A technical decision must be made as to whether a reread is warranted for readings = -LOQ.

12. For TCLP and SPLP samples, an MSA (method of standard additions) is required if:

a. The sample concentration falls between 80% to 100% of the regulatory limits AND the MS Recovery is <50%.

13. For all EW samples (samples from public drinking water sources); check the results against the MCL (maximum contaminant level). If an analyte exceeds the MCL, notify a verifier at once so that the supplier can be notified. The verifier must contact the Client Service Representative, who must then notify the Supplier. Suppliers must be notified within 24 hours. Reference *QA-SOP11886*.

B. When raw data checks are complete, check the following:

1. All samples requiring redigestion are listed on the redigestion schedule.

2. Redigest request forms are clipped to the front of the run.

3. The data are uploaded to eLIMS-EP via IDAT by reviewer then verified from eLIMS-EP by a verifier.

4. The data packet is placed in the verification bin.

C. Verification process

1. Confirm that all required pieces of QC have been uploaded to eLIMS-EP and are within specification.

2. If there is partial QC on the current run and the samples have been analyzed more than once, check to see if there are associated runs in the hold bin waiting on additional QC to be verified.

3. In eLIMS-EP, choose method of verification. (Metals verification by run or verify by individual element).

4. Ensure that all lab notes and project notes were followed.

5. Non-compliant data can be reported only after all required corrective actions have been taken. Document the nonconformance using *Q-EQA-FRM6869*.

6. Once all of the elements are verified for a digest, verify the digest number. Associated tracking numbers or suite numbers will be auto-verified after all of the metals are verified.

Instrument Maintenance and Repair

A. Routine Maintenance

1. Replace the pump tubing as needed under normal daily usage.

2. On an as needed basis, check the optical cell and windows, and if needed, clean the optical cell.

   a. Wipe the optical cell with a soapy solution (one drop of liquid Ivory soap to 500 mL reagent water) and warm tap water.

   b. Rinse with reagent water and dry. To speed the drying of the optical cell, connect the heater plug to the optical cell with the windows off for several minutes.

   c. Clean the quartz windows with methanol and a piece of lens paper.

3. Document any maintenance in the Mercury maintenance logbook located next to the instrument.

NOTE: Detailed instructions for the maintenance and troubleshooting of the Leeman Labs Mercury Analyzer can be found in the Leeman Labs Hydra II Mercury Analyzer Manual.

B. Taking an instrument/analysis out of service/returning an instrument/analysis to service.

NOTE: In the event of an equipment failure, perform the steps in SOP *QA-SOP11901*:

1. Document the nature of the failure in the maintenance logbook.

2. Document how and when the defect was discovered.

3. Notify a supervisor or experienced analyst to determine a person who can decide on appropriate action to take.

4. The instrument must be clearly tagged as Out of Service. The tag must contain the following information:

    a. Date taken out of service.

    b. Employee who took the instrument out of service.

    c. Reason for tagout.

5. The date taken out of service and the date returned to service must be documented in the logbook.

6. Document any corrective action that was taken and the result of that corrective action (i.e., system calibration within specifications, etc.) to bring the equipment back into service.

7. Supervisory personnel must perform a documented evaluation and review of instrumentation/equipment where a major or uncommon failure has occurred to assess the potential impact the failure could have on the calibration and/or qualification of the instrument.

8. After a repair, document whether the function has been fixed. Calibration or verification activities are to be performed before the instrumentation is put back into service.

Tables

Table I: Calibration Requirements and Corrective Actions EPA 245.1 Rev 3

	Frequency	Acceptance	Corrective Action
Calibration	The calibration contains a blank and 5 standards.	Correlation coefficient >0.995	If the correlation coefficient is not met, confirm instrument conditions (i.e. check pump tubing and gas liquid separator). Reanalyze the curve, if the correlation

			coefficient is acceptable, proceed with sample analysis. If the correlation coefficient is not met after reanalysis, redigest and reanalyze the curve and all associated samples.
Initial Calibration Verification (ICV)	Must be analyzed immediately following the calibration.	±5% of True Value If the ICV is out of specification high report the elements that are < LOQ. For elements > LOQ, data cannot be reported. EW Samples are not acceptable if the ICV is out of spec.	For samples >LOQ, the instrument must be recalibrated and samples reanalyzed. Confirm instrument conditions (i.e. check pump tubing and gas liquid separator). Reanalyze the ICV, if the recovery is acceptable, proceed with sample analysis. If the acceptance criteria are not met after reanalysis, redigest and reanalyze the curve and all associated samples. EW samples must be reported with an acceptable ICV.
Initial Calibration Blank (ICB)	Must be analyzed immediately following the ICV	Must be <MDL	Data cannot be reported from the run (reanalyze).
Contract Required Detection Limit (CRA)	Must be analyzed immediately after the ICB	±50% of the true value	Data cannot be reported from the run (reanalyze).
Continuing Calibration Verification (CCV)	Must be analyzed at the frequencyof every 10 samples and at the end of the analytical run.	±10% of the true value If the CCV is out of specification high	Data bracketing the CCV cannot be reported from other samples on the run (reanalyze)*.

		and the sample is not < - LOQ, accept samples that report as non-detect. EW samples must be reported with acceptable bracketing CCV.	
Continuing Calibration Blank (CCB)	Must be analyzed immediately following CCVs at a frequency of every 10 samples.	Must be <MDL	Data bracketing the CCB cannot be reported from the run (reanalyze)*

Table II: Calibration Requirements and Corrective Actions EPA 7470A, 7471A/B

	Frequency	**Acceptance**	**Corrective Action**
Calibration	The calibration contains a blank and 5 standards.	Correlation coefficient >0.995	If the correlation coefficient is not met, confirm instrument conditions (i.e. check pump tubing and gas liquid separator). Reanalyze the curve, if the correlation coefficient is acceptable, proceed with sample analysis. If the correlation coefficient is not met after reanalysis, redigest and reanalyze the curve and all associated samples.
Initial Calibration Verification (ICV)	Must be analyzed immediately following the calibration.	±10% of True Value If the ICV is out of specification high, report the elements that are < LOQ (elements > LOQ require corrective action)	Confirm instrument conditions (i.e. check pump tubing and gas liquid separator). Reanalyze the ICV, if the recovery is acceptable, proceed with sample analysis. If the acceptance criteria are not met after reanalysis, redigest and reanalyze the curve and all associated samples. The instrument is recalibrated and EW samples reanalyzed.
Initial Calibration Blank (ICB)		Must be <lLOQl	Data cannot be reported from the run (reanalyze).

	Must be analyzed immediately following the ICV		
Contract Required Detection Limit (CRA) Limit of Quantitation Check Standard	Must be analyzed immediately after the ICB	For 7470A and 7471A: ±50% of the true value For 7471B: ±30% of the True Value	Data cannot be reported from the run (reanalyze).
Continuing Calibration Verification (CCV)	Must be analyzed after every 10 samples and at the end of the analytical run.	±20% of the true value If the CCV is out of specification high, samples that are < LOQ may be reported. EW Samples are not accepted if out of spec.	Data bracketing the CCV cannot be reported from other samples on the run (reanalyze)* Samples >LOQ are reanalyzed. EW samples are not accepted if the CCV is out of specification.
Continuing Calibration Blank (CCB)	Must be analyzed immediately following CCVs at a frequency of every 10 samples.	Must be <lLOQl	Data bracketing the CCB cannot be reported from the run (reanalyze)*

* If the CCV/CCB are out of specification, it can immediately be re-read in duplicate. If both CCV/CCBs are within specification, the data from the last acceptable verification is reanalyzed. If one or both CCV/CCBs are still out of specification, then the run is terminated and the samples after the last good CCV/CCB must be reanalyzed on a new run.

Table III: Batch QC Criteria and Corrective Actions for EPA 245.1 Rev 3

	Frequency	**Acceptance**	**Corrective Action**
Preparation Blank (PB)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	IPBl must be < 2.2x MDL. Not applicable if analyte reading in the sample is >10× the PB reading or non-detect. EW samples are not accepted for any reason if	Redigest all associated samples.

		the PB is out of specification.	EW samples must be redigested.
Laboratory Control Standard (LCS)	Must be prepped at a frequency if 1 per analytical batch of 10 samples or less. *Note: The LCS is spiked at or below the MCL for drinking water. See *QA-SOP11886* for MCL level.	Use statistical limits, or the method limit of ±15%, as indicated by the client requirement. If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken. EW samples are not accepted if the LCS is out of specification.	Redigest all associated samples if the LCS is out of specification low. If the LCS is out of specification high, redigest samples that are greater than the LOQ. EW samples must be redigested.
Laboratory Control Standard Duplicate (LCSD)	If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a frequency of 1 per analytical batch of 10 samples or less. *Note: The LCS is spiked at or below the MCL for drinking water. See *QA-SOP11886*. for MCL level.	Use statistical limits, or the method limit of ±15% As indicated by the client requirement. If the LCSD is out of specification high and the sample result is less than the LOQ the data can be taken. EW samples are not accepted if the LCS is out of specification. RPD must be <20%.	Redigest all associated samples if the LCSD is out of specification low. If the LCSD is out of specification high, redigest samples that are greater than the LOQ. EW samples must be redigested. Redigest if RPD is out of specification
Matrix Spike (MS)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	Use statistical limits or the method limit of ±30% whichever is tighter. (PW,EW) Use statistical limits or the method limit of ±20% whichever is tighter (WW)	The data is flagged in the QC Summary and/or in the data package.
Duplicate (D)	Must be prepped at a frequency of 1 per analytical batch of 10 samples or less.	If the samples are >5× the LOQ the RPD must be <20%.	The data is flagged in the QC Summary and/or in the data package.

		If either the sample or duplicate is <5× the LOQ the difference between the two values must be <LOQ.	

Table IV: Batch QC Criteria and Corrective Actions for EPA 7470A, 7471A and 7471B

	Frequency	Acceptance	Corrective Action
Preparation Blank (PB)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	IPBl must be < ½ LOQ . For 7470A and 7471A: Not applicable if analyte reading in the sample is >20× the PB reading or <LOQ. For 7470B and 7471B: Not applicable if analyte reading in the sample is >10× the PB reading or <LOQ.	Redigest all associated samples.
Laboratory Control Standard (LCS)	Must be prepped at a frequency if 1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of ±20%, as indicated by the client requirement. If the LCS is out of specification high and the sample result is less than the LOQ the data can be taken.	Redigest all associated samples if the LCS is out of specification low. If the LCS is out of specification high, redigest samples that are greater than the LOQ.
Laboratory Control Standard Duplicate (LCSD)	If insufficient sample volume is submitted to perform batch QC then a LCSD is prepped at a frequency of 1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of ±20%, as indicated by the client requirement. If the LCSD is out of specification high and the sample result is less than the LOQ the data can be taken. RPD must be <20%.	Redigest all associated samples if the LCSD is out of specification low. If the LCSD is out of specification high, redigest samples that are greater than the LOQ. Redigest if RPD is out of specification
Matrix Spike (MS)	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	Use statistical limits or the method limit of ±20% whichever is tighter.	The data is flagged in the QC Summary and/or in the data package.
Duplicate (D)			

	Must be prepped at a frequency of 1 per analytical batch of 20 samples or less.	If the samples are >5× the LOQ the RPD must be <20%. If either the sample or duplicate is <5× the LOQ the difference between the two values must be <LOQ.	The data is flagged in the QC Summary and/or in the data package.

Q-EQA-FRM6869 Nonconformance Form
QA-SOP11178 Demonstrations of Capability
QA-SOP11886 Processing Regulatory Compliance (i.e. SDWA, NPDES) Samples
QA-SOP11892 Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896 Establishing Control Limits
QA-SOP11901 Instrument Maintenance and Calibration
T-MET-WI11924 Digestion of Aqueous Samples by SW-846 Method 7470A
T-MET-WI11948 Preparation of Solids by EPA 7471A or B for Mercury Analysis
T-MET-WI26740 Digestion of Aqueous Samples for Mercury by EPA 245.1
T-MET-WI9084 Preparation of Mercury Solutions and Standards

End of document

Version history

Version	Approval	Revision information
16	27.NOV.2015	
17	04.MAR.2019	
18	29.JUL.2019	

eurofins	Always check on-line for validity. **Digestion of Aqueous Samples by SW-846 Method 7470A**	Level: **Work Instruction**
Document number: **T-MET-WI11924**		
Old Reference: **1-P-QM-WI-9015082**		
Version: **21**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **12-AUG-2019**	Document users: **6_EUUSLA_Metals_Hg Prep, 6_EUUSLA_Metals_Hg Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

LIMS ID
5713

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Revision Log
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Cross Reference
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Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
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Revision Log

Revision: 21	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout document	New procedure	Removed reference to EPA 245.1 method and scans
Procedure A.	Reduce volume required	Changed sample volume from 40 to 20 mL and scaled all reagents accordingly.

Revision: 20	**Effective Date:**	March 19, 2019
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Through out Document	Update	Updates SOP references to D4 numbers
Reference Modification	No change to chemistry	Removed section
Procedure A	Current Practice	Added procedure for samples that are not split. Added that hydroxylamine is added in the prep lab.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

2. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI9084	Working Instructions for Preparation of Mercury Solutions and Standards
T-MET-WI7965	Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA

Scope

This procedure is used for automated and manual digestion of samples and standards for Mercury analysis in aqueous samples by SW-846 Method 7470A.

Basic Principles

The samples are digested with nitric acid, sulfuric acid, potassium permanganate, and potassium persulfate to oxidize mercury compounds to mercuric ions. Mercuric ions are reduced to mercury metal using stannous chloride. Mercury measurement is performed using the mercury cold vapor technique.

The DEENA Automated Sample Preparation System utilizes automated addition of reagents, heating, and filling to final volume to digest Mercury samples.

Interferences

Not applicable to this procedure.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO3) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes, or use the designated dispensing equipment.

Sulfuric acid (H2SO4) – This acid is a strong oxidizing agent and can cause severe burns. Sulfuric acid spills are extremely slippery, adding to the danger. Always use in a fume hood, or use the desinated dispensing equipment. Never mix with concentrated HCl or concentrated KMNO4 to avoid a violent reaction (explosive splattering and extreme heat).

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCI with concentrated H2SO4 to avoid a violent reaction. Always use in a fume hood, or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X -A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each employee performing the digestion must work with an experienced employee for a period of time until they can independently perform digestions. Proficiency is measured through documented audits of the tasks listed as well as an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (LCS's) that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Aqueous samples are collected in plastic or glass containers (drinking water sample volume is 1-L). Samples are preserved to a pH of <2 with nitric acid at collection and the pH is checked upon receipt and adjusted as necessary by Sample Support; samples that are pH adjusted at the laboratory must not be digested for a minimum of 24 hours. If samples fail to maintain a pH of <2 the Client Representative is notified for further direction. Samples are stored at 0 to 6°C, not frozen, prior to digestion. Samples must be analyzed within 28 days of collection.

Dissolved Mercury: Samples are to be filtered within 15 minutes of collection by the client. Clients may submit unpreserved bottles to the lab for dissolved mercury analysis. The sample is run through a 0.45 micron filter within 5 days of receipt and then preserved to a pH of <2 with HNO3.

Digested samples are stored in plastic bottles at room temperature. Store samples, standards, and digested samples separately.

Apparatus and Equipment

1. 50-mL polypropylene containers and covers (digestion vessels for block digestion) – certified clean and Class A equivalent

2. Environmental Express HotBlock (block digester) – adjustable and capable of maintaining a sample temperature of 95°C.

3. LLENS – the computer program that integrates a PC with an analytical balance to collect data directly from the balance. The program organizes the data and transmits the readings to the LIMS.

Reagents and Standards

1. For standards preparation, shelf life, and storage conditions, see ***T-MET-WI9084***. This form also has instructions for the initial preparation of Method Blanks, LCSs, Matrix Spikes and General Solutions.

2. Store all standards and reagents at room temperature. Label the container with the solution name, lot number, date prepared, the expiration date, the initials of the person preparing the solution, and the storage conditions.

3. Standard/ spiking concentration and reagent vendors are subject to change without notification.

4. Nitric acid, 70.0% to 71.0% HNO3, Fisher Trace Metal Grade reagent, 1.428 g/mL, or equivalent. Follow manufacturer's expiration date.

5. Sulfuric acid, 95.0% to 98.0%, H2SO4, 36 N, Fisher reagent, ACS, 1.84 g/mL, or equivalent. Follow manufacturer's expiration date.

6. Potassium permanganate, KMnO4, Baker Analyzed reagent, ACS, or equivalent. Follow manufacturer's expiration date.

7. Potassium persulfate, K2S2O8 Baker Analyzed reagent, ACS, or equivalent. Follow manufacturer's expiration date.

8. Sodium chloride, NaCl, J.T. Baker, Certified ACS, or equivalent. Follow manufacturer's expiration date.

9. Hydroxylamine hydrochloride, NH2OH·HCl, J.T. Baker, Certified ACS, or equivalent. Follow manufacturer's expiration date.

10. Stannous chloride, SnCl, Baker Analyzed reagent, ACS, or equivalent. Follow manufacturer's expiration date.

11. Hydrochloric acid, HCl, 36.5% to 38.0%, Fisher Trace Metal Grade reagent, 1.194 g/mL or equivalent. Follow manufacturer's expiration date.

Calibration

Not applicable to this procedure

Procedure

A. Manual hot block digestion

1. Turn block digester on and allow block to reach the Control Point setting that provides 95° ± 1°C sample temperature.

2. Before digestion, check the temperature with a calibrated thermometer and record in the logbook.

3. If the sample to be digested is not in split bin location:

a. print label with the LLI Sample ID and batch number from LLENS and place on sample digestion containers.

b. Shake sample well.

c. Transfer 20 mL of well-mixed sample (or an aliquot diluted to 20 mL) into the polypropylene container. If a different final volume is necessary, adjust reagent volumes accordingly.

4. Prepare batch QC and calibration standards. See *T-MET-WI9084* for preparation instructions and concentrations. See the Quality Assurance/Quality Control section for the required batch QC.

NOTE: Exception - For leachate batches containing leachate spiked QA samples. Use one of the leachate spiked QA samples as the batch QC matrix spike and matrix spike dup, and proceed with the spiking procedures for the LCS according to ***T-MET-WI9084***.

6. Add 1 mL of H2SO4 and mix.

7. Add 0.5 mL of HNO3 and mix.

8. Add 3 mL of 5% KMnO4 solution and mix.

9. Allow the sample to stand for 15 minutes and then check sample for purple color.

a. purple color does not persist for at least 15 minutes, perform a dilution on the sample beginning with a DF5.

b. Continue diluting in increments of 5 or 10 until the purple color persists for at least 15 minutes.

10. Add 1.6 mL of 5% K2S2O8 solution and mix.

11. Place containers in block digester.

12. Place a calibrated thermometer in method blank container.

13. Put a polypropylene cover on each container. Remove after the samples reach 95° ± 1°C.

14. Heat for 2 hours in the block digester at 95° ± 1°C. The temperature is checked with a calibrated thermometer and recorded in the logbook.

15. Remove samples from block digester and cool.

16. Add 1.2 mL of 12% sodium chloride/hydroxylamine hydrochloride solution to reduce excess permanganate (color change is from purple to colorless). If the solution is not colorless, add reductant in 1-mL increments until KMnO4 is completely reduced.

17. Screw on cap and shake sample

18. Adjust the volume to 20 mL with reagent water and mix. Reserve for analysis.

NOTE: The block temperature is different than the temperature of the liquid being digested.

B. Block Digester Instructions:

1. Turn block digester on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. Press and hold STAR (*) key.

4. The display shows the Set Point Temperature.

5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

NOTE: Polypropylene containers must not be heated above 130°C.

Calculations

Not applicable

Statistical Information/Method Performance

Not applicable

Quality Assurance/Quality Control

1. Each digestion batch is up to 20 samples.

2. Each digestion batch must contain a method blank, LCS, U, D, and MS. If insufficient sample for a duplicate or per client requirement, an LCSD is added to the batch.

   a. Method Blank – equivalent to a Preparation Blank (PB).

b. LCS/LCSD – Laboratory Control Sample/ Laboratory Control Sample Duplicate

c. U – unspiked background sample

d. D – duplicate

e. MS (R) – Matrix Spike

f. MSD (M) – Matrix spike duplicate

T-MET-WI7965 Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA
T-MET-WI9084 Preparation of Mercury Solutions and Standards

End of document

Version history

Version	Approval	Revision information
19.1	22.MAY.2017	
20	19.MAR.2019	
21	29.JUL.2019	

eurofins	Always check on-line for validity. **Ignitability of Solids by 40 CFR, Part 261.21**	Level: **Work Instruction**
Document number: **T-WC-WI10627**		
Old Reference: **1-P-QM-WI-9012741**		
Version: **8**		Organisation level: **5-Sub-BU**
Approved by: **UKA4** Effective Date **09-NOV-2015**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

LIMS ID
Analysis 0542

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Revision Log

Revision: 8		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflects re-identification of documents in EtQ	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers
Document Title	Enhancement	Add method: Ignitability of Solids by 40 CFR, Part 261.21

Revision: 8	**Effective Date:** This version	
Sample Collection, Preservation and Sampling	Reflects current industry standards	Replaced 4° ± 2°C with 0° to 6°C, not frozen.

Revision: 07	**Effective Date:** May 13, 2011	
Section	**Justification**	**Changes**
Revision Log	Formatting requirements per LOM-SOP-LAB-201	Removed revision logs up to the previous version.
Safety Precautions and Waste Handling	Formatting requirements per LOM-SOP-LAB-201	Added required text
Personnel Training and Qualifications	Formatting requirements per LOM-SOP-LAB-201	Added required text
Sample Collection, Preservation and Handling	Clarification	Expanded container and storage condition information
Calibration	Formatting requirements per LOM-SOP-LAB-201	Added required section

Reference

1. *40 CFR, Part 261.21*.

2. *Chemical Hygiene Plan,* current version.

Cross Reference

Document	Document Title
Analysis #0430	Determination of Flash Point for Liquids and Solids
1-P-QM-QMA-9015389	Balance, Syringe, Pipette Verification
1-P-QM-QMA-9021767	Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing

Scope

This method is applicable to testing solid samples for ignitability. Analyze liquid samples using Analysis #0430.

The overall test allows clients to classify their solid waste for the RCRA characteristic of ignitability using the definitions listed in the *Code of Federal Regulations* (40 CFR 261.21).

Basic Principles

The CFR defines a solid waste as ignitable if “it is not a liquid and is capable, under conditions of standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard.”

Since no official method exists for checking ignitability of solids, this in-house method was developed after consultation with the US EPA and Texas Water Commission.

Interferences

Not applicable to this procedure.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst’s training records.

Analysts are considered proficient when they have successfully demonstrated competency under supervision of a group leader or other trained analyst.

Sample Collection, Preservation, and Handling

Samples for the analysis must be unpreserved, collected in glass containers and refrigerated at 0° to 6°C, not frozen, up to the time of analysis. Analyze at room temperature within 28 days of collection.

Apparatus and Equipment

1. Crucible, aluminum pan, or equivalent

2. 400 grit size sandpaper, or equivalent

3. Pensky-Martens closed cup tester

4. Glass stirring rod, or equivalent

5. Pan balance or equivalent. Refer to 1-P-QM-QMA-9015389.

6. Bunsen burner (needed for samples that yield a positive flash during the closed-cup portion of the analysis)

Reagents and Standards

Not applicable to this procedure.

Calibration

Balances must be calibrated each day before use. Refer to 1-P-QM-QMA-9015389.

Procedure

Record data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

1. Weigh approximately 5 g of sample. Leave the sample in contact with air for 10 minutes. If the sample shows any signs of spontaneous combustion upon exposure to air, it is considered spontaneously ignitable.

2. Add approximately 5 mL of reagent water dropwise, to approximately 5 g of sample. Observe the sample at all times for signs of combustion. If the sample shows any signs of combustion upon contact with water, it is considered ignitable.

3. Using a glass-stirring rod, rub approximately 1 g of sample against extremely fine sandpaper (400 grit size). Perform this test under a hood. Maintain a safe working distance from the sample. If the sample shows any signs of combustion during the test, it is considered ignitable by friction.

4. Fill the cup of a closed-cup flash point tester half full with sample. Allow the sample to sit in the closed cup for 5 minutes at room temperature, then test the sample for ignitable fumes following Analysis #0430, **except do not stir and do not heat the sample.** If the fumes ignite, it is considered ignitable by a closed-flame source. If the fumes do ignite, proceed to Step 5.

5. If the fumes do ignite in Step 4, hold an approximately 5 g portion of the sample over a Bunsen burner to confirm the sample itself is ignitable. Remove sample from the flame and carefully document all reactions in the raw data logbook.

NOTE: After all portions of the analysis are complete, edit Comment #252 appropriately in LIMS.

Calculations
No calculations are needed for this analysis.

Statistical Information/Method Performance
Not applicable to this procedure.

Quality Assurance/Quality Control
No quality assurance procedures are available for this analysis.

End of document

Version history

Version	Approval	Revision information
8	09.NOV.2015	

eurofins	Always check on-line for validity. **pH by EPA 9045C, 9045D and Corrosivity by SW-846 Chap 7 of Solids, Soils, and Solvents using Electrometic Methods**	Level: **Work Instruction**
Document number: **T-WC-WI11518**		
Old Reference: **1-P-QM-WI-9011685**		
Version: **13**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **08-JUL-2019**	Document users: **6_EUUSLA_Water Quality_24/48 Hour Analyst, 6_EUUSLA_Water Quality_24/48 Hour Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

LIMS ID
Analysis 0394, 0496

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Revision Log

Revision	13	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Procedure 11	Clarification		Added how solid pH is reported (soil pH measured in water at recorded temp at time of analysis)

Revision	12	**Effective Date:**	Jul. 27, 2018
Section	**Justification**		**Changes**

Revision	12	**Effective Date:**	Jul. 27, 2018
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Title	Not applicable to SOP		Removed EPA 150.1
Reference	Not applicable to SOP		Removed EPA 150.1 and SM 20th Ed.
Personnel Training and Qualifications	Clarification		Added verbiage on IDOC
Statistical Information/Method Performance	Correction		Removed 9045C method reference and replaced with not applicable

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 9045C, January 1995.
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 9045D, November 2004.
3. Test Methods for Evaluating Solid Wastes, SW-846 Chapter 7.
4. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-WC-WI11519	pH Probes and Meters
T-WC-WI10360	Quality Control Data for Wet Chemistry
QA-SOP11880	Balance, Syringe, and Pipette Verification

Scope

This SOP provides the guidelines for analysts performing pH on solid, soil, and solvent samples. This procedure is applicable to solid/soil/solvent samples.

The sensitivity limit for this technique is 0.01 pH units.

Basic Principles

A 1:1 slurry is prepared and the activity of hydrogen ions in the supernatant is measured using a combination pH electrode.

Determination of corrosivity (LIMS #496) is based on the pH value of the sample.

Reference Modifications

Method 9045C/D has been modified for the analysis of solid, soil, and solvent samples in the following ways:

1. An Automatic Temperature Compensator is used for all samples instead of manually performing calculations to correct measured pH values if the sample and buffer solution temperatures differ by more than 2°C.

2. 25 g of soil to 25 g reagent water is used instead of the 20 g: 20 mL ratio.

3. The samples are tumbled for approximately 30 minutes instead of being stirred with a stir bar for 5 minutes.

These modifications are performed in order to allow for adequate agitation and to provide sufficient supernatant to immerse the pH electrode during analysis.

Interferences

Interferences occur when oily or particulate matter adheres to the electrodes and reduces the response. Gentle wiping or rinsing with reagent water usually corrects this problem. Temperature effects are compensated for by calibrating the pH meter at the temperature of the sample or using a pH meter equipped with temperature compensators. There are no means of controlling temperature effects caused by shifts in ionic equilibria of the sample.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention. Standard safe laboratory procedure must be followed as outlined in the Chemical Hygiene Plan.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four pH readings of the 7.00 pH buffer (which is used as the laboratory control standard) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Sample must be collected in an unpreserved container and stored at 0° to 6°C; not frozen, until the time of analysis. There is no published holding time for pH analysis on soil; analysis is performed as soon as possible after sample is received in the laboratory.

Apparatus and Equipment

1. Analytical balance capable of weighing 0.0001 g

2. pH meter equipped with an ATC probe (Automatic Temperature Compensator)

3. Combination electrode or equivalent

4. Stir bar and stir plate

Reagents and Standards

1. 7.00 pH Buffer (ISO 17025 approved vendor) – purchased; see container for shelf life information.

2. Appropriate pH electrode filling solution for electrode, purchased. Store at room temperature. See label for expiration date.

Calibration

Balances must be calibrated each day before use. Refer to *QA-SOP11880*.

Calibrate pH meter as described in *T-WC-WI11519*.

Procedure

1. Calibrate the pH meter

2. Weigh 25 ± 0.5 g of sample into a clean specimen cup and add 25 ± 0.5 mL of reagent water (makes a 1:1 slurry).

If the sample absorbs the water, add an additional 25 ± 0.5 mL of reagent water (makes a 1:2 slurry). If a 1:2 slurry does not provide sufficient supernatant to immerse the pH electrode, use less sample and add reagent water in proportion to the weight selected. Enter a comment in the databook indicating the dilution.

3. Tightly place the screw-cap lid on the sample and mix the slurry in the tumbler for approximately 30 minutes.

4. Remove the sample from the tumbler and allow the sample to settle for about 1 hour.

5. Rinse and shake off any water on the electrodes.

6. Dip the electrodes into the supernatant (aqueous layer) of the sample and allow to equilibrate. If necessary, decant or pipette this layer into another container.

7. Using the calibrated pH meter note the pH value of the sample after the meter equilibrates, and enter the value in the corresponding laboratory data notebook.

NOTE: If pH reading is < 4.00 or >10.00, then the pH result will be reported with a qualifying flag.

8. Note the temperature of the sample and record the value in the corresponding laboratory data notebook.

9. Rinse and clean the electrodes before proceeding to the next sample.

10. This method is also used to determine corrosivity (LIMS ID# 0496). To do this, the pH value and the corresponding corrosivity determination are entered as a "see below" Comment. (A sample is typically considered corrosive if the pH is <2 or >12). When determining corrosivity, three repeat pH measurements must be performed on each sample to verify that the pH does not differ by more than 0.1 pH unit. Record each measurement in the laboratory data notebook.

11. The sample result is reported as soil pH in water at __ C, where __ C is the temperature at which the test is conducted.

Calculations
Not applicable.

Statistical Information/Method Performance
Not applicable to this procedure

Quality Assurance/Quality Control
A Laboratory Control Standard (LCS; 7.00 pH Solution) must be analyzed at the beginning of each batch. A CCV (7.00 pH Solution) must be analyzed after every ten samples and at the end of the batch. If the meter is resloped, a LCS must be analyzed after calibration is performed. One batch consists of no more than 20 samples.

Two matrix duplicates must be analyzed per batch of 20 samples. If 10 or less samples are on a batch than only one matrix duplicate is needed. When analyzing for Corrosivity, a pH check using buffers 2 and 12 must be analyzed before analyzing the sample. See Analysis Summary in the LIMS for current quality control acceptance windows. Refer to *T-WC-WI10360* if any of the QC samples do not meet required specifications.

QA-SOP11880 Balance, Syringe, Pipette, and Labware Verification
T-WC-WI10360 Quality Control Data for Wet Chemistry
T-WC-WI11519 pH Probes and Meters

End of document

Version history

Version	Approval	Revision information
11	13.OCT.2016	
12	27.JUL.2018	
13	27.JUN.2019	

eurofins	Always check on-line for validity. **Reactivity of Waste**	Level: **Work Instruction**
Document number: **T-WC-WI11574**		
Old Reference: **1-P-QM-WI-9013027**		
Version: **14**		Organisation level: **4-Laboratory Site**
Approved by: **UCSS** Effective Date **07-AUG-2014**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

LIMS ID
Analysis 1121

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Revision Log

Revision: 14		**Effective Date:** This version
Section	**Justification**	**Changes**
Title	Formatting requirement	Change title to *Reactivity of Waste*
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflects re-identification of documents in EtQ No longer in use	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers Replaced LOM-SOP-LAB-208 with 1-P-QM-QMA-9015389

Revision: 14		**Effective Date:** This version
Reference	Additional documentation is appilcable	Added 40 CFR 261.23
Cross Reference	Reflects applicable documents	Replaced LOM-SOP-LAB-208 with 1-P-QM-QMA-9015389
Sample Collection, Preservation and Handling	Compliance	Changed 4° ± 2°C to 0° to 6°C, not frozen

Revision: 13		**Effective Date:** Aug 09, 2012
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per LOM-SOP-LAB-201	Removed revision logs up to the previous version
Sample Collection, Preservation and Handling	Resolve disparity between procedure and Parallax	Hold time from 'within 30 days of collection' to 'not regulated".

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Chapter 7.3, December 1996.

2. U.S. Government (1999), *Characteristic of reactivity*, 40 CFR 261.23, Appendix C.

3. *Chemical Hygiene Plan, current version.*

Cross Reference

Document	Document Title
Analysis 0237, 1123, 1549, 5895, 5898, 8255, 0241, 4814, 0961, 0957, 0959	Determination of Total and Amenable Cyanide in Water, Wastewater, and Soils, Free Cyanide in Water and Wastewater, Reactive Cyanide of Solids, and Weak Acid Dissociable Cyanide in Waters and Soils
Analysis #1122	Reactive Sulfide
1-P-QM-QMA-9017328	Reagents and Standards
1-P-QM-QMA-9015389	Balance, Syringe, Pipette Verification
1-P-QM-QMA-9021767	Laboratory Notebooks, Logbooks, and Documentation for Environmental Testing

Scope

This method is applicable to all wastes except those that form explosive mixtures when acidified. This method measures only the hydrocyanic acid and hydrogen sulfide evolved under these test conditions. It is not intended to measure other forms of cyanide or sulfide. This method is applicable for all concentration ranges.

Basic Principles

A measured amount of sample is treated with diluted acid in a closed system. This may convert the cyanide and the sulfide in the sample to gas. The gas is carried by a nitrogen stream into a gas-scrubbing bottle containing sodium hydroxide solution. The base traps the cyanide and sulfide. The sulfide is quantitated using Analysis #1122 and the cyanide is quantitated using the method described in analysis 0237.

Definitions

The regulation in 40 CFR 261.23 defines reactive wastes to include wastes that have any of the following properties:

1. Readily undergo violent chemical change.

2. React violently or form potentially explosive mixtures with water.

3. Generate toxic fumes when mixed with water.

4. Explode when subjected to a strong initiating force.

5. Explode at normal temperatures and pressures.

6. Fit within the Department of Transportation's forbidden explosives.

A definition of reactivity for this method is as follows: A cyanide or sulfide bearing waste is considered reactive if it, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or to the environment.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Use special precautions when handling KCN and $Na_2S \cdot 9H_2O$ as they are extremely toxic. Perform analysis in a hood or well-ventilated area to avoid inhalation.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Analysts are considered proficient when they have successfully completed a Demonstration of Capability. Demonstration of Capability consists of four check standards that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Demonstration of Capability is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling

Collect samples in glass containers with no headspace. Refrigerate at 0° to 6°C, not frozen, until analysis. The holding time is not regulated.

Do not homogenize samples before analysis to prevent unwanted aeration.

Use bottle code #74 when possible.

Apparatus and Equipment

1. Each analytical setup requires the following:

   a. Stirring apparatus – To achieve approximately 30 rpm

   b. Round-bottom distillation flask – 500 mL, tri-neck, with 24/40 ground glass joints or equivalent

   c. Addition funnel with pressure equalizing tube and 24/40 ground-glass joints or equivalent

d. 24/40 ground-glass stopper and keck clips or equivalent

e. Gas washing bottle (sufficient size to accommodate 500 mL of sodium hydroxide as the scrubbing solution) with scrubber assembly or equivalent

f. Flexible tubing

(**Assembly of this apparatus is shown in Figure 1.**)

2. Flowmeter or equivalent

3. Balance capable of weighing to 0.001 gram. Refer to 1-P-QM-QMA-9015389.

Reagents and Standards

Alternate weights and volumes are acceptable as long as final concentrations remain the same. Refer to 1-P-QM-QMA-9017328 for the proper labeling and documentation of reagent preparations.

1. Sulfuric acid (0.05M)

   a. Pipette 2.8 mL concentrated H_2SO_4 into reagent water and dilute to 1000 mL.

   b. Stable one year.

   c. Store in plastic container at room temperature.

2. Sodium hydroxide solution (1.25 N)

   a. Dissolve 50 ± 1 g of NaOH in reagent water and dilute to 1000 mL.

   b. Stable one year.

   c. Store in plastic container at room temperature.

3. Sulfide reference solution

   a. Dissolve 2.01 ± 0.01 g $Na_2S{\cdot}9H_2O$ in reagent water and dilute to 500 mL in a volumetric flask.

b. **Prepare fresh daily**. (This solution is approximately 570 mg/L hydrogen sulfide). Use for LCS and spiking solution.

NOTE: The cyanide reference solution is provided by the department that performs analysis 0237. The preparation of the cyanide reference solution is not covered in this method.

Calibration

Check the flow rate every 6 months using an NIST traceable flow meter. Record the NIST reading for each flow meter in the flow meter logbook. The acceptance range of the flow rate is ±10% of the flow meter setting.

Balances must be calibrated each day before use. Refer to 1-P-QM-QMA-9015389.

Procedure

Record the data in a raw data logbook following instructions in 1-P-QM-QMA-9021767.

1. Place 100 mL of 1.25 N NaOH and 400 mL of reagent water into the gas-washing bottle.

2. Weigh 10.000 ± 0.5 g of sample (solid or liquid) directly into the tri-neck distillation flask and record the amount in the raw data logbook.

Blank, LCS, and MS/MSD Preparation

a. For the blank and LCS, weigh 10 ± 0.5 g sea sand or glass beads.

b. Before closing the system add 10mL of the standard reference solution to the LCS, MS and MSD flasks.

3. Add a magnetic stirring bar into the flask.

4. In a hood, assemble the glassware apparatus as shown in Figure 1.

5. Place 25 mL of 0.05M H_2SO_4 and 225 mL reagent water into the addition funnel with the stopcock closed.

6. Check all the clips and securely close the system.

7. Begin purging the system with nitrogen gas. Adjust the flow rate to 60 mL/min.

8. With the nitrogen gas flowing, open the addition funnel stopcock to add the diluted H_2SO_4 directly into the flask.

9. Begin magnetically stirring the sample as the acid is entering the tri-neck flask and continue to stir at a constant rate throughout the test.

NOTE: Avoid creating a vortex while stirring.

10. After 30 minutes, turn off the nitrogen gas flow and disconnect the scrubber assembly.

11. Analyze the contents of the scrubber solution for reactive sulfide using Analysis #1122.

12. Subsample a small portion of the scrubber solution into a vial to be analyzed for cyanide using analysis 0237.

Calculations
Not applicable to this procedure.

Statistical Information/Method Performance
Not applicable to this procedure.

Quality Assurance/Quality Control
A batch is limited to 20 samples or less.

One method blank, a 570 mg/kg sulfide LCS, and a 1000 mg/kg cyanide LCS must be analyzed with each batch.

A matrix spike (MS) and a matrix spike duplicate (MSD) must be analyzed with each batch.

When sample volume does not permit the analysis of an MS and MSD, then a 570 mg/kg sulfide LCSD and a 1000 mg/kg cyanide LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD, a non-program deleted duplicate, or an LCSD.

A sample matrix duplicate is not required unless a batch contains a NPDES sample(s) from South Carolina.

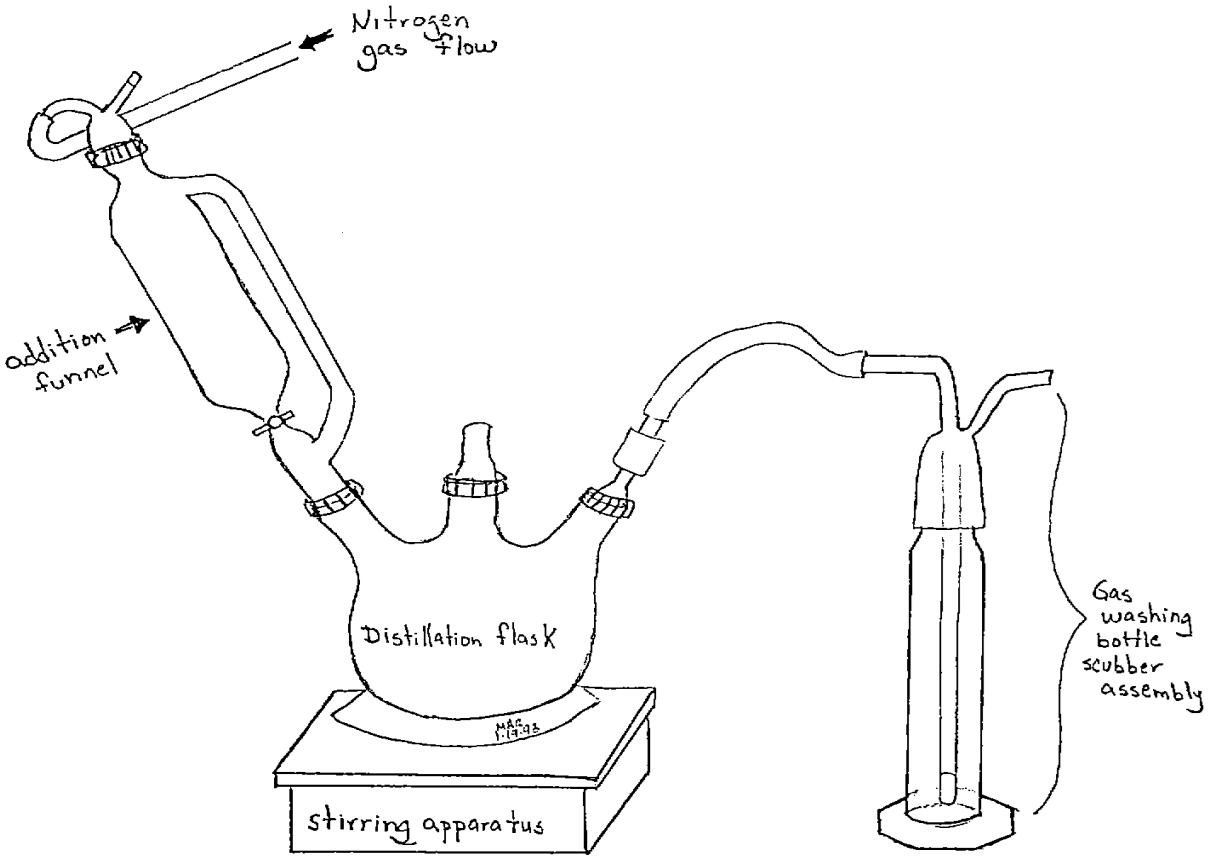
Attachment:
Figure 1

End of document

Version history

Version	Approval	Revision information
14	07.AUG.2014	

Figure 1


Nitrogen gas flow
addition funnel
Distillation flask
stirring apparatus
Gas washing bottle scrubber assembly

eurofins	Always check on-line for validity.	Level:
Document number: **T-WC-WI11572**	**Reactive Sulfide (titration) by SW-846 9034 (1996) or Chapter 7.3 (1996) in Solid or Liquid Waste**	**Work Instruction**
Old Reference: **1-P-QM-WI-9013032**		
Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **08-MAR-2019**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

LIMS ID
Analysis 1122

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Revision Log

Revision:	10	**Effective Date:**	This version
Section		**Justification**	**Changes**
Revision Log		Formatting requirement per LOM-SOP-LAB-201	Removed revision logs up to the previous version
Throughout document		Updating to D4	Replaced EtQ references with D4 references
Title		Clarification	Added titration, method references and matrix
Reference			Removed reference 1 and 2

Revision:	10	**Effective Date:**	This version
		Not active method references	Added EPA 7.3.4.2
Cross-Reference		Higher level documents are not required to be referenced	Removed LOM-SOP-ES-208, LOM-SOP-ES-225, LOM-SOP-ES-220
Scope		Enhancement	Added matrix, applicable concentration range
Reference Modifications		Not active method references	Removed references to SW-846 9030
Sample Collection, Preservation and Handling		Method requirement	Included storage instructions if not analyzing immediately.
Apparatus and Equipment 4.		Addition	pH strips to determine the pH of the scrubber.
Procedure 9-10		Method requirement	Added step to check the pH of the scrubber solution and repeat the titration if it has not been adjusted to approximately 2.
Calculation		Correction	100ml of sample replaced with wt. of sample x 2.5

Revision:	09	**Effective Date:**	14-Nov-2011
Section		**Justification**	**Changes**
Revision Log		Formatting requirement per LOM-SOP-LAB-201	Removed revision logs up to the previous version
Cross-Reference		Reflect applicable documents	Added LOM-SOP-ES-207
Personnel Training and Qualifications		Formatting requirement per LOM-SOP-LAB-201	Replaced first sentence with exact wording of required text
Reagents and Standards 1.		Clarification	Added container information
Calibration		Formatting requirement per LOM-SOP-LAB-201	Added required section
Statistical Information/ Method Performance		Clarification	Updated to include QC acceptance windows reference
Quality Assurance/ Quality Control		State specific QC requirement	Added South Carolina QC requirements

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846, Chapter 7.3, 1996.

2. *Test Methods for Evaluating Solid Wastes*, SW-846 9034, 1996.

2. *Chemical Hygiene Plan*, Lancaster Laboratories, current version.

Cross Reference

Document	Document Title
Analysis #1121	Reactivity of Waste
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896	Establishing Control Limits
T-WC-WI10360	Quality Control Data for Wet Chemistry

Scope

This method is applicable to the measurement of sulfide in solid or liquid wastes following Analysis #1121.

This method is not applicable to wastes that form explosive mixtures when combined with acids.

Chapter 7.3 states the total releasable sulfide is 500 mg H2S/kg waste.

Basic Principles

Sulfide is extracted from a sample using Analysis #1121 and is trapped in a sodium hydroxide scrubber solution. Excess iodine is added to a portion of the scrubber solution. Under acidic conditions, the iodine oxidizes the sulfide in the scrubber solution to sulfur. The excess iodine is then backtitrated with sodium thiosulfate to determine the concentration of sulfide in the scrubber solution.

Reference Modifications

Not applicable.

Interferences

The iodometric method suffers interference from reducing substances that react with iodine including thiosulfate, sulfite, and various organic compounds.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control spikes (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Analyze scrubber solution obtained in Analysis #1121 as soon as possible after extraction is completed.

If not analyzing immediately, seal the scrubber bottle and store at 0 to 6°C, not frozen.

Apparatus and Equipment

1. Analytical balance.

2. Class A burette with burette stand, or equivalent

3. 500-mL Erlenmeyer flasks or equivalent

4. pH indicator strips

Reagents and Standards

Alternate weights and volumes are acceptable as long as final concentrations remain the same.

1. Hydrochloric acid (1 + 1) – Mix equal portions of concentrated hydrochloric acid (HCI) and deionized water. Store in a glass container at room temperature and re-evaluate yearly.

2. Starch indicator – Purchased. Store at room temperature. See manufacturer's label for expiration date.

3. Potassium iodide (KI) crystals – Purchased. Store at room temperature and re-evaluate yearly.

4. 0.025 N potassium bi-iodate – Dry KH (IO3)2 for at least 2 hours at 103° to 105°C and cool approximately one hour in a desiccator. Dissolve 0.8124 ± 0.0002 g KH (IO3)2 in deionized water and dilute to 1000 mL in a volumetric flask. Store in amber glass bottle at room temperature. Stable 1 year.

5. 0.1 N sodium thiosulfate – Purchased. Store at room temperature. See manufacturer's label for expiration date.

6. 0.025 N sodium thiosulfate (Na2S2O3) – Dilute 250 mL of 0.1 N Na2S2O3 (purchased) to 1000 mL with deionized water. Hold time is determined by manufacturer's expiration date for 0.1 N sodium thiosulfate. Store at room temperature. **Standardize weekly** against 0.025 N potassium bi-iodate.

7. 0.025 N iodine solution – Dissolve 20 to 25 g KI in approximately 800 mL of deionized water and add 3.20 ± 0.05 g iodine. Allow plenty of time to dissolve and then dilute to 1000 mL with deionized water in a volumetric flask. Hold time is 1 year. Store in amber glass bottle at room temperature. **Standardize weekly** against 0.025 N sodium thiosulfate.

Calibration

A. Standardization**:**

Record all standardization in department's solution standardization logbook.

1. 0.025N Sodium thiosulfate

   a. Dissolve approximately 2.0 g KI in an Erlenmeyer flask with approximately 150 mL deionized water. Add a few drops of concentrated H2SO4. Swirl.

   b. Add by pipette, 20 mL of 0.025 N potassium bi-iodate.

   c. Dilute to approximately 200 mL with deionized water. Immediately titrate the liberated iodine with 0.025 N Na2S2O3 titrant to a pale yellow color.

   d. Add enough starch indicator to turn the solution blue, then titrate to the first colorless endpoint.

   e. Perform duplicate trials and average the results.

$$Na_2S_2O_3N = \frac{(20mL\,KH(IO_3)_2) \times (0.025N\,KH(IO_3)_2)}{mL\ of\ sodium\ thiosulfate\ titrated}$$

2. Iodine

   a. Pipette 10 mL of 0.025 N iodine solution into an Erlenmeyer flask.

   b. Add approximately 90 mL of deionized water.

   c. Titrate immediately with the Na2S2O3 (previously standardized) to a pale yellow color.

   d. Add a few drops of starch solution and titrate to the first colorless endpoint.

   e. Perform duplicate trials and average the results.

$$IodineN = \frac{(mL\ of\ Na_2S_2O_3\ titrated)\ (standardized\ normality\ of\ Na_2S_2O_3)}{10.0\ mL\ iodine\ solution}$$

B. A balance calibration check and level check must be performed each day before use.

Procedure

Add reagents to the Erlenmeyer flask in the exact order stated in this procedure to ensure no sulfide gas is liberated before the titration is performed.

1. Pipette 10 mL of the standardized iodine solution into a 500-mL Erlenmeyer flask.

2. Bring the volume up to approximately 20 mL with deionized water.

3. Add approximately 10 mL of 1 + 1 HCl.

4. Pipette 200 mL of the scrubber solution into the flask.

5. Discharge the scrubber solution under the iodine solution surface. Swirl gently.

If the iodine color disappears, add more iodine until the color remains. Record the total amount of iodine solution used. Titrate as usual. Then perform a second trial, adding enough iodine before the scrubber solution to maintain the yellow color after the scrubber solution addition.

6. Titrate immediately with standardized Na2S2O3 solution to a pale yellow.

7. Add enough starch indicator to turn the solution blue and titrate to a colorless endpoint.

8. Record the amount of titrant and iodine used.

9. Check the pH of the titrated solution. If the 10 ml of 1 + 1 HCl do not bring the pH down to at least 2, then repeat the titration using enough 1 + 1 HCl to bring the pH down to 2.

10. Document the pH check in the databook.

Calculations

mg/L sulfide = [(A x B) - (C x D)] x 16030 / wt. of sample x 2.5

Where:

A = mL of iodine solution
B = Normality of iodine solution
C = mL of Na2S2O3 solution
D = Normality of Na2S2O3 solution

Statistical Information/Method Performance

The method detection limit (MDL) is determined annually by following the procedure outlined in QA-SOP11892.

The quality control acceptance windows are generated annually by following the procedure outlined in *QA-SOP11896*.

Quality Assurance/Quality Control

One method blank and a 570 mg/kg sulfide LCS (See *Analysis #1121*) must be analyzed with each batch. A batch is limited to 20 samples or less.

When sample volume permits, a matrix spike (MS) and a matrix spike duplicate (MSD) must be analyzed with each batch. See *Analysis #1121* for the spike preparation instructions.

When sample volume does not permit the analysis of the MS and MSD, then a 570 mg/kg sulfide LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD or an LCSD.

A sample matrix duplicate is not required unless a batch contains an NPDES sample(s) from South Carolina.
See LIMS for current quality control (QC) acceptance windows. Follow guidelines in *T-WC-WI10360* for outlier QC data.

QA-SOP11892 Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896 Establishing Control Limits
T-WC-WI10360 Quality Control Data for Wet Chemistry
T-WC-WI11574 Reactivity of Waste

End of document

Version history

Version	Approval	Revision information
9	14.NOV.2011	
10	26.FEB.2019	

eurofins	Always check on-line for validity. **Nonvolatiles-Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312**	Level: **Work Instruction**
Document number: **T-TL-WI7151**		
Old Reference: **1-P-QM-WI -9015086**		
Version: **13**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **17-JUL-2019**	Document users: **5_EUUSLA_Leachate Preparation_All**	Responsible: **5_EUUSLA_Leachate Preparation_Manager**

LIMS ID
Analysis - 0947, 1339, 1567

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Revision Log

Revision	13	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Title	Enhancement		Added Reference method to title

Revision	13	**Effective Date:**	This version
Throughout Document	Consolidated departmental SOPs		Combined T-TL-WI7558 with this SOP- same procedures for solid determination and extraction procedure
Reference	Combined departmental SOPs		Added 1312 reference
Preliminary Solids	Clarification per EPA 1311 section 7.1.5		Reorganized section and added reference to revised sections of the Prefilter Template. Moved particle reduction to this section
Extraction Fluid Determination	Enhancement		Added Section
Procedure	Clarification - EPA 1311 section 7.1.5		Switched Procedure B and C for readability. Revised Procedure B to allow use of initial filtrate when appropriate
Calculation	Method Requirement		Removed Calculation c

Revision	12	**Effective Date:**	March 15, 2018
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Apparatus and Equipment	Enhancement		Added Centrifuge
Procedure B.9 and C.2	Enhancement		Took out using Graduated Cylinder to measure out 96.5mL
Procedure B.10 and C.3	Enhancement		Updated 50C for hot plate temperature to a range of 45-54 C
Procedure B.21 and C.10	Clarification		Added information about adjusting spike amount based on final volume differences
Procedure	Enhancement		Added section D on how to use the centrifuge

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 1311, July 1992.

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 1312, September 1994.

3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-TL-WI7143	Glassware Cleaning for Leachate Extractions
T-TL-WI7144	Leachate Blank Evaluations
T-TL-WI7145	Subsampling and Preservation of Leachates

Scope

TCLP is designed to determine the mobility of organic and inorganic nonvolatile contaminants in potentially hazardous waste. SPLP is designed to determine the mobility of waste samples under conditions that simulate rainwater percolating through a sample.

Basic Principles

For liquid wastes (containing <0.5% solids), the extract is defined as the filtrate resulting from filtration of the waste through a 0.6- to 0.8-µm glass fiber filter.
For wastes containing greater than or equal to 0.5% solids that have some liquid phase, the waste is filtered through a glass fiber filter and the filtrate is stored for later use.

The extraction fluid used with the solid portion of waste is determined by the type of extraction. TCLP (LIMS# 0947 and 1339) are determined using a portion of the solid sample and testing the alkalinity of the waste. SPLP (LIMS# 1567) are determined either by the origin of the sample, the type of sample, or the type of analysis performed on the sample. The extractions are performed by tumbling over an 18 hour period.

Following the extraction, the leachate is filtered through a glass fiber filter and the final and initial filtrates are combined.

Interferences

Any potential interferences are discussed in the individual analytical methods.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.
See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.
Follow routine safety steps. Special care must be taken when mixing the acid solution. Wear gloves, lab coat, and safety glasses when preparing the solution and handling samples. Read all lab notes and follow instructions carefully. Avoid skin contact or breathing the vapors from any of the reagents or samples. Use the appropriate ventilation system (bench top or hood) when instructed, if the sample looks suspicious (plating waste contains cyanide), or is particularly odoriferous.
If the sample fumes or reacts in any way when the acid is added during the extraction procedure, vent the sample periodically until the reaction is no longer evident.
Discard or send for repair any glassware that is chipped, flawed, or broken.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and a documented Demonstration of Capability (DOC).

The technician using this method must be trained by qualified personnel and perform these procedures at least twice in that person's presence before they are considered qualified.

Sample Collection, Preservation, and Handling

Samples must not be preserved and are stored at 0°C to 6°C, not frozen. Samples that require percent solids determination must have a minimum of 100g, plus any additional sample received to get sufficient extract for all analyses.

Samples for organic analysis must be collected in glass containers with PTFE-lined lids.

The holding time is from time of collection to time the leachate extraction starts. The holding time is:

14 days for semivolatile or pesticide/herbicide analysis.

28 days for mercury analysis.

180 days for metals analysis, other than mercury.

Evaluate the solid waste for particle size. The material must be able to pass through a 9.5-mm sieve or have a diameter of <1 cm with visual inspection. If the particle size does not meet this criteria, have the sample subcontracted for pulverization (if it is a stone-like material) or cut the material into smaller pieces if possible.

Apparatus and Equipment

1. Agitation apparatus (tumbler) – This must be an EPA-approved device which is capable of rotating the extraction vessels at 30 ±2 rpm in an end-over-end manner.

2. Extraction vessel – The extraction vessel must be a jar large enough to contain the volume of extraction fluid required (within the limitation of tumbler space). The vessel must be made of Borosilicate glass, Teflon, or polyethylene.

3. Filtration device – The Millipore Hazardous Waste Filtration system is suitable (also known as pressure filters).

4. Vacuum filtration system – Consisting of a vacuum flask, filter holder, and hose.

5. Acid Washed Glass fiber filters (0.6- to 0.8-µm pore size) – Assorted sizes

6. Beakers – Assorted sizes

7. Stirring hot plates

8. Thermometer – Capable of reading temperatures up to 70°C

9. pH meter – Orion Model 210 or equivalent – Capable of 0.01 pH unit display

10. Watch glasses

11. Graduated cylinders – Class A, assorted sizes

12. Glass jar for combining extracts

13. Glass bottles – Assorted sizes

14. Jug for preparing extraction fluid

15. Gooch crucible

16. Pipettes – Class A, assorted sizes

17. Balance – Capable of weighing to 0.01 g

18. Dispensette® Bottle-top Dispenser

19. 9.5 mm sieve

20. Centrifuge

Reagents and Standards

NOTE: Reagents used are ACS grade or equivalent. Recipes of standards may be adjusted as long as equivalent ratios are maintained.

1. Reagent water – water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the reagent water supplied at the taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.

2. Concentrated hydrochloric acid (HCl) - stored at room temperature per manufacturer's expiration date

3. Glacial acetic acid (CH2COOH) – abbreviated as Hac in prep logbook, stored at room temperature per manufacturer's expiration date

4. 10 N sodium hydroxide (NaOH) – purchased, stored at room temperature per manufacturer's expiration date

5. Concentrated nitric acid (HNO3) - stored at room temperature per manufacturer's expiration date

6. Concentrated sulfuric acid (H2SO4) - stored at room temperature per manufacture's expiration date

7. Metals Spike A – VHG Labs ZLANLABCM#1 or equivalent. This is stored at room temperature for up to one year.

8. Metals Spike B – VHG Labs ZLANLABCM#2 or equivalent. This is stored at room temperature for up to one year.

9. 1 N hydrochloric acid (HCl) : This can be purchased otherwise prepare as directed below

a. Use a graduated cylinder to slowly add 83 mL of concentrated HCl to approximately 500 mL reagent water in a 1000-mL volumetric flask.

b. Dilute the solution to volume with reagent water. Remake every 6 months.

c. Store in a glass bottle at room temperature.

10. 1 N nitric acid (HNO3): This can be purchased otherwise prepare as directed below

a. Use a graduated cylinder to slowly add 64mL of concentrated HNO3 to approximately 500mL reagent water in a 1000mL volumetric flask.

b. Dilute the solution to volume with reagent water.

c. Remake every 6 months.

d. Store in a glass bottle at room temperature.

11. Acid washed filters - Used if the leachate is to be analyzed for metals Prewashed filters are purchased. Alternatively, prepare the filter as follows:

a. Assemble the filtration apparatus with the filter in place.

b. Cover the filter with 1N nitric acid by pouring the acid from the bottle.

c. Apply vacuum or pressure (whichever is appropriate) until the filter is dry.

d. Using a graduated cylinder, pour a minimum of 100mL reagent water into the apparatus.

e. Apply vacuum or pressure until the filter is dry.

f. If a vacuum apparatus was prepared, discard the waste acid/water mixture and rinse the flask several times with reagent water. If a pressure filter was prepared, discard the waste acid/water mixture.

12. TCLP Extraction Fluid #1

a. Use a graduated cylinder to add 57 mL of glacial acetic acid to approximately 5000 mL reagent water in a 10 L jug.

b. Use a graduated cylinder to add 64.3 mL of 10 N NaOH.

c. Dilute with the solution to volume with reagent water.

d. The pH of this fluid must be 4.93 ±0.05.

e. Record the preparation and the pH of the extraction fluid in the appropriate logbook.

f. This solution must be prepared daily.

g. It is acceptable to prepare this solution in other volumes as long as the ratio of acetic acid and NaOH to final volume is maintained.

13. TCLP Extraction Fluid #2

a. Use a graduated cylinder to add 57 mL of glacial acetic acid to approximately 5000 mL reagent water in a 10 L jug.

b. Dilute the solution to volume with reagent water.

c. The pH of this fluid must be 2.88 ±0.05.

d. Record the preparation and the pH of the extraction fluid in the appropriate logbook.

e. This solution must be prepared daily.

f. It is acceptable to prepare this solution in other volumes as long as the ratio of acetic acid to final volume is maintained.

14. SPLP stock solution (60%H2SO4/40%HNO3)

a. Fill a 100mL volumetric flask with approximately 50 mL of reagent water.

b. Add 6 mL of H2SO4

c. Add 4 mL of HNO3.

d. Bring to volume with reagent water and mix thoroughly.

e. Store at room temperature in a glass bottle for up to 6 months.

15. SPLP Intermediate

a. Fill a 1 L volumetric flask with approximately 500 mL of reagent water.

b. Add 10mL of the SPLP stock solution.
c. Bring to volume with reagent water and mix thoroughly.
d. Store at room temperature in a glass bottle for up to 6 months.

16. SPLP Extraction Fluid #1 - Soil Samples East of Mississippi
a. Prepare enough for each day of use and discard extra.
b. Determine volume needed, and prepare 2 mL of SPLP Intermediate to 1 L total volume with reagent water. Alternate volumes are acceptable, the ratio must remain the same.

SPLP Intermediate (mL)	Final Volume (L)
1	0.5
2	1
4	2
10	5

c. Mix thoroughly

d. Determine the pH of the fluid. The pH must be 4.2 +/- 0.05. Record the preparation and pH in the appropriate logbook.

17. SPLP Extraction Fluid #2 - Soil Samples West of Mississippi
a. Prepare enough for each day of use and discard extra.
b. Determine volume needed, and prepare 3mL of SPLP Intermediate to 10L total volume with reagent water. Alternative volumes are acceptable, the ratio must remain the same.

SPLP Intermediate (mL)	Final Volume (L)
1.5	5
3	10

c. Mix thoroughly

d. Determine the pH of the fluid. The pH must be 5.00 +/- 0.05. Record the preparation and pH in the appropriate logbook.

18. SPLP Extraction Fluid #3

a. Reagent water is used as extraction fluid for SPLP extractions of wastes or soils that are extracted for cyanide analysis.

Glassware Cleaning

See *T-TL-WI7143*.

Determining the Amount of Extract to Prepare

1. Look up the leachate sample in LIMS, under the sample data program.

2. Note the analyses requested. Information about sample requirements is found in *T-TL-WI7145*.

3. Add up the sample volume required and divide by 20 to determine how much sample must be extracted.

4. Perform an additional extraction if the volume from a single TCLP extraction is not anticipated to be sufficient to perform all the required analyses. The leachates from multiple extractions are combined and then divided for analysis.

Preliminary Solids Determination

The *Federal Register* TCLP method defines percent solids as that fraction of a waste sample from which no liquid is forced out by an applied pressure.

The following is documented in the Preliminary Determination of %Solids section of the Prefilter Template spreadsheet (Figure 1):

1. If the sample is obviously 100% solids, proceed to Procedure B.

2. Record the date, technician, sample number and bottle codes used for the %solids determination.

3. Preweigh the container that will contain the filtrate ('Weight of filtrate container')

4. Weigh out the subsample of the waste. A minimum of 100g is required. If 100g is not available contact the CSR and place comment on sample if no more volume is obtained.

a. Record the weight of the sample in grams plus the beaker ('Weight of beaker + sample')

b. Pour the sample into the vacuum filter apparatus and slowly apply vacuum until no liquid flows through the filter.

c. Reweigh the beaker and record the weight ('Weight of beaker + sample residue'). The spreadsheet calculates the weight of sample filtered.

5. The solid phase is the material in the filter holder ('sludge cake and filter') of the waste and the filtrate is the liquid phase.

6. Weigh the container with the filtrate and record the weight on the spreadsheet ('Weight of the liquid phase + filtrate container')

7. The spreadsheet determines the percent solids using Calculation A

8. If there are <0.5% solids, then go to Procedure A.

9. If there are ≥ 0.5% solids with no liquid phase entrapped in the filter, then determine if sufficient extract will be generated to support all analyses. If an additional extract must be prepared, repeat steps

2-6 of this procedure and record these weights in the Filtration of Additional Waste section of the spreadsheet. Process all solid portions to be extracted following Procedure B.

10. If there are ≥ 0.5% solids and there is liquid phase entrapped in the filter, the percent dry solids is determined.

a) Dry the solid at 80-120c until two successive weights agree to within 1% and then calculated using Calculation B.

b) A fresh portion of waste is prepared following the Preliminary Solids Determination Steps 2-6. Record these weights in the Filtration of Additional Waste section of the spreadsheet.

c) See Procedure B with the new portion of solid to be extracted. If the liquid is organic and cannot be combined with the extraction fluid then see Procedure C.

Calibration

Not applicable to this procedure

Procedure

A. If the sample contains <0.5% solids

1. Filter the waste through glass fiber filter (0.6 to 0.8 µm). The filter must be acid washed if the leachate is to be analyzed for metals. The filtrate is defined as the TCLP extract.

2. Determine and record the pH of this extract in the logbook.

3. Change the analysis from 0947 to 1339 in LIMS. Enter the appropriate comments and preserve the subsamples as per *T-TL-WI7145*.

B. If the sample contains >/=0.5% solids

1. Determine if particle reduction is required.

Reduce the solid portion to a particle size of < /= 1cm in diameter, if necessary, using a sieve. When a sieve is used for reducing particle size, a sieve blank test must be performed. To perform the test, pour the extraction fluid to be used for the batch blank through the sieve and into the blank vessel to check for cleanliness. Document that the sieve test was performed on the batch sheet.

2. Weigh out a minimum of 100g of sample.

3. Determine the extraction fluid required for the solid portion of the waste.
TCLP (LIMS# 0947, 1339)

a. Weigh out 5.0 to 5.1g of the solid portion into a 150 or 250 mL beaker

b. Add 96.5mL reagent water and stir for 5 minutes. Measure and record the pH. If the pH is <5.0, go to step 3 of this section and use TCLP Extraction Fluid 1.

c. If the pH is > /=5.0, use a pipette or bottle-top dispenser to add 3.5mL 1 N HCL to beaker, cover with a watch glass, and heat on a hot plate to 45-54C. The temperature must then be maintained at 45-54C for 10 minutes. Record the thermometer ID in the logbook.

d. Cool the slurry to room temperature. Measure the pH and record. If the pH is <5.0, use Extraction Fluid #1. If the pH is >/= 5.0, use TCLP Extraction Fluid 2.

SPLP (LIMS# 1567)

e. SPLP Extraction Fluid #1 is for all solid samples east of the Mississippi River, and waste and wastewater samples (i.e. non-soils)

f. SPLP Extraction Fluid #2 is for all solid samples west of the Mississippi River

g. SPLP Extraction Fluid #3 is for samples receiving Cyanide analysis.

4. Use a graduated cylinder to slowly add the appropriate extraction fluid at a volume 20x the weight of the solid

5. Close the extraction bottle tightly, and place in a tumbler (rotating 30 +/- 2rpm) for 18 +/- 2hours. Record the ID of the tumbler and the start time in the leachate extraction logbook. Ambient temperature must be maintained at 23C +/- 2C (69.8F-77.0F) during the extraction period.

6. Following the 18 +/- 2 hours extraction, filter the solution through a pressure filter assembled with two stacked glass fiber filters of the same pour size (one 125mm-and one 150mm), again taking care to increase the pressure by 10-psi increments and to not exceed 50psi if using the pressure filter. Change the filter if necessary. The filter(s) must be acid washed if the extract is to be analyzed for metals.

7. If the phases can be mixed, combine the extract with any initial filtrate from the waste (see Procedure C if the phases cannot be combined) If multiple jars of the sample were leached, combined the extracts.

8. Measure and record the pH of the extract in the logbook.

9. Use pipettes to add the appropriate matrix spikes to metals samples. In order to give the correct spike levels, 8mL of each spike (A and B) are added to 400mL of leachate. Adjust spike amount appropriately to maintain equivalent concentration of spike levels if leachate is different from 400mL.

10. Subsample and preserve the leachate for the appropriate analyses in accordance with *T-TL-WI7145*

C. If the liquid and extraction fluid are not miscible (cannot be combined):

1. If the layer of liquid in the solid is organic and does not mix with water, a large quantity of sample must be filtered. This is because each layer of the final leachate, must be analyzed separately and enough solids must be collected to generate enough extraction fluid for the assigned analyses.

2. If the initial filtrate does not mix (is not miscible) with the extraction fluid, do not mix the two together. Contact the group leader and technical services. Each phase must be analyzed separately; therefore each phase must be entered as a sample.

D. After tumbling a centrifuge maybe used to help separate solids from liquid. Follow directions below to operate centrifuge.

1. Turn centrifuge on

2. Fill a minimum of two centrifuge bottles with equal amount of fluid to maintain balance.

3. Label bottles with sample number
4. Shut lid and press start. Centrifuge is programmed to run for 15 minutes and will automatically stop.

5. Press open to unlatch the lid and pull out samples for filtration

Calculations

A. Percent solids:

$$\%\ Solids = \frac{(Weight\ of\ solid\ phase)}{(Total\ Weight\ to\ be\ Filtered)} x\ 100$$

B. Percent dry solids:

$$\%\ Solids = \frac{(Weight\ of\ dried\ solid\ recovered)}{(Weight\ of\ sample\ filtered)} x\ 100$$

Statistical Information/Method Performance

See specific analysis method.

Quality Assurance/Quality Control

1. A new matrix batch must be prepared each day samples are leached. Batches must not be continued. Therefore, each matrix is a new batch each day.

2. An extraction fluid tumble blank must be prepared for each extraction fluid used per day. A blank must be started for each 20 samples with the same fluid type. A sieve test must be performed on a blank if any of the samples on a batch are sieved. When filtering the blank after tumbling, if any samples associated with that blank are pressure filtered, the blank must be pressure filtered also to check for cleanliness of the apparatus.

3. A blank must be performed after every 20 times an individual extraction vessel is used. A logbook of vessel usage is kept. Each time a vessel is used, record the date and the sample number. After 20 uses, prepare a blank in that vessel and record the blank number in the logbook. Every blank must be evaluated for contamination using the guidelines in *T-TL-WI7144*.

4. Record all the sample numbers in the batch logbook. One sample in the batch must be designated as the waste type spike. Choose the first sample in the batch that has sufficient volume. Each subsample type in the batch must have a spike. Record the lot number of the spike solution used on the batch sheet. Photocopy the sheet and deliver the photocopies to each department involved in the analyses. Enter the appropriate leachate information in Parallax.

5. Extraction of the solid phase must be initiated as soon as possible after initial filtration.

6. All instruments used in this procedure (i.e., pH meter and balance) must be calibrated according to an approved laboratory plan.

7. All quality control measures described in the appropriate analytical methods must be followed.

T-TL-WI7143 Glassware Cleaning for Leachate Extractions
T-TL-WI7144 Leachate Blank Evaluations
T-TL-WI7145 Subsampling and Preservation of Leachates

Attachment:
Figure 1

End of document

Version history

Version	Approval	Revision information
11	01.FEB.2016	
12	01.MAR.2018	
13	11.JUL.2019	

Preliminary Determination of %Solids for Leachate (TCLP/SPLP) Extraction

Date:	
Technician:	
Non-Volatile Sample #:	
Volatile Sample #:	
Bottle Code used for Preliminary %Solids Determination:	

Preliminary Determination of %Solids

			EPA 1311 / EPA 1312
Pre-filtration			
Weight of filtrate container		g	7.1.1.3
Weight of beaker + sample		g	7.1.1.7
Weight of beaker + sample residue after loading sample onto filter		g	
Weight of sample to be filtered (**100 g minimum**)	0	g	
Post-filtration			
Weight of liquid phase + filtrate container		g	7.1.1.9
Weight of liquid phase	0	g	7.1.1.9
Weight of solid phase	0	g	7.1.1.9
Percent Solids in waste			7.1.1.9
Approximate Volume of TCLP extraction from preliminary determination*	-100	mL	

Filtration of Additional Waste

Maximum Weight (100 g of solid phase will be produced) g

Pre-filtration			
Weight of filtrate container		g	7.2.3
Weight of beaker + sample		g	
Weight of beaker + sample residue		g	
Weight of sample to be filtered (**100 g minimum**)	0	g	7.2.5
Post-filtration			
Weight of liquid phase + filtrate container		g	
Weight of liquid phase	0	g	
Weight of solid phase	0	g	

*Based off approximate initial filtrate density of 1g/mL

Comments

Section

Preliminary Determination of %Solids

Weight of sample to be filtered (**100 g minimum**)
Weight of liquid phase
Weight of solid phase
Percent Solids in waste
Approximate Volume of TCLP extraction from preliminary determination*

Filtration of Additional Waste

Maximum Weight (100 g of solid phase will be produced)
Weight of sample to be filtered (**100 g minimum**)
Weight of liquid phase
Weight of solid phase

Calculation

(Weight of beaker + sample) - (Weight of beaker + sample residue after loading sample onto filter)
(Weight of liquid phase + filtrate container) - (Weight of filtrate container)
(Weight of sample to be filtered) - (Weight of liquid phase)
(Weight of solid phase) / (Weight of sample to be filtered)
(Weight of liquid phase) + [((Weight of solid phase) - (5 g portion for pH check)) x (20 mL)]

(100 g solid phase)/(Percent Solids in waste)
(Weight of beaker + sample) - (Weight of beaker + sample residue after loading sample onto filter)
(Weight of liquid phase + filtrate container) - (Weight of filtrate container)
(Weight of sample to be filtered) - (Weight of liquid phase)

Validated

KNB 6/17/19
KNB 6/17/19
KNB 6/17/19
KNB 6/17/19
KNB 6/17/19

KNB 6/17/19
KNB 6/17/19
KNB 6/17/19
KNB 6/17/19

eurofins	Always check on-line for validity. **Volatiles by Zero Headspace Extractor (ZHE) - Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312**	Level: **Work Instruction**
Document number: **T-TL-WI7258**		
Old Reference: **1-P-QM-WI-9015085**		
Version: **13**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **17-JUL-2019**	Document users: **5_EUUSLA_Leachate Preparation_All**	Responsible: **5_EUUSLA_Leachate Preparation_Manager**

LIMS ID
0946, 2573, 0075, 14072, 1339, 08792, 14071

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Revision Log
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Cross Reference
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Personnel Training and Qualification
Sample Collection Preservation and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Preliminary Solids Determination
Procedure
Calculations
Statistical Information Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 13	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	Consolidated Departmental SOPs	Combined T-TL-WI7561 with this SOP
Cross Reference	Added Reference	Added Nonvolatile SOP

eurofins	Always check on-line for validity.	Level:
Document number: **T-TL-WI7258**	**Volatiles by Zero Headspace Extractor (ZHE) - Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312**	**Work Instruction**
Old Reference: **1-P-QM-WI-9015085**		
Version: **13**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **17-JUL-2019**	Document users: **5_EUUSLA_Leachate Preparation_All**	Responsible: **5_EUUSLA_Leachate Preparation_Manager**

Revision: 13	**Effective Date:**	This version
Section	**Justification**	**Changes**
Regent and Standards	Method requirement	Updates 10N NaOH to 64.3mL for Extraction Fluid #1
Preliminary Solid Determination	Clarification	Reorganized section. Add reference to nonvolatile SOP determination
Procedure C	Enhancement	Removed repeated verbiage and added reference to Procedure B
Figure 1	Enhancement	Added new template document

Revision:	12	**Effective Date:**	October 29, 2018
Section	**Justification**	**Changes**	
Revision Log	Formatting requirements	Removed revision logs up to the previous version.	
Lims ID	Enhancement	Removed DOD, added 14072	
Sample collection and preservation	Enhancement	Added 14072 analysis Hold Time	
Cleaning Glassware	Unnecessary	Removed section	
Procedure	Unnecessary	Removed filtering through septum for 946 or 14072	
Procedure	Enhancement	Added 'or 14072' after all mentions of 946 in prep	

Reference

1. Method 1311, *Test Methods for Evaluating Solid Waste*, SW-846, USEPA, July 1992.

2. Test Methods for Evaluating Solid Waste, SW-846 Method 1312, September 1994.

3. *Chemical Hygiene Plan,* Lancaster Laboratories, current version.

Cross Reference

Document	Document Title
T-TL-WI7143	Glassware Cleaning for Leachate Extractions
T-TL-WI7144	Leachate Blank Evaluations
T-TL-WI7151	Nonvolatiles - Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312

Scope
TCLP is designed to determine the mobility of organic and inorganic nonvolatile contaminants in potentially hazardous waste. SPLP is designed to determine the mobility of waste samples under conditions that simulate rainwater percolating through a sample.

Basic Principles
For liquid wastes (containing <0.5% solids), the extract is defined as the filtrate resulting from filtration of the waste through a 0.6-0.8µm glass fiber filter.

For waste containing greater than or equal to 0.5% solids that have some liquid phase, the waste is filtered through a glass fiber filter and the filtrate is stored for later use with zero headspace. The extractions are performed with zero headspace over an 18 hour period.

Following the extraction, the leachate is filtered through a glass fiber filter and the final and initial filtrates are combined.

Interferences
Any interferences encountered during analysis are discussed in the individual analytical methods.

Safety Precaution and Waste Handling
See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Lab coats, gloves, and safety glasses must be worn all times when working with samples or reagents. Avoid skin contact or breathing the vapors from any reagents or samples. If samples are odorous or contain hazardous material, use a ventilation hood.

Discard or send for repair any glassware that is chipped or broken.

When working on the ZHE, use the ratchet wrench or cordless drill to prevent any wrist strain or injury. In case of injury notify your supervisor.

Personnel Training and Qualification
All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Technicians using this method must have documentation of training by a qualified person and perform these procedures at least twice in that person's presence before they are considered qualified.

Sample Collection Preservation and Handling

Samples must be collected in glass with **NO** headspace, unpreserved and stored at 0°-6°C and extracted within 14 days from the date of collection.

Samples that require percent solids determination must have a minimum of 100g, plus any additional sample received to get sufficient extract for all analyses.
Certain state or QAPP specific requirements require samples to be collected in Encore sampling devices. If this is the case, samples must be frozen within 48 hours of collection, and extracted within 14 days from the date of collection.

For Analysis 14072 and 14071 (NJ), Sample hold time is 48 hours from collection.

Apparatus and Equipment

1. Tumbler – Capable of rotating the extraction vessel at 30 ± 2 RPM in an end-over-end manner

2. Zero headspace extractor (ZHE)
3. Glass fiber filter (0.6- to 0.8-µm pore size; 90 mm in diameter)

4. Tedlar® bag – 0.5 or 1.2-L or equivalent

5. Vacuum filtration system (vacuum flask, filter holder [gooch], hose.

6. 48-lb. torque wrench (± 4 lbs.)
7. Poly extraction fluid transfer bag

8. Graduated cylinders – Class A, assorted sizes

9. Gooch crucibles

10. Drill

11. Ratchet wrench

12. Balance – Capable of weighing to 0.01 g

13. pH Meter – Orion Model 210A or equivalent – Capable of 0.01 pH unit display

14. Jug for preparing extraction fluid

15. Volumetric flasks – Class A, assorted sizes

16. Aluminum weighing pans

17. Ruler

18. 40-mL vials

19. Septa for 40-mL vials – modified to allow a Teflon®- outlet tube to pass through

Reagents and Standards

NOTE: All reagents used are ACS grade or equivalent. The recipes for the standards may be made at alternate volumes of equivalent ratios.

1. 10 N Sodium Hydroxide (NaOH)
2. Glacial acetic acid (HAC)

3. TCLP Extraction Fluid #1

Acetic acid	57 mL
10 N NaOH	64.3 mL

a. Use graduated cylinders to add 57 mL acetic acid and 64.3 mL 10 N NaOH to approximately 5 L of reagent water in a 20-L jug.

b. Dilute to 10 L with reagent water and swirl until the solution is thoroughly mixed.

c. This solution can be made in larger or smaller volumes as long as the ratio of acetic acid and NaOH to final volume is maintained.

d. The pH of this solution must be 4.93 ± 0.05.

e. Record the preparation and the pH of the extraction fluid in the reagent logbook.

f. This solution must be prepared daily.

4. Reagent water (SPLP Extraction Fluid #3)

a. Water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.

Calibration

Not applicable to this procedure

Preliminary Solids Determination

If the waste appears to be liquid and seems to contain a very low percentage of solids, perform the solids determination. The *Federal Register* TCLP method defines percent solids as that fraction of waste from which no liquid may be forced out by an applied pressure.

1. If the total solids determination was performed on the sample for the nonvolatile leachate, those values are used. See T-TL-WI7151. If a total solids determination is required, perform the following:

a. Weigh out a minimum amount of 25 g to 26 g of the sample into a crucible and record the sample number and weight including the graduated cylinder on the spreadsheet.

b. Pour the sample into the vacuum filter apparatus and slowly apply vacuum until no liquid flows through the filter.

c. Reweigh the crucible and record the weight and residue adhered to the cylinder. The spreadsheet calculates the weight of sample filtered.

d. Weigh a Tedlar® bag. Attach Tedlar® bag, filter liquid, reweigh bag with filtrate

e. The material in the filter holder is defined as the solid phase (sludge cake and filter) of the waste and the liquid phase is the filtrate.

f. The spreadsheet determines the percent solids using the calculation included in the attachment.

2. If the percent solids is <0.5% solids then go to Procedure A
If the percent solids is greater than or equal to 0.5% solids then go to Procedure B.
If the sample is 100% solids with no liquid phase then go to Procedure C.

Procedure

A. If the sample contains <0.5% solids

1. Assemble the ZHE and add enough sample to fill three 40-mL vials after filtration (analysis 0946).

2. Filter the sample through glass fiber filters (0.6- to 0.8-µm) and collect the sample in the vials with **NO** headspace unless the sample is from California (analysis 2573). In that case, collect the final filtrate into a single labeled Tedlar® bag and deliver to the appropriate department. This filtrate is defined as the TCLP volatile extract.

NOTE: If any sample is from California, the blank must be collected in a Tedlar® bag.

3. Change the analysis to 1339 and add the appropriate comment in Parallax.

B. If the sample contains >0.5% solids and has a standing liquid phase

1. Assemble the ZHE extractor.

2. Preweigh an empty Tedlar® bag and record the weight in the volatile prefilter spreadsheet (see Figure 1).

3. Use the Percent Solids to determine amount to weigh into crucible and record the weight in the spreadsheet.

$$Amount\ (g) = \frac{25}{\%\ solids} x100$$

4. Perform particle size reduction WITHOUT sieving as necessary.

5. Pour the sample into the ZHE extractor.

a. Re-weigh the aluminum pan used to weigh out the initial sample and record the weight of the residue and cup.

b. The spreadsheet calculates the weight of the sample.

6. Attach the Tedlar® bag to the ZHE extractor and filter the sample through the ZHE into the Tedlar® bag until the liquid stops flowing.

a. Reweigh the Tedlar® bag with the liquid and record the weight.

b. The spreadsheet calculates the weight of the liquid in the bag and the weight of the solid in the extractor.

NOTE: If the filter in the ZHE gets clogged **DO NOT** change it. Any sample left in the ZHE extractor is considered to be the solid. If the liquid is not water-soluble a larger amount of sample must be filtered; both layers must be analyzed separately. Verify that you have enough solids to complete the TCLP analysis on the sample.

7. Record the weight of the solids under "weight of sample extracted" in the data log.

8. The necessary volume of extraction fluid (20× the weight of the sample to be extracted) must be measured into the fluid holding bag using a graduated cylinder.

a. Connect the fluid holding bag to the ZHE and open the valves on both the transfer line and the ZHE.

b. Slowly add Extraction Fluid 1 by turning the ZHE piston downward with a drill.

9. Once the entire volume of extraction fluid has been transferred from the bag to the ZHE, close the valve on the ZHE and hand crank the piston with the 48-lb. torque wrench until it clicks.

a. Slowly open the valve to release any air that was trapped in the extractor.

b. Close the valve when the liquid appears.

10. Again crank the piston with the 48-lb. torque wrench until it clicks.

11. Place the extractor on the tumbler and rotate at 30 ± 2 rpm for 18 ± 2 hours.

12. Record the tumbler ID in the data log.

13. Ambient temperature must be maintained at 23° ± 2°C (69.8° to 77°F) during the extraction.

14. When the extraction is complete, connect the Tedlar® bag containing the initial filtrate to the ZHE unit and slowly open the valve on the bag. Quickly open and close the valve of the extractor while listening for an escape of gas. If no gas escapes, the extractor had a leak during the extraction and the sample must be repeated.

a. In addition, the extractor must be checked for leaks by pressurizing it to 50 psi and submerging it in water.

b. Check for air bubbles coming from any of the fittings. If air bubbles are present, check all fittings and inspect O-rings and replace them if necessary.

c. Reassemble and pressurize the extractor and repeat the submersion leak check. If the extractor continues to leak, remove it from service and contact the manufacturer.

15. Filter the entire sample extract through the filter already in the ZHE and into the Tedlar® bag unless the filtrate is not water-soluble.

a. If the initial filtrate is not water-soluble, DO NOT try to mix them together. They must be analyzed separately. Notify your supervisor to contact the appropriate person(s).

b. If the sample is scheduled for analysis 0946 or 14072, collect the final filtrate into three 40-mL glass vials with no headspace.

c. If the sample is from California (analysis 2573) collect the final filtrate into a single labeled Tedlar® bag and deliver to the appropriate department.

NOTE: If any sample is from California, the blank must be collected in a Tedlar® bag.

C. If the sample is 100% solid and contains no liquid

1. Weigh out 25 g to 26 g of sample into an aluminum weighing pan and record the weight in the data log under sample weight.

2. Pour the sample into the ZHE extractor.

3. Add 500mL of Extraction Fluid #1 to the extractor, release any trapped air and pressurize the ZHE following Procedure B 7-9

4. Verify that 500 mL of extraction fluid was added to the extractor by measureing the length of the rod protruding from the bottom of the extractor using a ruler.

   a. At least 4 3/8² of the rod must be visible or the extractor does not contain 500 mL of fluid.

   b. If the required length is not visible, add additional fluid following Procedure Steps B. 7. until the extractor contains 500 mL of extraction fluid.

   NOTE: This step is only performed if 25 g to 26 g of sample was weighed in step C.1.

5. Tumble the samples and deliver samples to departments as specified in Procedure B. 10-14.

Calculations

1. Calculation for % solids

$$\%\ Solids = \frac{Weight\ of\ sample\ recovered}{Weight\ of\ sample\ filtered} \times 100$$

2. Calculation for % dry solids

$$\%\ Dry\ Solids = \frac{Weight\ of\ dried\ solid\ recovered}{Weight\ of\ sample\ filtered} \times 100$$

Statistical Information Method Performance

Not applicable to this method.

Quality Assurance/Quality Control

1. A minimum of one blank must be performed for every 20 samples extracted in a day. This blank is not the same as the vessel blank.

2. A vessel blank must be performed after every 20 times an individual ZHE is used. A logbook of vessel usage is kept. Each time a vessel is used, record the date and sample number. After 20 uses,

prepare a blank in that vessel and record the blank number in the logbook. Every blank must be evaluated for contamination using the guidelines in *T-TL-WI7143*.

3. Record all sample numbers and the batch blank number in the batch logbook.

4. All instruments used in this procedure must be calibrated according to an approved laboratory plan.

5. All quality control measures described in the appropriate analytical methods must be followed.

T-TL-WI7143 Glassware Cleaning for Leachate Extractions
T-TL-WI7144 Leachate Blank Evaluations

Attachment:
Figure 1

End of document

Version history

Version	Approval	Revision information
11	29.MAR.2012	
12	15.OCT.2018	
13	11.JUL.2019	

Volatile Pre-Filtration Data

Date:	
Technician:	
Non-Volatile Sample# (%Solids Determination Data):	
Volatile Sample #	

Preliminary Determination of %Solids			**EPA 1311 / EPA 1312**
Percent Solids from Non-Volatile worksheet		DO NOT ENTER IF VOLATILE ONLY	
Weight required for 25g solid phase		g	
Percent Solids (Volatile only)			
Pre-filtration			
Weight of filtrate container		g	7.3.1
Weight of cruicible + sample		g	7.3.4
Weight of crucible + sample residue		g	7.3.8
Total weight of sample to be filtered (**25 g minimum**)	0.0	g	
Post-filtration			
Weight of liquid phase + filtrate container		g	7.3.9
Weight of liquid phase	0.0	g	
Weight of solid phase	0.0	g	

Comments

Section
Percent Solids (Volatile only)
Total weight of sample to be filtered (**25 g minimum**)
Weight of liquid phase
Weight of solid phase

Calculation
(Weight of solid phase) / (Weight of sample to be filtered)
(Weight of crucible + sample) - (Weight of crucible + sample residue after loading sample onto filter)
(Weight of liquid phase + filtrate container) - (Weight of filtrate container)
(Weight of sample to be filtered) - (Weight of liquid phase)

Validated
KNB 6/17/19
KNB 6/17/19
KNB 6/17/19
KNB 6/17/19

eurofins	Always check on-line for validity. **TOC and TC in Solids and Sludges by Combustion by SM 5310B, EPA 415.1, SW-846 9060/9060A, Lloyd Kahn**	Level: **Work Instruction**
Document number: **T-WC-WI11627**		
Old Reference: **1-P-QM-WI-9013418**		
Version: **17**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date **09-JUL-2019**	Document users: **6_EUUSLA_ Instrumental Water Quality _TOC Analyst, 6_EUUSLA_ Instrumental Water Quality _TOC Verifier**	Responsible: **5_EUUSLA_Instrumental Water Quality_Manager**

LIMS ID
Analysis 2079, 0383, 10065, 11356

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Revision Log

Revision:	17	**Effective Date:**	This version
Section	**Justification**	**Changes**	
Revision Log	Formatting requirement	Removed revision logs up to the previous version.	
Scope	Current Process	Removed LIMS analyses 6623 and 11763	
Reference Modifications	Method Requirement	Removed 10% dup instead of a quadruplicate per batch	
Procedure 8.	Current Process		

Revision:	17	**Effective Date:**	This version
			Removed the process of analyzing three blanks prior to calibration.
Procedure 10.	Current Process		Removed the concentration of the CCV, this changes dependent on the CRM provided by the manufacturer
QA/QC	Method Requirement		One quadruplicate per batch for Lloyd Kahn

Revision:	16	**Effective Date:**	Oct 17, 2018
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Cross Reference	Reflect re-identification of documents in D4		Updated all document titles.
Reference	New instrumentation		Deleted the OI soil analyzer and added the Skalar information.
Apparatus and Equipment	New instrumentation		Deleted the OI soil analyzer and added the Skalar information.
Reference	Method Update		Updated the Standard Methods Edition to the 22nd Edition, 2011.
Subject	Addition		Added method references to title.
Calibration	Update		Updated to reflect current CCV process.
Reference 2.	Removal		Removed the term 'modified'.
Personnel Training and Qualifications	Addition		Added requirement of an annual Demonstration of Capability.
Throughout Document	Changed document control platform		Updated ETQ References to the D4 References.

Reference

1. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 5310B-2011

2. *Method 415.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.*

3. Test Methods for Evaluating Solid Wastes, SW-846 Method 9060, September 1986.

4. Test Methods for Evaluating Solid Wastes, SW-846 Method 9060A, November 2004

5. *The Primacs SNC-100 Analyzer Manual*, Skalar..

6. *Determination of Total Organic Carbon in Sediment, U. S. EPA, Region II, July 27, 1988. ("Lloyd Kahn Method.").*

7. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896	Establishing Control Limits
QA-SOP11188	Reagents and Standards

Scope

This method is applicable for the determination of total organic carbon (TOC) in soils and other samples not easily analyzed by the TOC waters method. The limit of quantitation (LOQ) for this method can be found in the analysis information file. Quantitative TOC results up to 1,000,000 mg/kg may be obtained by this method.

Analysis 0383 is used for samples referencing the Lloyd Kahn Method.

Analysis 10065 is used for the determination of Total Carbon in solids. This procedure does not eliminate the inorganic carbon by acidification prior to analysis.

Analysis 11356 is a calculation to determine the Total Inorganic Carbon (TIC) result.

Basic Principles

TOC is determined by acidifying a sample and heating it to remove the TIC. An aliquot of sample (1 mg to 1 g) is weighed into a sample cup. The sample is then heated to 900°C for combustion of the remaining TOC. The resulting carbon dioxide from the TOC is detected by a nondispersive infrared (NDIR) detector that has been calibrated to directly display the mass of carbon dioxide detected. The mass is proportional to the mass of TOC in the sample. Samples analyzed by this method include solids such as soils or sediments, slurries, sludges, brines, and corrosives.

The TC measurement is identical to the TOC measurement, with the exception that there is not an acidification and heating step to remove the TIC.

TIC is the calculation subtracting the TOC soil result from the result obtained when analyzing the TC.

Reference Modifications

There is no referenced method for the determination of Total Carbon in solids. Analysis 10065 references a modified TOC method. The calibration standards, QC standards, and LCS employed for this analysis are composed of only organic sources of carbon (Sucrose for the calibration and QC standards, and a purchased standard for the LCS solid). Therefore, the Total Organic Carbon content is equal to the Total Carbon content in these standards.

Interferences

Carbon is ubiquitous in nature. Therefore, extra care must be taken to avoid contamination of reagents, glassware, and any other materials that come in contact with the sample. Samples which are

light in weight may need to be analyzed at smaller aliquots to fit within a sample cup. These samples are reported with an elevated LOQ.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

1. Normal laboratory practices for safety must be followed.

2. Extreme caution must be used when handling sample cups after they have been analyzed.

3. Discard acid waste in acid waste containers.

4. See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability. Analysts are considered proficient when they have successfully completed a Demonstration of Capability for the analysis. A Demonstration of Capability consists of four laboratory control standards that are carried through all steps of the analysis and that meet the acceptance criteria for the LCS and LCSD. Documentation for these studies are in each individual's training records.

Demonstration of Capability is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling

Samples must be collected and stored in glass containers unpreserved. Samples must be stored under refrigeration at 0° to 6°C, not frozen.

Because very small amounts (1 mg to 1 g) of sample are used for the analysis, the sample must be as homogeneous as possible.

The holding time for analysis by SM 5310 B, EPA 415.1 and SW-846 9060/9060A is 28 days. The holding time for analysis by the Lloyd Kahn method (analysis 0383) TOC is 14 days.

Apparatus and Equipment

1. Skalar-Primacs SC100

2. PC and SNAccess software

3. 2-stage gas regulator (two required)

4. Sample cups

5. Fiber quartz wool

6. Analytical balance, capable of accurately weighing to 1. mg

7. Glassware – General laboratory glassware as needed for preparing reagents and standards

8. Microliter syringe, various volumes

Reagents and Standards

NOTE: All chemical used must be ACS reagent grade unless otherwise noted.
Different volumes or weights may be used provided the ratios remain equivalent.
See *QA-SOP11188*, for the appropriate labeling and documentation of reagent and standard preparation.

1. Ultra pure nitrogen gas (60 psi)

2. Ultra pure oxygen gas (60 psi)

3. Hydrochloric acid, concentrated (HCI) – Purchased. Store at room temperature.

4. 1+1 Phosphoric acid

Phosphoric acid (H3PO4)	50 mL
Reagent water	50 mL

Take 50 mL of H3PO4 and add slowly while swirling to a 100-mL volumetric flask containing 50 mL reagent water. Store at room temperature. Prepare fresh every 6 months.

5. TOC stock calibration standard (30% carbon), purchased. See label for expiration date. Store at room temperature.

6. TOC LCS standard, purchased. See label for expiration date, and the certified concentration. Store at room temperature.

7. TC/TOC QC Stock solution 15,000 mg/L.

Potassium Hydrogen Phthalate (KHP)	15.945 g ± 0.005 g
Phosphoric Acid, concentrated, 10 drops.	

Add 10 drops of Phosphoric acid to a 500 ml volumetric flask containing approximately 250 ml of reagent water. Add 15.945 g ± 0.005 g of KHP to the flask, dissolve and bring to full volume with reagent water. Store in an amber glass bottle at 0° to 6°C, not frozen. Prepare every 30 days.

Sample Cup Preparation

Sample cups must be conditioned prior to analysis. This is achieved by heating the cups to 900°C for a period of 2 to 5 minutes.

Calibration

1. Working standards for calibration

Pipette a volume of the TOC stock calibration standard into the sample cups as follows:

Working Std. (mg C)	Vol. Stock TOC (µL)
0.30	1.0
0.90	3.0
3.0	10.0
6.0	20.0

Prepare fresh daily. Store at room temperature.

2. Continuing calibration verification standard (CCV)

This is a purchased standard, and the acceptable range is specified by the manufacturer.

Procedure

1. Turn on nitrogen to 60 psig.
2. Turn on oxygen to 60 psig.
3. Add water and a drop of HCI to the scrubber.
4. Measure the carrier gas (oxygen) flow rate and adjust to 200 mL/min.
5. Measure the dryer gas (nitrogen) flow rate and adjust to 160 to 300 mL/min.
6. Power up instrument.
7. Program in a sequence file.
8. Run the calibration sequence as follows: 0.30, 0.90, 3.0, and 6.0 mg C (Performed monthly).
9. The instrument automatically calculates the R and list the calibration data.

10. Samples are analyzed along with the appropriate laboratory control standard and preparation blank. A check standard (CCV) and a continuing calibration blank (CCB) must be run at the beginning of each run and after every ten samples.

11. Add sufficient glass wool to each cup to cover the bottom surface.

12. Weigh samples into sample cups (up to 1000 mg). Add 1+1 H3PO4 drop wise until effervescence stops. Heat at 75°C for 15 minutes. Record the oven ID, time and temperature of this step in the log book.

NOTE: This procedure will convert inorganic carbonates and bicarbonates to carbon dioxide and eliminate it from the sample. The addition of H3PO4 and the heating to 75°C is not performed for analysis 10065.

13. Analyze the residue according to the instrument manufacturer's instructions for the remaining TOC result.

Calculations

1. To determine mg/kg TOC or TC

   mg/kg = (Raw result in mg C) x (1000/weight in mg) x (1000)

2. To determine LOQ/MDL factors

$$Factor = \frac{Maximum\ sample\ aliquot\ weight\ (1000.mg)}{weight\ of\ sample\ (mg)}$$

3. To determine Total Inorganic Carbon (TIC)

   TIC = Total Carbon (TC) - Total Organic Carbon (TOC)

Statistical Information/Method Performance

1. The method detection limit (MDL) is determined annually by following the procedure outlined in *QA-SOP11892*.

2. The quality control acceptance windows are generated annually by following the procedure outlined in *QA-SOP11896*.

Quality Assurance/Quality Control

1. A calibration must be performed every 30 days. The acceptable range for the calibration is R = 0.995 or greater. If this criteria is not met, the instrument must be recalibrated.

2. A batch must contain no more than 20 field samples.

3. A batch blank (PBS) must be analyzed every batch or each day samples are prepared (not to exceed 20 samples). An acceptable result is < the limit of quantitation. If the PBS does not meet this criterion, it must be rerun twice. If either of the two additional trials do not meet the acceptance criterion, all samples in the batch must be repeated.

4. A laboratory control standard (LCSS) must be analyzed every batch or each day samples are analyzed (not to exceed 20 field samples). For TOC this is a purchased standard and the acceptable range is specified by the manufacturer. For TOC by 11763, the acceptance range for the LCS is 80% to 120%. For Total Carbon, spike 0.2 ml of the TC QC Stock solution onto glass wool. Assuming the nominal full volume of 1000 mg, the TC LCSS true value is 3000 mg/kg. The LCSS should undergo the same steps as the samples. If the LCSS does not meet the acceptable criterion, it must be repeated twice. If either of the two additional trials do not meet the acceptance criterion, all samples in the batch must be reanalyzed.

5. Based upon client requirements, a laboratory control standard duplicate (LCSSD) may need prepared and analyzed under the same conditions as the LCSS. The acceptance criterion for the LCSSD is the same as that of the LCSS. The relative percent difference between the LCSS and the LCSSD is calculated statistically.

6. Analysis 2079 - a duplicate is analyzed every 10 samples. Analysis 0383 - one sample is analyzed in quadruplicate every batch. The acceptable relative percent difference is statistically determined. The duplicate relative percent differences must be tracked to continually monitor method performance.

7. Analysis 2079 - A spike must be analyzed for every 10 samples. The sample is spiked with 3 ul of the purchased TOC stock calibration standard. The acceptance range is determined statistically. The spike recoveries must be tracked to continually monitor method performance.

8. Based upon client requirements, a matrix spike duplicate (MSD) may need prepared and analyzed under the same conditions as the MS. The acceptance criterion for the MSD is the same as that of the MS. The relative percent difference between the MS and the MSD is calculated statistically.

9. A check standard (CCV) and blank (CCB) must be run after every ten injections (including blanks and standards). The acceptable range for the CCV is ±10% of the true value. An acceptable CCB result is < the limit of quantitation. If either, or both, of these injections do not meet the acceptance criterion, the unacceptable original must be repeated twice. If either of the two additional trials do not meet the acceptance criterion, all samples since the last compliant CCV/CCB must be reanalyzed.

10. A CCV and CCB shall be analyzed at the beginning and the end of each run. At any time when the instrument has been idle for a period of 4 hours or more, a CCV and CCB must be analyzed. If either of these parameters cannot meet specifications, the instrument must be recalibrated.

QA-SOP11188 Reagents and Standards
QA-SOP11892 Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896 Establishing Control Limits

End of document

Version history

Version	Approval	Revision information
15	30.OCT.2013	
16	17.OCT.2018	
17	03.JUL.2019	

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Version: **17**		Organisation level: **5-Sub-BU**
Approved by: **UDM6** Effective Date **17-JUL-2019**	Document users: **4_EUUSLA_ELLE_All_Support, 4_EUUSLA_ELLE_All_Technical**	Responsible: **5_EUUSLA_Env Quality Assurance_All**

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Title Page

Environmental Quality Policy Manual

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Quality Assurance Director
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Revision Log

	Revision: 17	**Effective Date**: This Version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Section 2.2	Correction	Changed timeline for deputies and notification to agencies
Section 2.5	Correction	Notification timelines are dictated by regulatory authority.

Section 6.3.4	Clarification	Calibration/verification is at least annual

	Revision: 16	**Effective Date**: 3/19/2019
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	No longer applicable	Removed reference to microbiological analyses at ELLE
Section 1, 1.2, 2.4, 11.1, 13.2, 13.4	Compliance to PALA	Added reference to PALA compliance
Section 6	No longer applicable	Removed section 6.4 regarding Micro, renumbered following sections
Section 8.4	Clarification	Added Note: when procedural deviations are not permitted
Section 10.1, 13.2	Enhancement	Added reference to Project Notes
Section 10.7	Enhancement	Accreditation by parameter may be reported via the certification status in LIMS
Section 11.1	Compliance to PALA	Updated from 3 to 5 year retention of internal audit records

1.0 INTRODUCTION

This *Quality Policy Manual* is based upon Eurofins Lancaster Laboratories Environmental LLC's (herein referred to as the laboratory) overall business and management philosophies, mission, and goals. This manual is written to present the policies employed by the laboratory as well as the support departments that serve the environmental laboratories and to comply with the requirements of the National Environmental Laboratory Accreditation Program (also referred to as NELAP or TNI), ISO 17025, the Department of Defense (DoD), Quebec Accreditation Program for Analytical Laboratories (PALA) as well as individual state agency requirements. These policies define the "what" we do with emphasis on management's responsibilities and commitment to quality.

Governing SOPs are in place within the organization, to ensure the proper execution of this policy document (refer to Appendix A). This manual is required reading for laboratory personnel. The most recent and up-to-date *Quality Policy Manual* and all referenced documents are available to all laboratory personnel who work in or support the laboratory. As described within this document, the laboratory actively strives for continuous improvement of its quality systems to better serve our clients.

1.1 Mission Statement

The laboratory offers analytical and consulting services in the chemical and biological sciences with comprehensive expertise in environmental laboratory applications. The company mission statement describes the corporate philosophy:

At Eurofins Lancaster Laboratories Environmental LLC we are people working together to serve the health and environmental needs of society through science and technology. We strive to be the recognized leader in all that we do.

Our mission is to provide independent laboratory services in the chemical and biological sciences with excellent quality and service. As a corporate community, we:

- Deliver quality by fully understanding and always meeting the requirements of those we serve.
- Live our values by relating to our clients, coworkers, shareholders, suppliers, and community in a fair and ethical manner.
- Manage our growth and financial resources so we can serve our clients well, provide a satisfactory return to shareholders, and maintain our meaningful and enriching workplace.

1.2 Quality Policy

The Executive Management Group recognizes quality as a key element of the laboratory's standard of service. The group supports the laboratory's commitment to quality as defined by NELAP, ISO 17025, DoD, PALA and other regulatory agencies (i.e. states) through the strict adherence to the Quality Policy Statement. The Quality Assurance Director wrote the Quality Policy Statement, with final approval from the laboratory Vice-President. The policy cannot be revised without their approval.

The Quality Policy Statement gives employees clear requirements for the production of analytical data. Employees are trained on the components of the Quality Policy Statement during their first day of orientation. Each employee signs the statement upon hire as agreement to implement the policy in all aspects of their work. Employee agreement to any subsequent revisions of the statement is obtained by documented reading and understanding of an agreement to follow the Quality Manual, which contains the current version of the statement. The statement is as follows:

As an organization, all personnel are committed to high quality professional practice, testing and data, and service to our clients.

We strive to provide the highest quality data achievable by:

- Following all documentation requirements; describing clearly and accurately all activities performed; documenting "real time" as the task is carried out; understanding that it is never acceptable to "back date" entries and should additional information be required at a later date, the actual date and by whom the notation is made must be documented.
- Providing accountability and traceability for each sample analyzed through proper sample handling, labeling, preparation, instrument calibration/qualification, analysis, and reporting; establishing an audit trail that identifies date, time, analyst, instrument used, instrument conditions, quality control samples (where appropriate and/or required by the method), and associated standard material.

- Emphasizing a total quality management process and commitment to continuous improvement which provides accuracy, and strict compliance with agency regulations and client requirements, giving the highest degree of confidence; understanding that meeting the requirements of the next employee in the work flow process is just as important as meeting the needs of the external client.

- Providing thorough documentation and explanation to qualify reported data that may not meet all requirements and specifications, but is still of use to the client; understanding this occurs only after discussion with the client on the data limitations and acceptability of this approach.

- Responding immediately to indications of questionable data, out-of-specification occurrences, equipment malfunctions, and other types of laboratory problems, with investigation and applicable corrective action; documenting these activities completely, including the reasons for the decisions made.

- Providing a work environment that ensures accessibility to all levels of management and encourages questions and expression of concern on quality issues to management.

We each take personal responsibility to provide this quality product while meeting the company's high standards of integrity and ethics, understanding that improprieties, such as failure to conduct the required test, manipulation of test procedures or data, or inaccurate documentation will not be tolerated. Intentional misrepresentation of the activities performed is considered fraud and is grounds for termination.

I understand the expectations and commit to implementation of all applicable policies and procedures and to providing quality data.

1.3 Statement of Values

Eurofins Lancaster Laboratories Environmental is a team of people who work together to serve the health and environmental needs of society through science and technology.

At Eurofins Lancaster Laboratories Environmental, our mission is to provide independent laboratory services in the chemical and biological sciences with excellent quality and service. We fulfill our mission by incorporating our values into our work every day.

As a corporate community, we embrace our heritage of integrity and strive to live by the following principles:

- Fairness and honesty in all our relationships

- Mutual trust

- A respect for ourselves and others

- A sense of caring that leads us to act responsibly toward each other and society, now and in the future

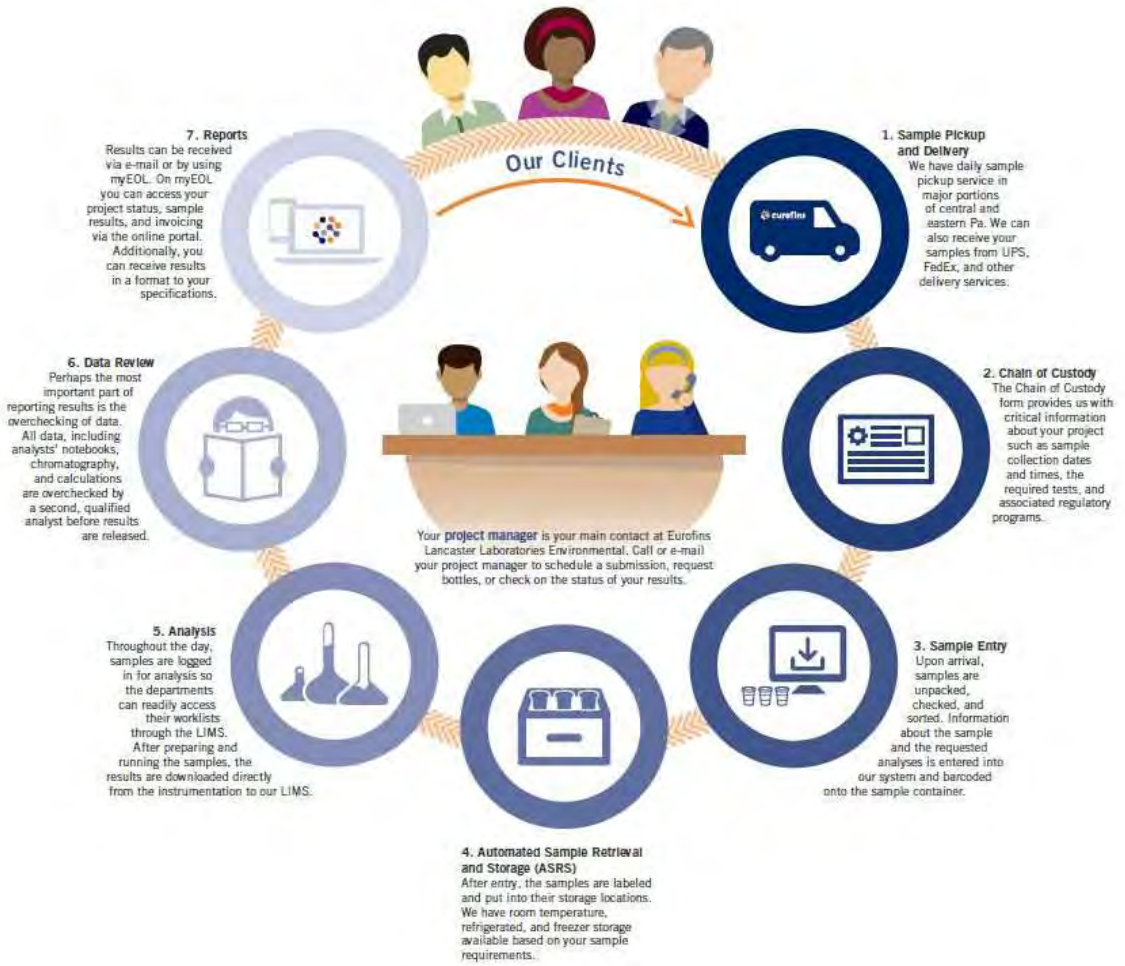
- Loyalty to our clients and one another
- A spirit of open-mindedness as we deal with all
- Dedication to service
- Good stewardship of our resources
- A commitment to flexibility and continuous improvement

We are committed to:

- Delivering quality by fully understanding and always meeting the requirements of those we serve.
- Living our values by relating to our clients, coworkers, shareholders, suppliers and community in a fair and ethical manner.
- Managing our growth and financial resources so we can serve our clients well, provide a satisfactory return to shareholders and maintain our meaningful and enriching workplace.

At Eurofins Lancaster Laboratories Environmental, we each take personal responsibility to live these values in all of our dealings, knowing full well that our pledge may involve difficult choices, hard work and courage.

1.4 Sample Flow-Through Diagram



1.5 Certifications, Accreditations, and Registrations

Accreditation/Certification is the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications and/or standards. It is the one generally accepted method by which a laboratory such as ours can demonstrate its capability of generating acceptable, professional, quality test results in those areas in which it claims competence. To this end, we have actively sought accreditation by organizations offering it in those areas relevant to our technical expertise. We strive to ensure that the facilities, equipment, procedures, records, and methods used by the laboratory in the testing of environmental samples are in compliance with the requirements of these standards.

Although organizations offering accreditation differ somewhat in the details of their programs, they generally evaluate laboratories in four basic areas: personnel (adequate staffing, education, training, and experience), physical facilities, instrumentation/equipment, and quality assurance program. This evaluation is performed by one or more of the following procedures: periodic on-site inspections of the laboratory by assessors experienced in technical operations, quality systems, and management; periodic analysis of proficiency test samples; and periodic updating of the laboratory's file to reflect changes in personnel, equipment, or services offered. Some agencies offer reciprocity with other agency programs.

Appendix B lists accreditations and registrations held by the laboratory in support of environmental work. Current copies of all scopes of accreditation are available on the laboratory website https://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/resources/certifications/ and are kept on file in the Quality Assurance Department.

2.0 ORGANIZATION AND PERSONNEL

2.1 Company Overview and History

The laboratory was founded in 1961 by Dr. Earl Hess in response to a need for high quality technical services by the agricultural and industrial communities in southeastern Pennsylvania. Nourished in a culture of quality and caring about all those associated with the business, the corporation became an industry leader known for innovative business practices and people-friendly policies. The company was independently owned until the retirement of Dr. Hess in 1995. At that time, the laboratory was acquired by a publicly held company, Thermo TerraTech, Inc., a Thermo Electron company. Ownership changed in September 2000, when the laboratory was acquired by Goldner, Hawn, Johnson, and Morrison, Inc. (GHJ&M), a private equity investment firm. In August 2005, the laboratory was acquired by Fisher Scientific under their BioPharma Division. On November 9, 2006, Thermo Electron and Fisher Scientific merged to form Thermo Fisher Scientific. In April 2011, Thermo Fisher Scientific sold the laboratory to Eurofins Scientific. Effective July 1, 2013, the Pharmaceutical and Environmental Divisions were split into separate business entities and the company name became Eurofins Lancaster Laboratories Environmental, LLC. The laboratory continues to operate as an independent laboratory and is incorporated by the State of Delaware.

The laboratory provides a wide array of laboratory services to clients working in environmental industries. We strive to offer high quality technical services in the chemical and biological sciences with personal attention to client needs. These services include chemical analyses and analytical method development. We are, therefore, a technical service company and do not manufacturer or distribute goods. Our "product" is accurate and timely technical information and our continued existence depends on the quality of the services we offer and efficiency with which we deliver them.

2.1.1 Business Continuity and Contigency Plans

Various policies and practices are in place to address continuity of business and contingency plans to ensure continued operations or minimal disruption in operations should unplanned events (natural disasters, unexpected management changes, etc.) occur.

Section 2.2 of this document explains the identification of deputies for key management positions. Section 3.3 discusses the disaster recovery plan. Section 6.4 addresses the security and backup of our computer systems. Section 10.8 addresses handling of client records should the company have a change in ownership or go out of business.

2.2 Organizational Structure

The laboratory President, in conjunction with the Vice-President and Director of Operations, is responsible for the daily operations of the laboratory. The Vice-President, Duane Luckenbill, is designated as the laboratory's Technical Director relative to accreditations.

The Executive Management Group is defined as the Eurofins Environment Testing US Chairman of the Board and President and Eurofins Lancaster Laboratories Environmental, LLC Vice-President.

The management staff includes directors, managers and group leaders. Organizational charts of the management staff are presented in Appendix C. Individual departmental staff lists are maintained in the company's internal intranet. The Vice-President and Quality Assurance (QA) Director have identified deputies for all key management personnel. Deputies would temporarily fill a role if the primary is absent for more than 15 consecutive calendar days. The deputies must meet the same qualifications as the primary person should they be required to take on the responsibilities. Notification to agencies is performed as noted in section 2.5.

2.2.1 Technical Director

The Technical Director ensures that the laboratory's policies and objectives for quality of testing services are documented in this quality manual. The Technical Director must assure that the manual is communicated to, understood, and implemented by all personnel concerned.

2.2.2 Quality Assurance Director

The Quality Assurance Director ensures that the quality system is followed at all times. The QA Director reports directly to the President thus ensuring corrective actions to quality issues are taken promptly and are separate from business decisions. The QA Director has no direct supervisory responsibility for the generation of technical data to avoid any conflict of interest in administrating the QA program. The QA Director has the final authority to stop work that compromises our integrity or data quality. The situation must be investigated and appropriate corrective action must be put in place before the QA Director will authorize the resumption of work. The specific duties of the QA Director are communicated in the position qualification description (PQD).

2.3 Management Responsibilities

Laboratory management duties are outlined for supervisory personnel using a job plan format, which details each individual's responsibilities along with expected results. Typically, management duties include, but are not limited to:

- Personnel hiring and training
- Supervision of personnel
- Providing resources to ensure a work environment free from commercial, financial, and other undue pressures that may adversely affect the quality of their work
- Providing resources to ensure a safe work environment
- Directing daily work operations, including scheduling of work

- Ensuring compliance with the TNI Standards, ISO 17025, Department of Defense Quality Systems Manual, regulatory programs, analytical methods, and client requirements.

- Assessing laboratory capacity and workload

- Resource allocation

- Ensuring quality of data produced

- Contributing to the continuous improvement of the laboratory operation

- Ensuring that corrective actions are carried out in an appropriate and agreed upon time-frame.

- Communicating problems and concerns to Senior and Executive Management to enlist a higher level of support for corrections and continuous improvements.

- Maintaining awareness of technical developments and regulatory requirements

2.4 Overview of the Quality Assurance Program

Quality Assurance (QA) is responsible for developing planned activities whose purpose is to provide assurance to all levels of management that a quality program is in place within the laboratory, and that it is functioning in an effective manner that is consistent with the requirements of NELAP, ISO 17025, DoD, PALA, and any other regulatory agencies (i.e. states) in which we hold accreditation. Although the laboratory is a wholly owned subsidiary of Eurofins Scientific, the Quality Assurance and Quality Systems operations described in this manual are specific to the Lancaster site and associated service centers.

The administration of the QA program is the responsibility of the QA Director in cooperation with all levels of management.

The QA program, as directed by executive management, was established to:

- Ensure accountability, accuracy, and traceability of all analytical data generated.

- Ensure that current regulatory, agency, and client requirements are being met.

- Ensure that operating procedures are in place to minimize the possible loss, damage, and tampering with data, in addition to ensuring that raw data is stored in a secured area and is maintained by designated archivists and/or system administrators.

- Ensure that curriculum vitae (CVs) and training records are maintained to document that staff members have the necessary education, training, and experience to perform their job responsibilities and functions.

- Ensure that regulatory training is provided to applicable employees on a routine and ongoing basis.

- Ensure that all procedures are available, controlled, and current.

- Ensure that documentation demonstrates that procedures are carried out in a compliant and effective manner.

- Ensure that all equipment and instrumentation is qualified, maintained, and calibrated, as appropriate, in accordance with written standard operating procedures.

- Ensure that all significant laboratory problems are investigated, evaluated for root cause and corrective action is put in place as documented

- Ensure that an internal audit program is in place to provide on-going monitoring and confirm that laboratory personnel are adhering to standard operating procedures and applicable regulations.

- Ensure that quality issues are brought to the attention of management in a timely manner.

2.5 Quality Assurance Responsibilities

The QA Director assigns tasks with input from the company President. The primary responsibilities of QA include, but are not limited to the following:

- Oversee the laboratories' internal audit program which consists of various audit types and applies to all laboratory activities (technical and administrative).

- Review and approve standard operating procedures and analytical methods.

- Review and approve validation documentation.

- Review non-conforming quality control data

- Perform tracking and trending of quality measurements and report the status and effectiveness of the quality system to management.

- Approve investigation and corrective action reports (ICARs) and audit responses to ensure that they are completed in a timely manner, evaluated for root cause, that corrective actions are implemented as needed and to monitor corrective action for effectiveness.

- Host client and regulatory agencies during facility audits and follow-up to any cited deficiencies.

- Provide regulatory guidance to the laboratory and support areas.

- Monitor Good Laboratory Practice (GLP) regulatory activities.

- Communicate quality issues to management in a timely manner

- Provide and/or coordinate on-going regulatory training (e.g., Ethics, GLP).

- Participate in the vendor and supplier approval process, including subcontractors.
- Review analytical data for compliance with our procedures.
- Prepare and review QA project plans (QAPPs) as required by EPA and client projects.
- Maintain and update this *Quality Policy Manual*.
- Maintenance of the Laboratory's accreditations, including but not limited to, administration of the proficiency test sample programs, both single and double blinds.
- Communication to the relevant regulatory authorities is required when there are management or facility changes that impact the laboratory. Changes in the technical director must be communicated within a period of time and in the manner dictated by each regulatory authority.

2.6 Communication of Quality Issues to Management

The QA Department is responsible for preparing reports to Management to keep them apprised of outstanding quality issues. Reports to management foster communication, review, and refinement of QA activities to ensure that the QA program is adequate to meet regulatory and the laboratory's quality objectives. The following reports are used to communicate quality issues and include, but are not limited to:

- Internal, client, and agency audit reports and corrective action plans
- Proficiency test reports
- Investigation and corrective action reports
- Monthly quality status reports
- Plans for corrective action

Upon review of quality issues, management and/or QA may issue a stop work notice if an issue indicates the potential for a problem on a broader scale with an analysis. The investigation would need to be completed and the issue resolved before work could continue. The information is tracked through our Investigation and Corrective Action Report (ICAR) process.

2.7 Personnel Qualifications and Responsibilities

The position qualification descriptions (PQDs) for senior staff (Vice-President/Technical Director, QA Director, Laboratory Operations Director, Science Officer, Technical Manager and Support Manager) are provided in Appendix D.

PQDs for all positions are maintained in the laboratory's document control system. Resumes (curricula vitae or CVs) are maintained on file for all staff in the training record system. Responsibilities are outlined in the PQD at the position

level. Individual responsibilities and expectations are documented in each employee's job plan. The job plan is evaluated and discussed with each employee on an annual basis. The job plan is a confidential personnel record.

2.8 Relationship of Functional Groups and Quality Assurance Program

In addition to this *Quality Policy Manual*, aspects of the QA program are documented in a series of standard operating procedures that support the proper execution of this document. Technical operation procedures with required quality components are also in place. A list of the titles of relevant SOPs is provided in Appendix E. There are a variety of mechanisms used to communicate requirements and verify compliance with the QA program, including:

- Management requires that all employees read and be trained in the policies and SOPs that are pertinent to their jobs.

- Employee job plans define individual responsibilities. All job plans include QA aspects, and performance is reviewed annually.

- Laboratory audit findings are circulated to management and require a response and follow-up to items needing corrective action.

- Cross-functional meetings, including representatives from QA, Client Services, Marketing, management, and technical operations are held regularly to review specific projects and quality issues.

2.9 Balancing Laboratory Capacity and Workload

Evaluating laboratory capacity to perform specific projects is the responsibility of the Vice-President, laboratory directors and managers, and the Client Services director and manager. These responsibilities are documented in the individual job plans for these positions.

The laboratory facilities and staff size are very large compared to other laboratories serving the environmental industry. Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in case of malfunctions. This minimizes the need to evaluate small and medium size projects against capacity available to complete them. Large projects are reviewed against capacity estimates before bids are submitted to ensure that the client's analysis schedule is met.

Regularly scheduled meetings are held with upper management, laboratory middle management, Client Services and QA personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Laboratory capacity and backlog is tracked on a continuous basis using information from the Laboratory Sample Information System (LIMS) including turnaround time, and work in-house.

2.10 Identification of Approved Signatories

All data is reviewed and verified by a second level reviewer at the department level prior to release to the client. Based on complexity or regulatory needs, some projects are designated for secondary (technical and/or QA) review of the Analysis Reports and/or data deliverables. Approved signatories for these secondary reviews are defined in the SOP

on Data Entry, Verification, and Reporting. Directors, managers, group leaders, and other employees (such as QA, project managers, and senior technical staff) are designated, through specific LIMS roles/permissions, to approve/release Analysis Reports. Request for approval of an employee to approve/release reports must be made through the QA and IT Departments. These authorized personnel are designated in the LIMS with the "approve reports" role. A list of the employees with this LIMS permission can be obtained from IT.

2.11 Personnel Training

The experience and training received by personnel is of great importance to our clients and regulatory agencies. Curricula Vitae (CVs) and on-going training documentation are available to demonstrate how personnel have been prepared for the tasks they routinely perform. To ensure the highest quality of services at the laboratory, training programs and plans are developed to match skills with job functions. Accurate training documentation is the responsibility of both the employee and their supervisor. On a routine basis, the supervisor reviews and approves training documentation to verify that it is complete and current.

Training requirements can be met through education, prior job experience, internal and external training classes, on-the-job training, training modules, procedure reading, or any combination thereof, to enable the person to perform assigned job functions and meet regulatory compliance.

Each analyst training to perform a new analysis is required to perform an initial demonstration of capability and meet the requirements for accuracy and precision before working independently on the test method. Typically, this is accomplished by the successful analysis of four known samples (i.e. a quad study). However, there are certain tests performed that are not required by the mandated test method or regulation to perform the above procedure since they are not conducive to spiking . In this case, the analyst's documentation of proficiency is achieved by documentation of having read, understood, and agreed to follow the SOP as written, on-the-job training and observation by a senior analyst.

Management personnel are responsible for planning ongoing professional growth and development activities for an employee through on-the–job training and/or internal and external training courses so an employee can maintain a current skill set to match job responsibilities.

An annual performance review based on job responsibilities, accountabilities, objective measures, and pre-defined standards is completed by management personnel for each employee. This assessment is documented and maintained. Input is obtained from other managerial personnel as needed. Performance reviews are maintained in the employee's personnel file and are confidential.

2.11.1 New Hire Training

New employees are oriented as part of a year-long process that is designed to make the employee feel welcome and comfortable by defining our culture, traditions, philosophies, and work practices. During the orientation process an employee learns about personnel and safety policies and business strategies in addition to quality, ethics, and customer satisfaction expectations through a formal process administered by collaboration of our Human Resources staff, QA, and the management of the employee's assigned department.

New employees are required to attend "core" technical orientation, as applicable, which can entail the participation in training module exercises, short session attendance, and/or other skill training specific to their assigned department or job function. Additional job-specific training required for an employee is based upon their assigned duties and is identified by their supervisor. Technical orientation occurs during the first few weeks of employment.

Note: Seasonal and temporary employees have reduced “core” training requirements based on the assigned tasks and as defined by QA, Safety, and the assigned department management.

The orientation process is designed to enable employees to initiate and take responsibility for their personal and professional career growth at the laboratory. The orientation process is conducted without regard to employee race, color, creed, national origin, sex, age, or disability in accordance with the laboratory’s Employee Equal Opportunity (EEO) policy.

2.11.2 Ongoing Training

Refresher and ongoing training occurs through various means, which include but are not limited to, training in or independent review of new/updated standard operating procedures and work instructions; on-going regulatory training; in-house or off-site classes or seminars. The goal of this training is to ensure that employees remain current with changes to laboratory systems and practices, as applicable to their job function. Retraining and re-qualification activities occur as directed by procedures or regulations. Employees are retrained if an issue or investigation warrants that retraining is a necessary corrective action. Management directs when employee re-training is required, and the extent of the re-training.

2.12 Regulatory Training

The QA Department is responsible for coordinating and conducting initial and ongoing regulatory training (i.e., Ethics, GLP) for all applicable laboratory and support personnel. It is the responsibility of management within each department to ensure that personnel attend the required training sessions.

The choice of training format and topics covered for ongoing regulatory training is left to the discretion of QA and the trainer. All training sessions reinforce the concepts in the regulations as they are relevant to the laboratory.

Whenever possible, after training is completed, a demonstration of proficiency of the training topic is given. The demonstration of proficiency is generally in the form of a quiz although other demonstrations of proficiency are acceptable depending on the scope and content of the training. If necessary, training is presented and/or repeated one -on-one with individuals who do not demonstrate proficiency in the training topic. This is performed by QA in conjunction with applicable laboratory management personnel.

2.13 Employee Safety

The laboratory, being mindful of its responsibilities as an employer and active corporate citizen, has established the following objectives of its safety program:

- Provide a safe environment for its employees, visitors, and the community surrounding its place of business.
- Provide ongoing safety training for employees.
- Provide all necessary facilities and equipment to ensure the safety of its employees and to minimize all chemical exposure during the normal performance of their required tasks, and to take all necessary precautions to safeguard the surrounding environment.
- Provide periodic health physicals for employees.

- Foster and encourage safe operations and a proper safety attitude on the part of our employees through general operations and systems, training, and the *Chemical Hygiene Plan* (CHP).

The CHP addresses various aspects of our safety program in greater detail.

A Safety Committee works to enhance our overall safety program. The committee meets on a routine and ongoing basis and its specific responsibilities are detailed below:

- Review accident and incident reports. Make recommendations for methods of prevention to eliminate further accidents.

- Promote safety awareness and distribute safety information by various means (e.g., posters, videotapes, pamphlets, and books). Use internal communication channels to promote safety awareness.

- Enhance and recommend safety-training programs for all employees, as necessary.

- Maintain up-to-date information on employee concerns that are safety related. Offer input and information to the Chemical Hygiene Officer and/or Safety Officer, as needed.

2.14 Client Services/Project Management Responsibilities

Members of the laboratory Client Services/Project Management Group are responsible for organizing and managing client projects. Clients are assigned a project manager (a.k.a. “CSR”) who serves as their primary contact at the laboratory. It is the project manager’s responsibility to act as the client advocate by communicating client requirements to laboratory personnel and ensuring that clients provide complete information needed by the laboratory to meet those requirements. All client verbal communications are documented by the project manager in a controlled notebook. In addition to information management, Project Management responsibilities include:

- Coordinating and preparing proposals in conjunction with technical staff.

- Confirming certification status.

- Assisting QA with hosting client visits and audits.

- Coordinating and communicating turnaround time (TAT) requirements for high priority samples/projects.

- Answering common technical questions, facilitating problem resolution.

- Providing clients with sample status report or results (partial reports) prior to receipt of the final Analysis Reports.

- Scheduling sample submissions, sample containers orders, and sample pick-up via the laboratory courier service.

- Informing the client of deviation from their contract.

2.15 Confidentiality

Strict confidentiality is maintained in all of our dealings with clients. Confidentiality agreements, therefore, are willingly provided.

All employees are required to protect company data, including client names and test results from disclosure to any third party. This policy, as described in the *Eurofins Lancaster Laboratories Employee Handbook*, is provided and presented to employees during their orientation period and whenever revisions are made.

Intellectual property associated with the testing that we perform under contract for a client is the property of the client.

In an attempt to ensure the confidentiality of our systems and procedures within our laboratory, it is our policy to restrict the distribution of our internal procedures to clients. Clients are permitted to review our procedures while on-site as part of an audit or visit. Based on this policy, we would request that any documents viewed would not be shared or made available to any third parties without the permission of the laboratory.

2.16 Business Conduct

Our business conduct policy applies to all operations of the company. All employees must avoid involvement in any activities that would diminish confidence in their competence, impartiality, judgment, or operational integrity. All employees must further avoid any relationship with other individuals or organizations that might impair, or even appear to impair, the proper performance of their company-related responsibilities. Employees must avoid any situation that might affect their independence of judgment with respect to any business dealings between the company and any other organization or individual. Any employee who believes that they have such a conflict, whether actual or potential, or who is aware of any conflict involving any other employee must report all pertinent details to the Vice-President or President of the company.
The company's management vigorously enforces this policy and takes prompt and appropriate action, including termination, against any employee found to be in violation.

2.17 Operational Integrity

All employees review and sign the Employee Ethics Statement on their first day of employment and annually thereafter. All employees are instructed in regard to how ethics and data integrity are relevant to every position in the company. Employees responsible for generating, handling, or reviewing laboratory data understand that the laboratory mission is to perform all sample processing and testing with the highest level of integrity. Under no circumstances are shortcuts or generating results to suit a client's purpose rather than good scientific practice considered acceptable. Any violation of the laboratory ethics policy results in a detailed investigation that could lead to termination.

All levels of management consider the following activities unacceptable:

- Knowingly recording inaccurate data.

- Fabrication of data without performing the work needed to generate the information. This includes creating any type of fictitious data or documentation.

- Time travel or adjusting clocks on computerized systems to make it appear that data was acquired at some time other than the actual time.

- Manipulation of data for the express purpose of passing system suitability or quality control criteria.

- Selective use of data generated, or not using data that was legitimately generated and has an impact on the outcome of the test.

- Executing significant deviations from approved test methods and procedures without prior approval from the laboratory management, QA, and/or the client.

If an issue does arise which could compromise data integrity, personnel are instructed to perform the following activities:

- Clearly document the situation and maintain all data generated. There is a big difference between poor judgment and fraud. Fraud usually involves intent to conceal an action taken. Therefore, the more documentation that is maintained, the less likely an action is considered fraudulent if further scrutinized.

- When out-of-specification results or quality type issues are detected, all supporting data and relative background information must be documented and presented for management review. Problem resolution and client contact, as applicable, must also be documented.

- Review any questionable situations and decisions with a supervisor.

- Bring a questionable or uncomfortable issue directly to the QA Director or a member of the QA Department as part of our QA open door policy.

- Utilize the company's anonymous Ethics hotline service. See Section 12.4 of this manual.

3.0 BUILDING AND FACILITIES

3.1 Facility

The laboratory is located at 2425 New Holland Pike, Lancaster PA. The facility consists of two campuses with multiple buildings located on the North and South sides of Route 23. The two campuses are connected by a pedestrian bridge that spans Route 23.

Building A resides on a commercial plot measuring 13.6 acres on the north side of Route 23. Building A is a three-story building of concrete and steel construction which houses both laboratory space and administrative offices. It is approximately 108,000 square feet and consists of approximately 47,000 square feet of laboratory space; 29,000 square feet of office space; and 32,000 square feet of storage, mechanical, and common areas. On this parcel, adjacent to Building A, sit two chemical storage buildings (Buildings I and L) with a total space of 2500 square feet. In addition, a 10,500 square foot storage building houses stability chambers (Building J). The bottles packing area, which includes preservation of bottles being sent to clients for sampling, is located in a separate 3100 square foot building (Building K). In addition, there are two other buildings (Buildings G and H) with a total square footage of 20,000 square feet that host recycling, storage, workshop and facilities maintenance areas.

The remaining buildings reside on a commercial plot measuring 35.7 acres on the south side of Route 23. These building are connected to the north campus buildings via a pedestrian walkway over the highway.

Building B is a three-story building of steel and concrete construction. It is approximately 56,000 square feet and consists of approximately 17,000 square feet of laboratory space; 14,000 square feet of office space; and 25,000 square feet of storage, mechanical, and common areas.

Building C resides between buildings B and D and consists of a three-story building of steel and concrete construction. It is approximately 47,000 square feet and consists of approximately 25,000 square feet of laboratory space; 6,900 square feet of office space; and 15,100 square feet of storage, mechanical, and common areas. The first floor houses the main lobby and visitor's entrance.

Building D is connected to building C. It is a 78,000 square foot, four-story building of steel and concrete construction and provides approximately 35,000 square feet of laboratory space, 19,000 square feet of office space, and 24,000 square feet of storage, mechanical, common area.

Two small support buildings (Buildings E and F) with a combined space of approximately 800 square feet are used for chemical and waste storage on the south campus.

Building U is a 17,000 square foot stability storage building.

The Lancaster campus also utilized an adjacent parcel for a technical training center. This space is approximately 6,500 square feet.

There is an automatic fire alarm and security system hooked up at the facility. This system is monitored offsite by Choice Security. The entire campus and all exterior doors are monitored by video surveillance.

This facility is serviced by public sewer. Drinking water and the facility sprinkler system is fed by the public water supply. Laboratory process water is supplied via on-site wells. The closest surface water is the Conestoga Creek.

3.2 Security

The laboratory is considered a secure facility. All outside doors except the main lobby entrance are locked during normal business hours to prevent unauthorized entry. An attendant monitors this entrance at all times.

During evenings, weekends, and holidays, all doors are locked and Security personnel are on site to prevent unauthorized entry into the building. Video cameras are utilized by Security personnel to monitor the facility grounds.

Every employee is issued a photo ID badge which also serves as a building access card. This badge must be worn at all times while on laboratory property so that employees are easily identified. Access to secured/designated areas within the building is limited to only applicable employees through the building security system. This system is administered by Security staff.

All visitors must register with the lobby attendant and are issued a visitor badge. A staff person must accompany visitors while in the facility. Additional visitor rules are outlined in the *Visitor Security and Safety Rules* pamphlet which is provided to all guests.

Building access cards are issued on a temporary basis to contractors or service technicians (e.g., electricians and plumbers) who need access to the building to work on a project. These cards provide the contractor with limited access during the normal workday and must be returned when the work is complete.

3.3 Disaster Recovery

A disaster recovery plan is in place to provide direction for situations where normal operations of the laboratory are not possible. In the event that the building or information technology (IT) systems would be severely challenged, a designated disaster recovery team, which includes Physical Services, Maintenance, Safety, Corporate Management, Public Relations, IT, QA and other applicable personnel depending on the scope of the disaster, would assemble at a designated area to assess the situation and formulate a plan.

The plan addresses, in general terms, how to approach the following issues: electrical failures, heating/air conditioning failures, fire/building evacuation, computer failures, hazardous material spills, injury to employees, pandemic flu, disruption of phone service, and stability chamber failures.

3.4 Environmental Monitoring

The air handling system for the main laboratory is specially designed to protect sensitive instruments from harmful vapors to ensure that samples are not contaminated. The Physical Services/Maintenance Group is responsible for maintaining the HVAC and exhaust hood systems. This is particularly important in our instrumentation rooms and computer center where a controlled environment, positive pressure system is maintained.

Most refrigerators, freezers, incubators, and ovens used for analysis are monitored by a computerized system equipped with stationary thermometer temperature probes linked to a master panel that is accessed through a computer. If a unit is outside of a predefined temperature range for a specified period of time, the system alarms. Units not on the computerized system must be monitored manually by recording thermometer temperature readings twice daily.

The laboratory is set up so that there is effective separation between neighboring areas in which there is potential for contamination. Laboratory storage blanks are also used to evaluate conditions under which samples for volatile analysis are stored to monitor for cross-contamination potential. QA provides oversight of the environmental monitoring system.

QA and technical management, in consultation with facilities management as needed, evaluate any issues with environmental conditions that could have adverse effects on data to determine if alternative operational plans (moving testing to alternate laboratories, temporary shutdowns, etc.) need to be employed.

3.5 Water Systems

Well water and the public sewer system service the facility. The water system is monitored to meet the permit requirements of the Pennsylvania Department of Environmental Protection.

Reagent water is available to analysts for sample preparation (including dilution) and glassware cleaning. Two reverse-osmosis deionized water systems deliver highly purified water to a sealed fiberglass storage tank. From the storage tank the water is delivered to an ion-exchange-carbon filter system for further polishing. The water is also exposed to an in-line ultraviolet sterilization lamp before being circulated to taps throughout the laboratory.

Daily monitoring and preventive maintenance for the system is the responsibility of the Physical Services Department. Monthly and annual testing is performed as required by regulatory guidance. QA provides oversight of the water system monitoring. In addition, method blanks are tested with each batch (=20) of samples.

3.6 Housekeeping/Cleaning

The laboratory is dedicated to providing a clean workplace. A third party professional cleaning service provides routine cleaning of "common areas" that include lavatories, drinking fountains, floors, and windows. Technical staff are responsible for the cleaning (or the contract of cleaning) of specific laboratory work areas.

Detergents used for cleaning contain no to very low levels of metals, pesticides/herbicides/ fungicides, or volatile solvents.

3.7 Insect & Rodent Control

Steps are taken to prevent, monitor, and control insect and rodent infestation. The coordination of this program is the responsibility of the Physical Services Department under the direction of QA. An outside service firm is contracted to perform routine and ongoing monitoring of the facility to ensure that preventive measures which are in place are effective and are working as intended.

No insect or rodent control chemical agents in a liquid or vapor form are applied or sprayed in any laboratory building, unless there is no other option, in which case department management must be contacted for approval.

3.8 Emergency Power Supply

The laboratory is located at the junction of two power grids that supply electrical service to the facility. If one of the power grids fails, we have the ability to work with the power company to have service switched to the other grid. Various types of diesel and natural gas generators are also available on a standby basis to supply power to selected areas of the laboratory in case of a power outage.

To reduce spikes and spurious line voltage changes to laboratory instruments that can affect results or damage electronic equipment, "conditional power" is fed to these sensitive instruments. All essential computer systems are on uninterrupted power supply (UPS) which is a battery system that provides continuous conditional power for a limited time period in the event of a short power outage.

3.9 Facility Changes

Procedures are in place to manage change, ensure communication, and to minimize negative consequences through active participation of personnel involved in a facility change. The goal is to ensure that physical and environmental condition changes are adequately evaluated for impact and reduction of risk to quality, safety, health, employee, environment, property, analytical services, and business operations before and after the change is implemented.

4.0 DOCUMENT CONTROL

The administration of the document control system including tracking, filing, updating, and archiving of inactive copies is managed by the laboratory and QA staff using an electronic record keeping system. All documents are maintained and accessed through the electronic system. If an employee or department uses hardcopy versions of the documents, they are responsible to ensure that they are using the active version of the document.

It is our policy to restrict the distribution of our internal procedures to clients and we discourage the distribution of company confidential documents outside of the facility. Clients are permitted to review

our procedures while on-site as part of an audit or visit. Any documents that are distributed are only sent with the approval of QA and are considered "Uncontrolled".

The goals of the document control process are:

- Format documents according to consistent and defined standards
- Review and approve new documents
- Schedule review of existing documents
- Control of document versions and effective dates
- Review and approval of document changes
- Communicate and track employee training on SOPs
- Control document distribution and removal of obsolete documents
- Archive obsolete documents

4.1 Hierarchy of Internal Operating Procedures

The hierarchy of controlled procedures at the laboratory is defined. The levels (e.g. Policy, SOPs, work instructions, forms) are identified for each document in the document control system. These procedures and documentation are made available to promote consistency throughout the organization and to meet regulatory requirements. A list of relevant methods and procedures is located in Appendix E. The development of new procedures and the review and updating of current procedures is ongoing based on laboratory changes, new method development and regular review cycles.

4.1.1 Level 1 - Quality Policy Manual and Company Policies

The intent of these documents is to define "what" we do with emphasis on Executive and Management's responsibility for quality.

The purpose of the Quality Policy Manual is to provide a framework to outline the quality systems at the laboratory. Information on key quality system processes is described within the manual. Organizational charts, list of SOPs, a list of equipment, instrumentation, and PQDs for senior personnel are included as attachments to this manual.

- Executive Management is responsible for ensuring that adequate personnel, resources, and support are available to carry out the requirements of this Quality Policy Manual.

- Management is responsible for ensuring that SOPs, Work Instructions, or other appropriate documents are written and available to personnel to define the practices and systems which support these policies.

- All employees are responsible for conducting business in a manner which is compliant with quality and company policies and associated SOPs, Work Instructions, or other appropriate documents. Review of these policies and procedures must be documented.

Additional company policies are written to support and expand upon this Quality Policy Manual. These policies contain more detailed information about a subject with approval signatures executed at the Executive and/or Management level.

4.1.2 Level 2 - Standard Operating Procedures

The intent of these standard operating procedures is to define "who, what, where, and when." These procedures provide specific information for a process or topic so that the requirements outlined in this *Quality Policy Manual* and company policies can be achieved. The review and approval of these SOPs is performed at the director/manager/group leader level, including QA review and signoff, and the responsibility of these SOPs lies with the area or person directing the operation.

SOPs can apply to site-wide operations, the entire company, across multiple departments, or a specific operating area.

4.1.3 Level 3 - Work Instructions (at a department level)

The intent of these procedures or documents is to define in greater detail the specific "how to". The level of detail in these documents must be sufficient so any appropriately trained person can perform the task accurately. Examples include, but are not limited to departmental standard operating procedures (SOPs); maintenance and calibration procedures; and the laboratory analytical methods. Departmental level procedures/documents are reviewed and approved at the manager or group leader level including QA review and signoff.

4.1.4 Level 4 - Quality Records

The intent of these
documents is to provide documented evidence to support our quality systems and operations. Examples include but are not
limited to, data notebooks/logbooks, and preformatted data recording forms.

4.2 Document Approval, Issue, Control, and Maintenance

The document control process ensures that documents are approved and adequate for use. It ensures that documents are readily available to personnel and at locations where essential operations are performed.

Procedures are available to all employees in electronic form through our document management system. The laboratory management and QA staff is responsible for ensuring the documents in this system are in a current and accurate state. These procedures can be printed from this system for reference by employees as the corresponding task is being performed. Prior to using a printed document, the employee **must** ensure that it is the current version.

Each procedure is uniquely identified and includes effective date, version identification, designated user groups and the "approved by" employee. Document editors and reviewers are recorded in the electronic system for each version of a document. All documents are searchable and uniquely identified in the document management system.

Controlled policies, procedures, and work instructions are reviewed and approved by appropriate individuals and are formally issued and administered through the electronic document management system. The editor, reviewer and approval personnel are recorded within the document as through the document control interface. The recording of these steps is through the employee's secure network log -in and password. Designated personnel are assigned the editor, reviewer, and approval roles. Administration of the role assignments is managed by QA.

Procedures undergo scheduled annual review to ensure that they are accurate, current, and compliant. QA is the final approver and publisher on procedures which gives QA the authority to implement the procedure. Forms may be approved and published by department management. Upon the effective date of new or updated documents, all copies of obsolete documents are removed from service.

Interim amendments to procedures are not allowed. Any needed changes require a revision to the document. The document management system has a feedback function which enables information to be given to the assigned document editors. If minor edits (e.g. typos) are identified that can wait until the next review cycle, these can be communicated through the feedback function.

Forms are frequently used in logbooks. The logbooks are created by the Office Services group. The appropriate form is provided to Office Services to be made into a logbook. The logbook is given a unique identification number and is tracked by Office Services in regard to issuance to the associated department and through to subsequent archival.

4.3 Client-Supplied Methods and Documentation

Client documentation to support environmental testing at the laboratory is maintained in a centralized area. This information is organized by client/project in the Client Services/Project Management Group. Client documentation includes the following information depending on project size and scope:

- Client supplied analyte lists
- Client supplied project plans
- Client contract quality manuals with specified limits, QC criteria, etc.

- Communication/correspondence records which relate to testing requirements, interpretation of results, or reporting formats

4.4 Laboratory Notebooks, Logbooks, and Forms

Procedures are in place to ensure that all data is traceable, authentic, complete, and retrievable. The following general requirements outline our system for the issuing, control, and archival of laboratory notebook and logbooks.

- The administration of notebooks and logbooks is controlled by the Office Services Group. They maintain a master index to uniquely number and identify each book distributed.
- Notebooks and logbooks can contain blank or preformatted pages.
- Notebooks and logbooks are bound, uniquely identified and have sequentially pre-numbered pages.
- If notebooks or logbooks contain preprinted laboratory form pages:
    - A unique identification number is assigned to each form
    - Forms are approved through the electronic document management system by appropriate management personnel before they are put into use
    - Forms are reviewed on a routine basis to ensure they are still accurate and current
- Completed notebooks are returned to an archivist. Incomplete books are returned to the Office Services group:
    - Two years from the issue date
    - For employee specific notebooks – when the employee leaves the company
    - For project specific notebooks – when the project for which it was used is complete
- In specific situations, records may be bound to create books at the time of archival (e.g., temperature charts).
- At the time of archival any page(s) in the notebook or logbook that does not contain data documentation is crossed-out or a statement is written on the last page used to note that the book is complete to prevent data from being entered at a later date.
- Notebooks and logbooks identified as requiring permanent archival are assigned a designated qualifier.

4.5 Control of External Documents

Hard copy versions of external documents are controlled using an inventory form in the document management system. Any external document that is maintained in the laboratory are inventoried and listed on a department specific controlled form.

External documents such as copies of the 40 CFR and ASTM methods are stored exclusively in the QA Department. QA also keeps applicable agency documents on file, these include, but are not limited to, the TNI (The NELAC Institute) and ISO 17025 standards.

Environmental methods from the EPA or Standard Methods are available in the QA Department, but the technical areas also have copies that pertain to the tests that they perform. Some methods are available on-line and are accessed through the Internet.

It is the laboratory's understanding that the need to control external documents is to ensure that the most current version of a method is referenced or appropriate manual is being used. Regulatory methods are used as references by the laboratory and testing is performed as per written SOPs that fall under our existing document control system and have scheduled reviews. The scheduled review of SOPs is used to ensure that the proper version of a method is referenced. While using the most current version of an analytical method is our typical practice, there are specific client needs and accreditation rules that require previous versions of a method to be used.

The technical areas are responsible for ensuring that all manufacturers' manuals are current and available to analysts. The vendor provides instrument manuals when new equipment is purchased or existing instruments are updated. These manuals are kept with the instruments to which they are associated.

5.0 SAMPLE HANDLING

5.1 Sample Collection

It is the responsibility of the client to send us representative and/or homogeneous and properly preserved samples of the system from which they are drawn. The laboratory assumes that all multiple sample containers with the same designator/description and bottle type contain a homogeneous, representative sample. We also assume that it is acceptable to deplete one container and move to the next, without implications unless otherwise indicated by the client.

The laboratory provides the appropriate sample containers, required preservative, chain-of-custody (COC) forms, shipping containers, labels, and custody seals. The laboratory also provides trip blanks and analyte-free water for field blanks. Preparation of methanol containers for field preservation of volatile soil samples is available.

Sample containers are purchased pre-cleaned by the supplier. For pre-preserved bottles, each lot of preservative is checked for contaminants before use. This also serves as a check on the associated containers. An annual bottle lot check is performed to evaluate the cleanliness of any containers not already covered by the preservative checks. The evaluation is to assess cleanliness to the laboratories'

detection limits. These checks are processed through the LIMS as samples. Results are documented through the LIMS Analysis Report.

The laboratory provides instructions with all bottle orders that define how to sample, preserve, store, and ship the samples prior to their delivery at the laboratory. These instructions inform the client of the importance of proper sampling and advise them that non-compliant samples are rejected or reported with a qualifier.

As samples are analyzed at the laboratory, there are times when additional sample volume is necessary to complete testing or perform retesting. If this situation arises, "additional sample" is requested by the laboratory and/or submitted by a client to supplement current work being performed within our facility. Additional sample received is either assigned a new laboratory sample ID number and/or a comment noted on the final report to state that additional sample was received, depending on the situation. It is our goal to provide accurate traceability between sample submission and when testing is performed.

5.2 Sample Receipt and Entry

5.2.1 Sample Entry

Samples can be received at the laboratory 24 hours a day, 7 days a week, 365 days of the year. Receipt can occur in one of three ways:

- The laboratory courier services (i.e., Transportation Department
- Personal delivery
- Commercial courier

All samples received for testing are delivered to the Sample Registration group immediately upon arrival. This group is responsible for the unpacking and organizing of the samples. This process includes checking custody seals if present, paperwork agreement, signing the chain of custody, recording cooler temperatures, documenting the condition of containers, accounting for all sample bottles, and observing any safety hazards, and reporting any problems to Client Services for communication to the client. This receipt process is documented in the LIMS.

5.2.2 Sample Entry

As soon as practical after sample receipt, all samples are entered into our LIMS. Samples awaiting log-in are stored in temporary holding areas, at appropriate storage conditions to maintain sample integrity. Samples scheduled for Volatile analysis are stored separately. If there is doubt about the suitability of items received or if items do not conform to the description provided or the testing required is not clear or specified, the client is contacted and the conversation documented.

At the time of entry, the LIMS assigns a unique laboratory sample number to each sample. This number is sequentially assigned and a label is generated and is attached to the sample container. Each sample container is uniquely identified with a bottle code. the sample number and bottle code are

subsequently recorded on laboratory data records to ensure traceability from the test data to the sample container.

Samples are tracked to the minute upon arrival. This allows the client to see exactly how long it took the samples to pass through receipt, unpacking, and entry.

A sample acknowledgement is generated from the LIMS per sample entry group. Upon request, a copy of the Acknowledgement may be sent to the client on the day following sample log-in to confirm sample receipt and entry. Internally, appropriate personnel audit all applicable sample entry and client paperwork.

5.2.3 Sample Preservation Check

Sample Registration personnel check and document preservation of non-volatile liquid samples after the samples have been entered into the LIMS and before they are released to the laboratory for testing or placed into storage. Any checks of volatile samples are performed and documented at the time of analysis.

5.2.4 Sample Rejection Policy

Regulated (e.g. drinking water, NPDES) samples are rejected if receipt requirements are not met. The laboratory's Sample Acceptance Policy is communicated to clients with each bottle order. Any time a sample is received in a condition that does not meet the method, regulatory, or client requirements, the condition of the sample is clearly documented through the LIMS on a sample registration documentation log or sample problem form. This information is forwarded to the CSR and the client is contacted to discuss the best course of action. The client is given the option to resample or have the sample analyzed and reported with a qualifying comment.

5.3 Sample Identification and Tracking

A sample label is generated for each sample and, in addition to the assigned unique sample number, the following information is displayed on the label: client name, sample identification assigned by the client, sample collection information, bottle code ID, analyses requested, and any applicable notes to laboratory personnel. The label includes a barcode that is used to track this information about the sample/container and to trace each container's storage location.

To ensure accountability of results, the unique sample number assigned is used to identify the sample in all laboratory data documentation, including notebooks, instrument printouts, and final reports. The sample number is also used to identify additional containers of the sample that are created during sample preparation and analysis (e.g., subsamples, extracts, digests). Each container for a sample is tracked through the bottle code and an A.B.C… designator when there are multiple containers of the same type received. The link of the bottle code and sample number is used to identify which specific container was used for testing.

Routine sample tracking is documented using the Laboratory Sample Analysis Record (LSAR) which captures the date, time and analyst for each sample preparation and analysis. The information is

compiled in the LIMS using electronic record tracking from the data upload and entry functions. This displays, per sample, on each Analysis Report.

5.4 Sample Storage

After sample registration is complete, samples are placed in an assigned and identified storage location until needed for analysis. Room temperature, refrigerated, and frozen storage are available and samples are stored in accordance with regulatory, method, or client direction. The LIMS is used to assign storage locations, which assists in the orderly storage of samples. Sample storage locations are secured and monitored for accurate temperature control. Samples are stored separately from standards and reagents.

The central locked storage facility contains 3430 square feet of refrigerated space, including 2740 square feet equipped for automated sample retrieval. Samples are stored in the laboratory's automated storage and retrieval system (ASRS) or other assigned storage locations (separate volatiles areas) within the laboratory until completion of all analytical work.

When a sample is scheduled for analysis, the analyst requisitions it through the LIMS from the storage area. Barcode readers are used for LIMS documentation of the movement of the samples between storage and the laboratories. To maintain the integrity and security of the sample(s), the aliquot needed for analysis is removed and the sample(s) returned to storage as soon as possible.

5.5 Sample Return/Disposal

Samples remain in the storage area following analysis until the testing results have been verified and the analysis report has been generated. On a regular basis, a list is generated from the LIMS that summarizes samples that can be removed from the storage area. At a minimum, water samples are held for 1 week and soil samples for 2 weeks after reporting before they would be eligible for disposal. Samples are either returned to the client or disposed of in accordance with local, state, and federal regulations. Removal of the containers from storage for permanent discard is also documented in the LIMS using the barcode reader.

Due to the variety of waste generated at the laboratory, several general categories of wastes and waste streams have been identified. Identification of waste occurs through information provided by the client, historical information, and/or analytical testing. The laboratory uses a sophisticated, computerized LIMS, which includes programming to assist in the identification of hazardous wastes at time of discard.

For reasons of environmental liability, client confidentiality, proprietary product formulation protection, etc., wastes generated by the laboratory are disposed of via incineration at EPA licensed facilities. The three exceptions include bulk neutralized acid waste, COD analysis waste, and lab pack waste containing mercury. None of these exceptions involve containers with client information.

5.6 Legal Chain of Custody

Samples being tested for litigation require locked storage and documentation of the time and personnel

responsible when the sample was not in storage. This level of documentation is available upon client request and procedures to define these activities are in place and include the following:

- A chain-of-custody document is initiated for each bottle type submitted by the client.
- The chain of custody is signed each time the sample is stored, removed from storage, or changes hands.
- Clients requesting legal internal chain-of-custody documentation receive the completed forms after the analysis is complete.

5.7 Representativeness of Samples

Each analytical method provides specific procedures for ensuring that a representative aliquot of the sample is used for testing. These procedures include shaking water samples and mixing solid samples prior to removing an aliquot for testing. Analysts are also instructed in sampling techniques that prevent contamination of samples.

6.0 TECHNICAL REQUIREMENTS - TRACEABILITY OF MEASUREMENTS

6.1 Reagents and Solvents

The reliability of our analytical results can be directly affected by the quality of reagents used in the laboratory. Procedures are in place to address labeling, storage, and evaluation of these materials. Reagents and solvents include acids, bases, indicators, buffer solutions, colorimetric solutions (CS), test solutions (TS), and volumetric solutions (VS). The *Chemical Hygiene Plan* provides safety information in regard to the storage and handling of laboratory chemicals. All reagents are stored separately from samples.

Each analytical method includes a list of reagents needed to perform the test. Reagents/solvents are fully described, including chemical name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed. The laboratory is responsible for checking that new supplies meet the method requirements. These checks are documented and maintained.

Departmental management ensures that an adequate inventory of reagents needed to perform testing is maintained. Reagents received at the laboratory funnel through the Shipping and Receiving Department and deliveries are verified and labeled with the date of receipt. Large volume reagents (e.g., solvents, acids) are stored in a building outside of the laboratory until needed for use.

In addition to the name and concentration of the reagent, all reagents are labeled with the manufacturer/vendor, storage conditions, the date opened, and an expiration or re-evaluation date. Before using any reagent, the analyst must ensure that the material was properly stored and labeled.

If a reagent has passed its expiration date or shows signs of deterioration, the material is not to be used in the laboratory and must be discarded or segregated as expired. In some method development or research work, expired reagents may be used. These must be labeled as such or stored in a designated location.

If a re-evaluation date is reached before a reagent is completely consumed, the reagent will be inspected by physical observation for signs of degradation. Physical signs include, but are not limited to, color changes, clumping or other texture changes for solids and formation of precipitate in solutions. This evaluation is performed by an experienced chemist.

Subsequent reagent solutions or mixtures prepared at the laboratory are fully documented in a log and labeled to include: unique name, concentration, date prepared, name of analyst who prepared the reagent, storage conditions or reference to the log containing these details, and expiration/re-evaluation date. The information recorded allows these solutions to be traced to the original stock solution. The reference to the log is intended for use on containers that are too small to clearly document all of the information.

All reagent certificates and MSDSs are retained by the laboratory.

6.2 Calibration Standards

Written calibration procedures are required, where applicable, for all instruments and equipment used in the laboratory. The source and accuracy of standards used for calibration purposes are integral to obtaining quality data. Requirements for calibration are provided in each analytical method including specifications for the standards used. Where available and practicable, calibration measurements made by the laboratory must be traceable to national standards of measurement (e.g., NIST). Certificates of Analysis (C of As) are maintained for each material, as applicable.

The laboratory's ISO 17025 and DoD accreditations require calibration materials to be certified and purchased from a reference material producer accredited to ISO Guide 34 and ISO 17025, when available. A list of accredited suppliers is maintained by QA. This is applicable to the tests under these scopes of accreditation and can be met through the stock standards used for calibration; a standard processed under the calibration such as an ICV or LCS; or comparison to a separate reference material at a frequency defined by at the test level (i.e. annually).

Standards are usually purchased from commercial supply houses either as neat compounds or as solutions with certified concentrations. Upon receipt at the laboratory, the material must be labeled with the date of receipt. The accuracy and quality of these purchased standards is documented on a C of A and these certificates are maintained on file in the laboratory.

Most solutions and all neat materials require subsequent dilution to an appropriate working range. Records of all standard preparations include the dilution(s) made and a reference to the original and any intermediate mixtures. Solutions are labeled according to laboratory procedures and assigned unique names or code numbers that provide traceability to the original components.

All standards are stored separately from samples and in conditions as stipulated by the method or vendor (refrigerator, freezer, room temperature, etc.).

Each new preparation of standard is tested for integrity by comparison to standards from another source or previously prepared solutions. Standards are not used for sample analyses in the laboratory past their expiration date. In some method development or research work, expired standards may be used. These must be labeled as such or stored in a designated location.

6.3 Equipment and Instrumentation

The laboratory is equipped with all equipment and instrumentation required for testing the scope of work which it supports. All equipment and instrumentation is maintained in proper working order. A master list of our equipment and instruments is maintained by our accounting department and includes the date received and the condition at receipt (new v. used). Our major equipment and instrumentation capabilities are summarized in Appendix F. In addition, we have numerous other instruments including pH meters along with support equipment such as ovens, incubators, centrifuges, balances, etc.

6.3.1 General Requirements

Equipment/instrumentation is assigned a unique designation. This unique number or system identification is used to track the equipment or instrument within data documentation.

A maintenance logbook is established in conjunction with installation and is readily available to document all incidents and/or routine maintenance processes that pertain to the equipment or instrument as they occur. The corrective action taken, the date that the equipment/instrument is returned to service, and performance checks performed is documented.

All test, measuring, and inspection of laboratory systems, equipment, and instrumentation used at the laboratory is routinely calibrated and maintained in accordance with applicable standard operating procedures.

A member of the technical group, or designated individual, performs routinely scheduled maintenance and calibration of laboratory equipment and instruments as required by laboratory procedures. These activities are documented.

If appropriate standards or expertise for calibration or maintenance are not available in-house, the operation is conducted by an outside service firm, with appropriate accreditation. Certificates or other data generated by the service firm are reviewed by applicable the laboratory personnel to verify acceptability. This information is maintained on file.

All equipment or instruments taken out of service are tagged "DO NOT USE". The following minimum information is documented on the tag:

- Date taken out of service
- Employee who took the equipment/instrument out of service
- Reason for tag-out

6.3.2 Standard Operating Procedures

Information regarding operation, maintenance, and calibration of equipment and instrumentation is found in the respective SOPs. The procedures include, where applicable, a routine schedule for preventive maintenance and calibration along with acceptance criteria and remedial action to be taken in the event of failure. These procedures are maintained in the document control system and reviewed on a regular basis to verify they remain current and accurate. Vendor supplied manuals are also available to provide additional information in regard to operation and maintenance.

6.3.3 Maintenance

Instrument and equipment maintenance is performed as either a preventive or corrective operation. These processes and schedules are defined in the corresponding SOPs and Work Instruction documents.

Preventive maintenance procedures and schedules are developed for each instrument or piece of equipment, where applicable. Preventive maintenance operations are performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel). Documentation is maintained in the associated maintenance log for the procedure(s) performed as part of the preventive maintenance operation. It is the responsibility of departmental management to ensure that a preventive maintenance schedule is addressed by a procedure where appropriate and is followed.

Corrective maintenance is performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel) in response to indications of equipment or instrument malfunctions. The unit must be clearly tagged as out of service. All corrective actions taken to bring the unit back into service are documented in the associated maintenance log. After repair, further notation is made in the log regarding the functional status. Calibration activities are performed, as applicable, and documented in the log before the unit is placed back into service.

A supply of commonly needed replacement parts is maintained by the laboratory.

6.3.4 Calibration

Calibration is the establishment of, under specified conditions, the relationship between the values/response indicated by a measuring instrument or system and the corresponding known/certified values associated with the standards used. Some types of calibrations are performed with a set frequency (e.g. daily) while others provide intermediate checks to ensure that the instrument response has not changed significantly.

All measuring and testing instruments and equipment having an effect on the accuracy, precision, or validity of calibrations and tests are calibrated and/or verified at least annually. Methods for calibration of instruments and equipment vary widely with the nature of the device and the direction given by analytical procedures, departmental procedures, manufacturer recommendations, or regulatory requirements. Frequency of calibration can also depend on additional factors including ruggedness of the instrument or equipment and the frequency of use. The calibration procedures, schedules, and acceptance criteria are defined in the corresponding SOPs and Work Instruction documents.

Departmental management is responsible for developing or acquiring written calibration procedures for the types of instruments and equipment employed within their area, as applicable. Procedures address the following aspects: description of the calibration method, frequency/schedule for calibration, acceptance criteria, and corrective actions if failure occurs.

Calibration information is recorded in a logbook that is associated with the instrument/equipment and/or a calibration certificate is maintained and/or data is generated and filed to document the activity.

Calibration measurements are traceable to national standards of measurement (e.g., NIST) where available. Physical standards, such as NIST certified weights or thermometers are re-certified on a routine basis. Calibration certificates are maintained on file, where applicable, to indicate the traceability to national standards of measurement. These physical standards are used for no other purpose than calibration.

Calibration failures are documented in the associated logbook and/or within the data generated from the instruments or equipment. Management personnel perform an evaluation and review of failures and assess any potential impact the failure might have on previously generated data. The laboratory utilizes "real-time" controls to ensure the accuracy of the data. These controls are used to assist in assessing the impact of the situation.

After repair, adjustments, or relocation that could affect instrument response, calibration/verification activities are performed, as applicable, before the unit is returned to service.

Analytical data is not reported from instrumentation or equipment with noncompliant calibration unless the client has agreed to receipt of the data and appropriate qualifiers or comments are applied to the final Analysis Report.

6.4 Computerized Systems and Computer Software

6.4.1 Computer Usage

The laboratory provides computer equipment for employees to use as a tool in performing their work. Computer equipment is the property of the laboratory and used in accordance with defined terms and conditions. Our goal is to provide standard hardware and software that meets the needs of the user. The majority of desktop PCs and laptops in use are standardized using cloning software.

6.4.1.1 Physical Security of Computer Systems

It is company policy to protect computer hardware, software and data documentation from misuse, theft, unauthorized access and environmental hazards. The corporate computer area and computer "Hot-Site" is locked and requires identification/building card access. All vendors, contractors, or other visitors must be escorted into this area. Controlled access of the laboratory buildings is outlined in Section 3.2.

6.4.1.2 Passwords

Passwords are important for the security of company data and resources. The laboratory's primary network operating system is Windows and each employee must have a user ID and password combination to access the system. Other computer systems also require a user ID password combination for access. The following procedures apply regardless of which system(s) is being utilized:

- Passwords must be created as strong passwords in accordance with Eurofins Password Policy and must be kept confidential.
- Users must log-out of a system when not in use to prevent unauthorized access. In addition, the network access will automatically timeout after a set period of inactivity, requiring a user to log-in to access the system.
- Forgotten passwords can only be reset by the IT Department or by an appropriate System Administrator.
- Network and LIMS passwords automatically expire at designated intervals. The computer prompts a user to change the password when the expiration date nears. If the password is not changed, the user will be locked out of the system.

6.4.1.3 Viruses

The laboratory centrally and continuously monitors the computer network for computer viruses. Employees are prohibited from using the company's computer equipment to propagate any virus. Anti-virus software is employed to detect viruses on the Windows network. A notification is sent when there is a particularly dangerous or virulent data destructive program that employees need to be aware of. However, employees are instructed to always be cautious and observant even if there are no current warnings. Employees must report any virus concerns to the anti-virus administrator or IT Management as soon as possible. Employees who share files between their home computer and the laboratory should install anti-virus software on their home computer. If an employee does not have such software, the laboratory can suggest various no-cost anti-virus software products.

6.4.1.4 Internet and E-mail Systems

The e-mail system is used primarily for the laboratory's business purposes. The *Eurofins Lancaster Laboratories' Employee Handbook* provides additional information in regard to system usage. Employee access to the internet is restricted to those employees who have a business need for it. All employees have access to e-mail. Access to the internet is configured through a user's Windows network account. All internet and e-mail activity is subject to monitoring. All messages created, sent or received over the internet are company property and can be regarded as public information. E-mail and website filtering software is utilized.

6.4.1.5 The Laboratory's Intranet (LabLinks)

The Intranet is designed to be a useful tool for employees to acquire company information and to provide a company communication system. The *Eurofins Lancaster Laboratories' Employee Handbook* provides additional information in regard to usage.

6.4.1.6 Software Policy

Copyright laws protect software, and the laboratory's intent is to abide by all software agreements.

Software purchases must be formally requested and approved by management and/or validation personnel, as necessary.

All software is used in accordance with applicable license agreements.

Employees are not to install any software on computer(s) unless authorized by the IT Department.

Software upgrades must occur in accordance with applicable change control procedures.

Employees must not give software to outsiders (e.g., clients, contractors), unless approval is granted by management.

Users must not make copies of any licensed software or related documentation without permission. Any user that illegally reproduces software is subject to civil and criminal penalties including fines and imprisonment.

6.4.1.7 Computer System Backup, Data Restoration, and Data Archival

Mission critical data is stored on several computers throughout the laboratory. These computers are connected through the local area network. Selected files on these computers are backed up using an enterprise-level backup software program. The objective of this backup is to have the ability to restore data after a total loss (e.g., theft, fire, natural disaster). Procedures are in place to perform data backups and restores.

6.4.1.8 Remote Access to Computer Systems

Designated employees are able to remotely connect to the laboratory computer systems through an encrypted (SSL) login. When logging in, users are authenticated with their Windows Active Directory account and password.

6.4.1.9 Electronic Data

Instrument software used for processing data
must, when available, have password access and audit trails enabled. All data processed through the LIMS includes
tracking features to document who and when data was entered and/or
changed.

6.4.2 System and Software Verification

The laboratory LIMS is an in-house developed program. The design and updates to the system are written following typical Software Development Life Cycle (SDLC) processes for initial planning through testing and implementation. Before a new computer system/program or significant modification of an existing system/program is implemented in our laboratory, it is necessary to generate a plan to specify the level of documentation required for the new or updated application. Developers, affected area management, and QA personnel review and approve the documentation.

The following are the typical documents that are compiled for these updates:

- System Change Request document – used for documenting/tracking changes in the programming
- Requirements documents – Describe the required system functionality and specifications
- Design documents – System overview, screen design, report layout, data description, system configuration, file structure and module design
- Testing documentation for system development/verification – Structural testing of the internal mechanisms and user testing of the installation and system qualification
- Periodic Review documents – periodic retesting of the programs is performed to ensure that the systems remain in a validated state.
- Retirement documents – used for documenting when a program is taken out of service
- Standard operating procedures and/or manuals

6.5 Change Control

Procedures are in place to define how to maintain facilities, processes, instrumentation, equipment, computerized systems, and computer software in a validated or controlled state through a plan of change control. Successful changes require a thorough evaluation and testing for potential consequences prior to implementation. Planning, authorizing, testing, and reviewing of proposed changes are documented throughout the change process. Changes are planned or could be made in

response to an emergency situation. The following "general" elements apply to changes, as appropriate:

- Request to perform a change
- Evaluation of a change
- Authorization of a change request
- Preparation for an authorized change
- Execution and testing of the change
- Documentation of the change
- Approval of the change
- Change implementation and follow-up (Formal approval of the change is performed by designated responsible individuals and QA.)

Note: The DoD will be notified in advance of the migration to a new LIMS platform and/or relocation of the data center from the Lancaster site.

6.6 Labware Cleaning

Dedicated washroom personnel support the laboratory operations in regard to labware preparation, washing, rinsing, and drying. Labware can include, but is not limited to glassware, plastic ware, utensils, and pipettes. Procedures are in place to outline the washing process for each type of labware. Most labware is cleaned using a Miele glass washing machine. Some labware is still washed by hand and either air-dried or dried in specifically designed ovens.

Most of the labware used in the laboratory is "common or non-dedicated" labware (common to a department), but some of the labware used in the laboratory may be identified as "dedicated" labware and exclusively used for certain analyses. This labware is isolated and cleaned only with "like" labware.

All glassware is class A and 100% visually inspected for breakage (e.g., cracks, chips), cleanliness, and dryness before being returned to the laboratory for use.

Generally, each test has controls in place to ensure that results are not adversely affected by unclean labware. These controls include blanks to detect positive interferences and recovery controls to detect negative interferences.

7 PURCHASING EQUIPMENT AND SUPPLIES

7.1 Procurement

It is the responsibility of management personnel within each department to ensure that the appropriate supplies are available and/or ordered with sufficient lead-time to perform analytical testing or to provide support to the testing areas. The individual technical departments have trained personnel who enter the supply order into the company's purchasing system. The selection of these products is based on technical input at the analyst level and authorized by technical departmental management. The Purchasing Department maintains an ordering system in which purchase requisitions are managed. Common laboratory items (e.g., beakers, flasks, reagents) are ordered directly through the purchasing system. Purchase orders over a specified dollar amount require approval from the appropriate member (s) of the Executive Management Group before an order can be placed.

Upon receipt of an order, the Shipping and Receiving Department checks the order to ensure that all items were received as specified. Products that have specific storage requirements are taken to the technical area upon receipt. It is the technical area's responsibility to ensure that the product is stored in the appropriate manner. Any checks on the quality of the materials received for use in a specific test are the responsibility of the laboratory using them. This is based upon the experience of the laboratory with the usability of the product. Generally, each test has controls in place to ensure that test results are not adversely affected by the materials.

Any problems encountered when using a material in the laboratory must be brought to the attention of the Purchasing Department and/or Quality Assurance, as applicable, to ensure that follow-up and corrective action occur.

7.2 Supplier Evaluation

Procedures are in place to evaluate vendors who supply us with: new equipment, instrumentation, computerized systems and computer software; commercially purchased glassware, including sample bottleware, reagents, chemicals, solvents, gases, media, and standards; and contracted and subcontracted services.

The laboratory strives to ensure that our suppliers continually improve their quality systems and we reserve the right to purchase from suppliers of our choice in order to best fulfill the needs of our clients and our business. When directed by a client to purchase from a specific supplier, we will do so. In this instance it is the client's responsibility to "qualify" the specified supplier. We attempt to purchase from businesses that we have an established purchase history or have previously acquired information regarding the supplier's quality programs.

The laboratory does not evaluate every supplier. Risk assessment is taken into consideration when making this decision. The risk assessment analysis includes system, material, services, and number of samples or operations the purchase may affect or support. Evaluations are not required for computer operating systems, utilities, toolsets, or systems software. They also are not required for any off-the-shelf configurable software package that has an extensive market performance history (e.g., Microsoft Word, Excel, Access).

Additional quality systems are also in place within the laboratory to further verify and support the materials used:

- C of A for every lot of purchased chemicals, where available, are reviewed and maintained on file.
- For most chemical analyses a blank and a recovery check are routinely analyzed and serve as real time suitability testing of the reagent being used.

8 ANALYTICAL METHODS

8.1 Scope of Testing

Samples are analyzed in accordance with official published methods, standard methods, client-supplied methodology, or validated in-house methods. We recognize the importance of providing verifiable results and, therefore, use methods accepted and approved by a broad range of federal and state regulatory agencies. The laboratory can also assist in developing and validating analytical methods for specific products and matrices. All methods submitted for our review, as well as all analytical results, are considered confidential.

The laboratory performs a wide variety of environmental testing in support of the Safe Drinking Water Act (SDWA); Clean Water Act (CWA); Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA/Superfund); and the Clean Air Act (CAA). Methods approved by ASTM are also used in testing. Potable water, wastewater, soil, sediment, sludge, oils, biota, tissue, soil gas, and air are among the matrices typically analyzed.

Our areas of expertise include:

Standard Services	**Specialty Services**
• Volatiles • Semivolatiles • Metals • Pesticides/PCBs/Herbicides • Petroleum Analysis • Waste Characterization • Non-potable Water Testing • Drinking Water • Soil and Surface Water Testing • Vapor and Air Analysis • Sediment and Tissue Testing • Method Development • Shale Oil & Gas Analysis	• Dioxins & Furans • Hydrazines and NDMAs • Perchlorate • 1,4-Dioxane • Pharmaceutical Manufacturing Industry (PMI) Wastewater • EPA Method 25D • PCB Congeners • Explosives • Alkyl PAHs, Alkanes, Biomarkers • PFAS • Organic Acids • Aldehydes

All current certificates and scopes of accreditation are available on the laboratory's website at http://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/resources/certifications/. A complete list of the tests routinely performed by the laboratory can be found in the *Schedule of Services*.

8.2 Analytical Test Methods

Each laboratory is required to establish and maintain analytical procedures for all the methods referenced in standard testing. The sources for these methods include the most recent versions of these compendia:

- Test Methods for Evaluating Solid Waste, SW-846
- Standard Methods for the Examination of Water and Waste
- Code of Federal Regulations, Chapter 40
- EPA 100 through 600 and 1600 series methods
- ASTM

The test methods used are re-written into a laboratory standard format, which provides consistency in content and allows the analysts to locate the information they need quickly. Procedures are in place to define the format, required approvals, and the control system for these method documents. Elements to address in SOPs are based on TNI and DoD required sections. The format requirements include, but are not limited to, the following:

- Uniquely assigned method number, which is used extensively for scheduling and documentation purposes.
- Reference to the original source of the method (e.g. SW-846)
- Scope
- Basic Principles
- Apparatus and Reagents
- Personnel Training and Qualifications
- Safety and Waste Disposal
- Detailed procedure (including any method modifications)
- Calculations
- QA/Quality Control
- Revision Log

- Review and approval by technical management and QA personnel

Analytical methods are maintained as controlled documents to ensure that analysts are always working with the most current version and are reviewed periodically for accuracy.

8.3 Client Supplied Methods

Most of the client-supplied method requirements presented to us involve achieving specific quality control criteria, limits of quantitation (LOQ), and/or method detection limits (MDL) using standard EPA methods. These requirements are communicated to the appropriate technical groups prior to the project start up. Each technical group evaluates the scope of work and the requirements to ensure the criteria can be met using the standard EPA method. The data is monitored to ensure the criteria are met throughout the project. The CSR notifies the client if there is a more appropriate method available or if the client's criteria cannot be achieved on a certain sample matrix (i.e., due to matrix or dilutions).

Occasionally, we are asked to transfer a non-standardized method from a client into our lab or to develop a new method, when one is not available. In the case of a method transfer, we set up the client's method and perform some initial evaluation. After the initial evaluation, we may make recommendations on how to improve method performance. If the method appears to be adequate, we determine linearity, specificity, precision, accuracy, MDL, and LOQ by performing calibrations, analyzing method blanks, and carrying out method detection limit and quad studies.

In the case of method development, we work with the client and/or data user to determine the level of validation required ensuring that the method meets its intended purpose. In addition to the elements above, we also determine standard and sample stability and robustness depending on the scope of the project. Typically, a standard operating procedure is written and submitted to the client with the results of the validation. These steps are completed prior to analysis of field samples. Data related to the setup of the method are archived.

8.4 Method Validation

Before new or revised analytical methods are authorized for routine use in the laboratory, validation data is required to demonstrate that the method as performed in our laboratory and analysts performing it are capable of meeting data quality objectives for precision and accuracy. A procedure is in place to outline this process.

Many methods published by USEPA include instructions for performing an initial demonstration of capability, which typically consist of determining the method detection limit and analyzing fortified samples in quadruplicate (i.e. a quad study). This demonstration is performed and compared to acceptance limits for precision, accuracy, and detection limits, when available.

Methods that do not include specific validation requirements are validated by analyzing fortified samples or standard reference materials in replicate. The results of these analyses are used to assess accuracy

and precision. Results of validation studies are documented and subject to review and approval by technical and QA management.

8.5 Procedural Deviation

Analysts are required to follow a documented method for all tests performed. Procedures are in place to ensure that deviations from analytical methods are documented, approved, and justified in an appropriate and consistent manner. We classify method deviations as either being a planned deviation or an unplanned deviation. In general, the following information is captured to document both types of situations:

- Description of the deviation
- Reason or justification for the deviation
- Impact the deviation had on the testing
- Signature/date of analyst performing the test
- Signature/date of Quality Assurance and Laboratory Management approving the deviation
- Signature/date of client approval, if necessary

Deviations to written procedures are documented in raw data records or through the ICAR (Investigation and Corrective Action Report) system. Both types of documentation require management and QA review and approval.

NOTE: Deviations to analytical methods are not permitted by PALA . If samples are analyzed for compliance to a regulatory program, deviations may be allowed with approval from the appropriate compliance officer and/or program.

9 INTERNAL QUALITY CONTROL CHECKS

9.1 Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. Management is responsible for ensuring that QC is analyzed as required by the referenced method. Each analytical SOP specifies (or cross-references another procedure) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the acceptable range.

The laboratory provides additional bottleware to the client for matrix QC sampling as determined by the method or regulatory requirements.

QA staff, at the direction of the technical department, must program the LIMS with the acceptance criteria for each QC type (other than blanks). The acceptance criteria are based on statistically generated limits from historical laboratory data, on method defined limits, government agency recommendations, or on client/project specific limits.

These limits are used to flag samples that are out of specification.

The types of QC samples and the information each provides are discussed in the following paragraphs.

9.1.1 Blanks

A blank is a designated sample designed to monitor for sample contamination during the analysis process. The blank consists of a clean matrix (i.e. reagent water, Ottawa sand, glass beads, Teflon chips) taken through the entire sample preparation and analysis process. The blank and field samples are treated with the same reagents, internal standards, and surrogate standards. Ideally, blanks demonstrate that no artifacts were introduced during the analysis process. The specific acceptance criteria for each test are usually based on the required reporting limit (MDL or LOQ).

9.1.2 Surrogates

Surrogates are organic compounds, which are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. When required by the analytical method, surrogates are spiked into all the field and QC samples to monitor analytical efficiency by measuring recovery on an individual sample basis. The percent recovery is determined and compared to the acceptance criteria.

9.1.3 Matrix Spikes

A matrix spike sample is created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. Blanks are not used for matrix spike QC. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the potential matrix effects on the data. Matrix effects can cause results to be outside of the acceptance criteria.

9.1.4 Laboratory Control Samples

Laboratory control samples (LCS) are samples of known composition that are analyzed with each batch of samples to demonstrate laboratory accuracy. Laboratory fortified blank (LFB) is another term used to describe a LCS. The samples are clean samples fortified with known concentrations. Percent recovery is calculated and compared to acceptance limits.

9.1.5 Duplicates and Matrix Spike Duplicates and Laboratory Control Sample Duplicates

A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. To compare the values for each analyte, the relative percent difference (RPD) is calculated by dividing the difference between the numbers by their average. Precision for analytes that are not typically found in environmental samples (i.e., organic contaminants) is determined by analyzing a pair of matrix spike duplicates, defined as two spiked samples and comparing the RPD for the spiked compounds. The acceptance criteria are described as a maximum for the RPD value.

9.1.6 Internal Standards

Internal standards are organic compounds, which are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. When required by the method, internal standards are added to every field and QC sample after extraction but prior to analysis. Comparison of the peak areas of the internal standards is used for quantitation of target analytes. Internal standard peak area and retention time also provide a check for changes in the instrument response. The acceptance criteria are stipulated in the analytical method.

9.1.7 Serial Dilutions

A serial dilution is the dilution of a sample with sufficiently high concentration by a factor of five to check for the influence of interferents. This QC check is performed for inorganics analyzed by ICP or ICP -MS. When corrected by the dilution factor, the diluted sample result must agree with the original sample within method specified limits.

9.1.8 Interelement Correction Standard

This QC check is performed for inorganics analyzed by ICP to verify interelement and background correction factors. A solution containing both interfering and analyte elements of known concentration is analyzed at the beginning and end of each analytical run or a minimum of twice per 8 hours.

9.1.9 Second Source Check

A second source check is analyzed using either the LCS and/or an Initial Calibration Verification (ICV). The second source is a standard that is made from a solution or neat purchased from a different vendor than that used for the calibration standards. For some custom mixes, the same vendor but a different lot and preparation is used. This ensures that potential problems with a vendor supply would be evident in the analysis. Some tests use the continuing calibration verification standards as a second source from the initial calibration.

9.2 Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples and the corrective action required when a QC result fails to meet the acceptance criteria.

The QC acceptance criteria are available to analysts in the laboratory through their SOPs or Work Instructions and the LIMS. If the method reference requires the use of specific limits then the laboratory uses the published limits that are documented as part of the analytical method. Many methods require that each laboratory determine their own acceptance criteria based on statistical data obtained from performance of the method. In these cases, the limits are available to the analysts and are entered into the LIMS described below. Statistically determined acceptance criteria are subject to change as the laboratory recalculates its control limits. Due to their dynamic nature, acceptance criteria are not included in this manual.

The results of all quality control samples are entered into the LIMS in the same way as the results of client samples. The LIMS compares the individual values with the acceptance limits and identifies quality control sample results that are out of specification. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This includes, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a flag and/or comment stating the observed deviation, and reanalysis of the samples in the batch.

Each month, a summary of all QC entries (except blanks and surrogates) is generated from the LIMS. This summary is reviewed by QA staff and evaluated for changes in data that may indicate that an analysis is trending towards an out-of-control situation. The technical department is notified if a trend is observed. A weekly trend analysis is performed by the LIMS and any trends identified based on defined statistical parameters are communicated via email to the associated department manager.

The laboratory allows for marginal exceedances based on the number of analytes in the LCS. The exceedances are carefully monitored so that any systemic problems would be identified and corrective action taken. If the LCS is being reported based on the marginal exceedance allowance,a comment is added to the analytical report.

9.3 Quality Control Charts

The LIMS quality control system is used to report QC data to clients, to collect data for assessment of precision and accuracy statistical limits, and to generate control charts. Control charts are accessible to all employees through the LIMS interface. The system charts results from blanks, surrogates, matrix spike/matrix spike duplicates, duplicates, and laboratory control samples/laboratory control sample duplicates. These charts provide a graphical method for monitoring precision and bias over time. They can be used to detect quality problems by observation of patterns. The QA staff uses the charts in conjunction with a LIMS generated monthly QC trend report to evaluate potential data trends.

9.4 Measurement Uncertainty

Per ISO 17025-2017 section 7.6.1 "Laboratories shall identify the contributions to measurement uncertainty. When evaluating measurement uncertainty, all contributions that are of significance, including those arising from sampling, shall be taken into account using appropriate methods of analysis." This means the laboratory must determine the uncertainty contribution of all steps in the testing process such as equipment, calibration, standards, reagents, preparation, cleanups, etc. Since, in most methods, the laboratory control sample (LCS) goes through the entire process of preparation to analysis; all factors that would contribute to uncertainty is evident through the LCS results. LCSs are performed with every batch of samples where appropriate for the method. Tests that do not have LCSs (i.e. TCLP; paint filter test), are evaluated on a case-by-case basis by taking into account the uncertainty of each of the steps taken to perform the test. Our laboratory does not perform field sampling so our ability to assess uncertainty is limited to the processes that we perform. Thoroughly mixing samples prior to taking the testing aliquot minimizes the uncertainty risk with our aliquot.

Measurement Uncertainty reports are generated by each technical department on an annual basis using a LIMS program and submitted to QA. Measurement Uncertainty is calculated as two times the standard deviation of the LCS recoveries for the group and date range of data points selected for all applicable methods. This is reported as a percentage. It is not necessary to apply or report the uncertainty value with sample results. When a client requests the measurement uncertainty it is applied by multiplying the determined analyte concentration by the uncertainty percentage.

10 ASSURING QUALITY OF TEST RESULTS

10.1 Data Management

At a minimum, data management is initiated when the laboratory receives the samples from the client. More often the process begins with client communication of their needs and requirements for a specific project and/or testing. When requested, bottle orders for the client's sampling efforts are generated through the LIMS by the CSR. The CSRs are responsible for entering the information in the sample set up function of the LIMS. Upon receipt of the samples a unique tracking number for the sample group and the samples within the group is generated based on this information. At this point, the LIMS becomes an integral part of tracking the samples through laboratory operations. The flow of data from the time samples enter the laboratory until the data is reported is summarized in the following table:

Sample and Data Flow

Action	Personnel Involved
Bottle orders generated upon request · Bottles packed and shipped to the client under chain of custody documentation	Client Service Representative Bottles Preparation
Sample received at Lancaster Labs · Unpacked and reconciled against the client paper work or COC · Sample Entry Documentation log completed	Sample Registration
Sample is entered into the LIMS · Lab ID number assigned · Analyses entered · Storage location assigned · Electronic record of sample number · Labels generated · Acknowledgement printed (record of samples received and analyses entered)	Sample Registration
Preservation checks performed Sample stored in assigned location (refrigerator, freezer, etc.) · Electronic record of sample #, bottle code, and location	Sample Registration
Acknowledgment sent to client (when requested)	Sample Registration
Samples requisitioned and removed from storage for analysis · Electronic requisition of sample number by bottle code · Necessary aliquot taken	Sample Registration Technical Personnel

Action	Personnel Involved
· Remaining sample returned to storage	
Analysis is performed according to selected analytical method and applicable Project Notes* · Raw data recorded · Data Reviewed · Data uploaded to the LIMS from the instrument or manually entered by the analyst* (This is tracked by the unique sample number and batch number.)	Technical Personnel
LIMS performs calculations as programmed according to methods	Data Processing
Designated analyst or supervisor verifies raw data	Technical Personnel
Generation/release of reports (automated through LIMS)	Billing and Reporting Group
Data package deliverables are assembled, reviewed and released to client Electronic copy saved in the LIMS	Data Package Group
Electronic Data Deliverables (EDDs) are generated	EDD Group
Designated Data packages are overchecked by QA prior to release	QA
Hard copy of batch raw data is archived Electronic files are backed up and archived	Technical Personnel, Data Package Personnel, Office Services, IT

*Project Notes contain client- and agency-specific requirements (i.e. DoD, PALA, NJ DKQP, CT RCP, MA MCP)
**Analyses requiring the analyst's interpretation may involve manual data reduction before entry into the LIMS.

10.2 Data Documentation

Analytical data generated in the laboratory are collected from the instruments or associated data system or are manually documented in bound notebooks. Analysts review data as it is generated to determine that the instruments/systems are performing within specifications. If any problems are observed during an analytical run or the testing process, corrective action is taken and documented.

Procedures are in place to ensure that all data is traceable, authentic, and complete. Electronic data records are maintained and tracked through the LIMS, requiring authorized, password protected user access. The following general requirements outline our system for notebook, logbook, and documentation recording:

- Observations, data, and calculations are recorded at the time they are made and are identifiable to the specific task.
- Entries must be legible, signed, and dated. The signature may be a wet or electronic signature.

- Errors are corrected in a manner that does not obliterate the original entry, initialed and dated, and coded with an explanatory identifier. Changes to electronic data are tracked through audit trail functions.
- Blank pages or substantial portions of pages which are left blank are crossed-out to eliminate the possibility of data entry at a later date.
- Notebook pages and instrument printouts are signed/dated to indicate second party data review; this may be a wet or electronic signature.
- At periodic intervals a supervisor or data reviewer checks equipment/instrument logbook entries and temperature recordings for completeness, legibility, and conformance to procedures.
- At a minimum, the following information is recorded as part of data documentation:
  - Date of analysis/operation
  - Signature/date of analyst performing test/operation
  - Identification of client sample(s) and material(s) analyzed
  - Materials, reagents, standards used to perform the testing/operation
  - Method used to perform testing/operation (including version number and/or effective date)
  - Equipment/instrumentation used to perform testing/operation
  - Calculations and how they were derived
  - Departures, planned or unplanned, from the analytical method
  - Signature/date of person reviewing data documentation
- For computer generated data, the following information is recorded:
  - Sample(s) analyzed/operations performed
  - Date of analysis/operation
  - Unique instrument identification
  - Name/date of person operating the instrument
  - Name/date of person reviewing data

- Any manual notations made on instrument printouts are signed, dated, and reviewed

10.3 Data Calculations

Most instruments either include or are connected to a data system programmed to perform calculations to reduce the raw data to a reportable form. All calculations are maintained in the instrument manuals and/or as part of the analytical method.

In many cases, the data from the local instrument system are uploaded directly to the LIMS for review and reporting. This direct upload eliminates the need to retype data and an associated source of transcription errors from the analytical scheme.

Some instruments report data that require application of additional factors before the data is in final form. For example, an extract concentration may be reported by the instrumental data system, but additional dilution and preparation factors may be needed before the result represents the concentration of analyte in the sample. Analysts input these additional factors into the LIMS, where final calculations are performed.

Analysts manually enter collected data, such as titration data, into the LIMS, which is programmed to perform calculations for final reporting. Documentation of the programming for each calculation performed by the LIMS is maintained.

10.4 Reporting Limits

It is important to ascertain the limit of quantitation (LOQ) that can be achieved by a given method, particularly when the method is commonly used to determine trace levels of an analyte. The Environmental Protection Agency has set forth one method for determining method detection limits (MDLs) from which LOQs can be extrapolated. This process is summarized in a laboratory procedure.

MDLs are determined annually using quarterly MDL analyses performed for each method across all instruments used for that method. The MDL is the basis for the LOQ used in the default reporting format. Because MDLs change each time they are re-evaluated, they are not included in this manual, but are maintained in the LIMS and available to clients upon request.

The reporting limit used to determine whether a result is significant and reported as detectable is dependent upon agency and client requirements. A variety of formats are available and include use of the MDL, LOQ, method specified limits, and project specific limits. The MDL and LOQ for each analyte are programmed into the LIMS for reporting purposes.

Under the DoD program, the laboratory must establish a Detection Limit (DL) and Limit of Detection (LOD). As defined by the DoD program, the DL is the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. The laboratory determines the DL using the calculated value from the MDL Study. The DL can be derived from pooled MDL values obtained across instruments. The LOD is the smallest amount of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. It is established by spiking

a quality system matrix at a concentration of 2-4 times the DL and must be less than the LOQ. The LOD must be verified on a quarterly basis or with each batch of samples.

10.5 Data Review

Final review and verification of the data are performed by designated employees using the sample results, quality control information, method criteria and Project Notes entered into the LIMS. Data are initially evaluated by the analyst and then a second designated employee knowledgeable in the test, other than the employee responsible for performing the test, reviews the data. The reviews include checks for correct transcription, calculations, passing calibrations, compliant quality control results, holding time compliance, and project specific requirements. Any issues or errors identified during this stage are addressed, corrected, and reviewed with the responsible person.

After determining that all necessary requirements for valid data and for the project are met, the reviewer electronically approves the data by changing the LIMS status of the data from "complete" to "verified". The LIMS is programmed with a list of approved reviewers for each test, and the system is password protected to ensure that only qualified individuals verify the data.

Designated projects require further review by QA prior to release of the Analysis Report and/or data package to the client. These projects are identified in the LIMS through QA review tracking numbers.

10.6 Data Qualification

Data qualifiers are used to provide additional information about the results reported. The most typical use for data qualifiers is for results that fall below the quantitation limit, in the region where it becomes more difficult to distinguish a positive result from the background instrument signal. The data systems used to generate and report results are programmed to flag values in this range as estimates.

Other qualifiers are applied to advise data users of any validation issues associated with the data. The laboratory makes every effort to meet all of the requirements for generation of data. Occasionally, generation of data that does not meet all the method requirements occurs due to sample matrix or other analytical problems. If the test cannot be repeated or reanalysis would not yield better quality data, qualified data is reported. Qualifiers can be in the form of comments on the analytical report or flags applied to the results.

Qualifications for regulated samples (e.g. drinking water, NPDES) may not be permissible. The process for evaluating regulatory sample qualifications is detailed in *QA-SOP11886 Processing Regulatory Compliance (i.e. SDWA, NPDES) Samples.*

10.7 Data Reporting

When all analyses are completed, reviewed and verified, the Analysis Report is auto-generated and released by the LIMS, or by QA for the designated QA review projects. The client receives a copy of the report containing the results of the analysis and, where necessary, qualifier flags and/or explanatory comments to address non-conformances. A QC Summary or QC Exception report is appended to the

Analysis Report when requested. To avoid ambiguity in interpreting results, a summary page that contains an explanation of all symbols and units used in reporting data is included with the Analysis Report submitted to clients. Some regulatory agencies also require the laboratory accreditation identification on the Analysis Reports. Additionally, some agencies require the certification status by parameter (analyte/method/matrix) on the Analysis Reports. Where required, this information is added. The current list of agencies and certification status by parameter can be accessed in the LIMS. Copies of reports and associated supporting raw data are retained in our archives. The report contains the signature of the assigned client service representative who is the key contact for any questions concerning the results. Personnel authorized to review, sign, and release Analysis Reports are maintained in the LIMS.

The laboratory offers a variety of data reporting levels and formats, from a basic report of sample and QC results only, to a comprehensive data package of QC/calibration information and raw data. The client and any agency involved direct the selection of report type. A summary of report formats and data packages types is provided in the laboratory *Schedule of Services*. Various electronic formats are also available formatted to client-specified file structure and sent via e-mail, direct upload, secure web-site access, or common courier. The secure web-site access is used for clients that require secure transfer of electronic data.

Client confidentiality of web-site data is ensured by the use of a secured firewall internet environment coupled with the use of a user ID and password to gain login access to the system. User accounts are configured to only allow access to specific data associated with the user's business account number.

Amendments to a final report after issue are in the form of an additional document or data transfer and include a reference to the original report. When a completely new final report is required, it is uniquely identified and includes a reference to the original report it replaces.

10.7.1 Reporting the Results

Analytical reports are generated with a cover page that summarizes all samples in that group. This page lists the laboratory assigned sample number and the corresponding client description. The cover page identifies the laboratory contact person's name and phone number if there is a question about the report. Within this package, each page is uniquely identified and paginated. Analytical test results for methods listed on the laboratory's accreditation scope meet all requirements of the relevant regulatory body accreditation, NELAP accreditation and ISO 17025 unless noted otherwise.

10.8 Data Storage, Security, and Archival

The laboratory has documented procedures and instructions for the identification, collection, access, indexing, filing, storage, maintenance, and disposition of data records. Records are in the form of paper records, electronic data files, magnetic tape, and CD-ROMs.

All data records are maintained in a confidential manner in an environment to minimize deterioration or damage and to prevent loss. Some records are stored in off-site facilities, in such a way that they are readily retrievable. Retention time for records is in accordance with specific procedures or instructions. Prior to the destruction of data/records, and if requested by a client or agency, the laboratory will notify the client/agency that their data is scheduled for destruction so arrangements can be made to have the original data sent to the client.

If specified in client contract(s), archived records are transferred according to their instructions in the event of a change in laboratory ownership or if the laboratory goes out of business. If not specified by the client, the sale agreement must require that archived records be maintained as scheduled by the new owners. In the case of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed.

The laboratory maintains all documentation which is necessary for historical reconstruction of data:

- Analysis reports
- Data notebooks
- Data logbooks
- Instrument output
- Correspondence and client files
- Instrument and equipment logbooks
- QA records
- Corporate documents
- Electronic records

11 AUDITS AND INSPECTIONS

11.1 Internal Quality Assurance Audits

The QA Department, which is independent of laboratory activities, performs routine and on-going system, traceability, and observation audits to objectively review current systems, operations, and procedures as well as automated data integrity audits of electronic data records. The goal of the audits is to ensure that the quality system activities are effective and in compliance with regulatory programs, including NELAP, ISO 17025, DoD, PALA, and state agencies, as well as internal policies and procedures. Audits are documented and tracked in a QA database.

Audits are scheduled and conducted following a predefined schedule, based on criticality of operation and prior audit results, with the goal of evaluating systems and technologies across the operation. If

warranted, additional audits are performed to follow up on promised corrective action or areas of concern.

Results of an audit are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an audit with root cause analysis and application of a corrective action plan.

Audit reports and responses are circulated to Management to communicate the outcome of the audit and the proposed plan(s) for corrective action, if warranted. If any of the audit findings cast doubt on the validity of the results, the clients must be notified within one business day from confirmation of the issue. Should an audit issue present a major concern regarding validity of laboratory methods, QA personnel can issue a stop work notice.

All records maintained as part of an audit are kept on file for five years.

On an annual basis, an audit of the QA Department is performed as directed by the laboratory's Executive Management. The auditors assigned to carry out this operation are qualified staff members independent of the QA Department.

The specific content and findings of internal audits are considered company confidential and are not shared with clients.

11.2 Review of the Quality Assurance Program

All levels of management are continually updated on the status of quality and compliance by circulation of pertinent documents. Management review is documented by signatures on the documents, electronic records of each person's review, along with any comments or request for additional follow-up. The types of documents circulated real-time include:

- Internal, client, and agency audit reports and responses
- Proficiency test results
- Investigation and corrective action reports
- Monthly QA status reports

Executive management reviews the elements of the total quality program on an annual basis to ensure its continuing suitability and effectiveness in meeting the stated objectives outlined in Section 2.4 of this manual. The evaluation entails review of reports to management, all audit findings, client complaints, laboratory investigations, staff adequacy and training, and projected growth in workload. Patterns or trends in any of these areas are reviewed as a means to continually improve the quality system. This review also includes an evaluation of any audit findings resulting from the audit of the QA Department. At the conclusion of this quality system review, executive management determines the

need to introduce changes or improvements into the quality systems at the laboratory. The minutes from the meeting and any recommendations for improvement are documented and a copy is forwarded to the QA staff for review and follow-up.

11.3 Good Laboratory Practice Critical Phase Inspections

Any project that is subject to Good Laboratory Practice (GLP) regulations is audited by the QA Department, as required by the regulations, at intervals adequate to ensure the integrity of the study. Inspections of a GLP project include direct observation of analysts as they perform various phases of the study. Data documentation is reviewed as part of the inspection. The purpose of this type of audit is to ensure that there are no deviations from written methods, procedures, or study protocols.

Results of inspections are documented in a report format and distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an inspection. Inspection reports and responses are circulated to applicable laboratory management and an off-site study director, as applicable, to communicate the outcome of the inspection and the proposed plan(s) for corrective action, if warranted.

All records maintained as part of an inspection are kept on file.

11.4 Client Audits

Because clients place great importance on compliance with applicable regulations, data quality, and project requirements, they may audit our facility as assurance that their objectives are being met. QA, management staff, CSRs, and the analytical laboratories play a key role in these audits. Visits by clients can range anywhere from a tour (to verify laboratory facilities and instrumentation) to an intensive inspection of technical operations, procedures, regulatory compliance, and/or review of specific project(s).

Audits are scheduled directly with the CSR or QA. The request to audit is communicated to all applicable laboratory departments. An escort (designated laboratory employee) remains with an auditor at all times. In accordance with our policy on client confidentiality, a client is permitted to review only data and results that apply to their work, or which have been approved by laboratory management.

Responsibilities are assigned to the following groups in regard to client audits:

11.4.1 QA Department

- Research previous audit reports and laboratory responses to past deficiencies.
- Follow-up with the applicable analytical laboratory areas to ensure action items were completed from the last audit, as necessary.
- Work with client to set audit agenda.

- Function as an escort during the audit
- Answer questions the auditor has in regard to laboratory and quality systems.
- Take notes of areas where corrective action or suggestions are recommended during the audit.
- Communicate audit issues to management at the completion of the audit.
- Respond to client audit reports.
- Ensure follow-up to cited items are addressed in a timely manner.

11.4.2 CSRs

- Gather and organize relevant information (e.g., client correspondence, analysis/project requests, copies of analytical data from archives).
- Be knowledgeable about client-specific project requirements and issues.
- Function as an escort during the audit.
- Communicate issues/problems to appropriate personnel.

11.4.3 Laboratories

- Gather and organize laboratory data and documentation in preparation for client review.
- Assure corrective action was implemented from past audit findings, if necessary.
- Be prepared to discuss project data/testing results during the audit.
- Be familiar with client-specific project requirements and be prepared to answer client questions.
- Be familiar with the location of routine laboratory information and equipment (e.g., SOPs, data notebooks, calibration data, etc.).
- Be prepared to answer specific technical questions in regard to laboratory procedures and instrumentation within the area.
- Functions as an audit escort within the department during the audit.
- Laboratory managers may function as an escort during the audit.

11.5 Agency Inspections

It is laboratory policy to cooperate to the fullest extent and maintain cordial relations with all government agencies. The QA Department is assigned the responsibility of hosting and working with agency representatives. The QA role includes, escorting the investigator(s); ensuring all questions are answered promptly and accurately; making note of all unresolved issues; informing management of the audit status and outcome; responding to the audit report and ensuring that appropriate corrective action is completed. CSRs and laboratory staff responsibilities are similar to those noted above for client audits.

Inspections can be performed by investigators or auditors from the EPA, states, third-party accreditation bodies (i.e. A2LA, United States Department of Agriculture (USDA)), or other regulatory agencies.

Government agencies have the right to investigate and inspect the laboratory during normal business hours and permission to inspect is granted by Executive Management.

Designated members of the QA Department are primary contacts for announced inspections. The QA Director is the primary contact for all unannounced agency inspections. If the QA Director is unavailable, Executive Management is notified, in addition to a member of the QA Department. The QA Director, or their designee, must obtain evidence of the investigator's authority either in the form of a letter or examination/explanation of credentials.

Inspections include the examination of records or the inspection of facilities. Investigators are usually concerned only with the records relating to their responsibilities. As a general rule, they are given copies of records and documents, if requested. The laboratory must have a record of all items provided to an investigator.

Investigators must be escorted through the laboratory. The laboratory is not obligated to show an investigator the following types of information: sales, financial or pricing information, or any personnel data other than training or qualification documentation. On a case-by-case basis, internal QA audit reports and investigation reports are made available for agency review. Any questions or concerns about a request made by an investigator in regard to recording devices or photographs must be reviewed with legal counsel.

The laboratory personnel are not permitted to sign affidavits. If an affidavit is presented during an inspection, all personnel are directed not to sign it, read it, nor listen to it being read. The only document that is acceptable to sign is an acknowledgement that an inspection report has been received. If there is any doubt as to what should be signed, legal counsel must be consulted.

11.6 Proficiency Testing

Many of the organizations that certify our laboratory to perform various analyses require proof of our competency. Laboratory performance is checked regularly by participation in a variety of proficiency

testing (PT) programs. When available, blind samples are obtained from vendors that are accredited to provide PT samples under the TNI and/or ISO 17025 standards for all test and matrices routinely tested at the laboratory. In addition, some individual certification programs require analysis of specific sets of proficiency samples.

Generally, the PT programs consist of samples or ampulated spiking solutions used to fortify laboratory samples. The laboratories analyze the samples in the same manner as a client sample and the data is sent to the agency or vendor for evaluation. After the study results are returned to the laboratory, any data falling outside the acceptance criteria is investigated, root cause is identified, and corrective action is implemented, if needed. Results are circulated to management. No PT samples or portion of a PT sample are sent to another laboratory for analysis.

Double blind samples are submitted to the laboratories with some client projects so that the laboratory is not aware that the samples are PTs. The acceptance criteria for these double blind samples are developed statistically using data from participating laboratories, providing a source of inter-laboratory comparison. The clients will provide the results to the laboratory. Results are reviewed, investigated as needed with response to the client.

If a trend in PT failures is identified, additional blind samples are ordered for that specific test as corrective action.

12 CORRECTIVE AND PREVENTATIVE ACTION

12.1 Laboratory Investigation and Corrective Actions

Due to the technical nature of laboratory work and the broad scope of our QA program, a wide variety of laboratory issues can require investigation, root cause analysis, documentation, and corrective action. Prompt investigation and implementation of corrective action ensure that only data of known quality are reported and prevent the recurrence of errors. The following list provides "examples" of the type of issues that warrant investigation:

- Noncompliant QC results*
- Failed PT samples
- Reporting incorrect results
- Contamination issues
- Client technical complaints
- Procedural errors
- Missed holding times

- Systematic problems that compromise the accuracy or compliance of the data generated
- Problems with instrumentation and equipment which could compromise the data generated

These investigations must include the following:

- Identification of the problem
- Steps taken to investigate the problem
- Explanation of probable root cause(s) of the problem
- Steps taken to prevent future occurrence
- Determination of samples or systems affected by the problem

*Note: individual QC noncompliance does not require in depth investigation. Actions are taken as defined in the corresponding method and documented in the data. An adverse trend with noncompliance would be investigated.

Management is informed of problem situations. The QA staff track documentation, the status of the investigation activities, evaluates investigations for completeness and appropriateness, and monitors corrective action for follow-up/closure. Technical management and/or QA may issue a stop work notice if issues indicate the potential for problems on a broad scale or present a critical concern regarding the validity of the laboratory methods. The goal is to identify root cause, have the corrective action implemented promptly, and to the degree appropriate for the magnitude and risk of the problem. Tracking and trending of laboratory issues is performed by QA staff and reported to management on a monthly basis or immediately upon detection of a trend with potential for putting the laboratory or our clients at risk.

12.2 Investigation Process

All results from quality control (QC) samples are logged into the LIMS quality control system, which is programmed to alert analysts to unacceptable results. Analysts are required to review the results and determine the source of the problem. The source of the problem and proposed action must be documented. Action for QC outliers may include, but is not limited to, re-analysis, re-extraction or re-digestion, instrument maintenance, or re-calibration. If these actions do not yield compliant data within the required hold time, a Nonconformance Form is initiated to document actions and communication with the client. The original form is archived with the associated raw data. Nonconformance Forms are reviewed by the technical department's management, or designee. A copy of the form is reviewed by QA.

Missed holding times are investigated and documented using a Missed Holding Time form. The form includes documentation of the affected samples, reason the hold was missed and corrective actions

taken, if applicable. Each form also has documented review and approval by the department manager, department director and the QA Director. Clients are informed of any problems involving holding time.

Other types of problems having potential impact on data quality or involve deviations to our processes are investigated and documented using an Investigation and Corrective Action Report (ICAR). This process was developed to ensure that laboratory problems are investigated, evaluated for root cause, corrective action is put into place to prevent recurrence, laboratory management review and QA approval occurs, and all steps are documented. These investigations are initiated and managed through a workflow interface (Jira). Any employee can initiate an ICAR through this system to document a laboratory problem. The investigation must be completed by designated members of management and approved/closed by QA. Each investigation has a unique tracking number assigned by Jira. Closed investigations are routed to the laboratory Vice-President, associated laboratory Director and the QA Director. Follow-up to ensure effective corrective action is managed by QA staff.

If a laboratory error is identified from the outcome of the investigation that impacts validity of client data, the client must be notified in writing of the situation and corrected data provided as soon as possible. If the root cause of the problem has affected any other client sample results, all affected clients are notified of the problem.

12.3 Client Feedback

The laboratory is in the business of providing high quality analytical testing services. The data that we supply to our clients must be technically complete, accurate, and compliant with applicable regulations. Complaints can be received via letter, phone call, e-mail, or face-to-face meeting.

When a complaint is received, it is our responsibility to determine, to the best of our ability, the extent of the issue and what data is in question. The person receiving the complaint documents this information and promptly forwards it to the appropriate management personnel where the work in question was performed. If a data reporting error is discovered, the final report and/or data must be regenerated with the correct value(s).

The CSR is responsible for entering client concerns into the LIMS and an automated summary report is sent to QA on a weekly basis for review. In some cases, an ICAR is initiated to address and document the situation. While an individual issue may not warrant a formal investigation, QA monitors these issues for potential trends and will issue an ICAR if a trend is evident.

On an annual basis, the laboratory sends a client satisfaction survey to all clients. The results of these surveys are compiled, routed to the laboratory executive managment and the QA Director, and used to identify areas of improvement for the laboratory.

12.4 Preventative Actions

All employees are empowered and encouraged to use the concept of Preventive Action to avoid a problematic situation. The company supports, embraces and drives the process for continuous quality improvement by several means, such as: Ethics Hotline, the Suggestion Box (accessible to all

employees on the company's Intranet 'LabLinks'), and training classes that include "Making Quality a Science" and Ethics. If an employee identifies a potential problem or an area of concern or it should be brought to the attention of his/her supervisor, Human Resources, QA Director or the Ethics Hotline.

The laboratory also utilizes a formal program to encourage preventive action through development of Lean processes. The goal of this program is to optimize processes to ensure efficiency and operational improvements while maintaining compliance. The efficiency gains are inherently coupled with minimizing errors and rework. Teams of employees learn the tools and techniques to evaluate a process, identify potential sources of errors, delays or problems in an operation, determine system changes that will minimize these and work to implement the improvements. Each project includes thorough documentation of the evaluation, measurement, and implementation phases. The process is continually monitored to ensure that the anticipated results are sustained.

Employees are also encouraged to communicate to their supervisor any area(s) or operation(s) that they believe could be streamlined, make their job easier, would provide a quality improvement, or could provide a cost savings to the company.

Described below are some of the systems available to employees to assist with building quality and efficiency into their daily jobs. They stress a proactive approach/environment to problem solving and to review quality systems and operational efficiencies.

- "Making Quality a Science" is an introductory total quality management (TQM) course required for all employees to teach why quality is important and to explain the laboratory's quality philosophy and processes, and how to apply quality thinking and techniques on the job. Topics discussed include: communication, teamwork, serving the client, measurement, quality tools, and continuous process improvement. To foster continuous improvements of laboratory systems, process improvement teams are formed, as needed, if an employee needs help in solving a problem or addressing an issue. The goal of these groups is to have representation from various areas of the laboratory work together to look at a problem, evaluate the need for a temporary fix, brainstorm root causes, plan process improvement, implement the process improvement, evaluate and follow-up to the corrective action.

- "Putting our Values to Work" (Ethics) is a seminar required for all employees to teach the laboratory's Statement of Values by examining how it translates to our everyday jobs and ethical decision making. Topics discussed include: Statement of Values, ethical paradigms, and ethical decision making. Mandatory ethics training refresher seminars are offered on an annual basis.

- The laboratory has contracted with an Ethics Hotline to provide an anonymous means of reporting ethics concerns or issues. The issue is forwarded by the service to the QA Director who will communicate internally with those who need to address the issue. All communication and actions are documented in a secure web interface managed by the hotline service company.

- The QA staff prepares monthly program status reports for management. The reports include a variety of metrics and graphs which are used to evaluate trends in laboratory performance across all quality and compliance areas. Management responds to any negative trends by developing a corrective action plan.

- The laboratory uses a Project Cycle process (further described in section 13.2) to proactively review and prepare for client projects in an effort to ensure full understanding by all laboratory staff of the client's needs and resolve any concerns in advance of receiving the work.

13 SERVICE TO CLIENTS

13.1 Service to Clients

We value our client relationships and support these partnerships through the following principles:

- Honesty and Fairness – Our corporate culture is founded on the principles of professionalism and high ethical standards in dealing with our clients. This may mean declining to provide the service requested (if we are convinced that to do so would be meaningless) or it may mean referring clients outside of our laboratory if we believe that another company can better meet their needs.

- Complete Service – We will give our clients full value on every service provided. We will provide detailed information on our methods, procedures, and QA programs if requested, and take a personal interest and initiative in helping solve our client's problems within the area of our professional expertise.

- Trustworthiness – All data and information developed for a client will be held confidential and not disclosed to a third party except on written request of the client. If information is subpoenaed, we must, by law, release it, but the client will be informed of the release.

- Commitment to Quality – We constantly strive to improve our service in quality, flexibility, and dependability, to keep our competitive edge. We will achieve this through: meeting the requirements of those we serve, staying apprised of regulatory and industry expectations, and providing prompt responses to client concerns.

- Basics of Superlative Service – Our focus is on our client's success. Through proactive collaborative communication, our leadership ensures we understand our client's expectations and strives to exceed them. We foster a service culture in our training, reward and recognition, and performance management process so each employee takes ownership to deliver superlative service to our clients. Feedback from clients, whether positive or negative, is an important part of our continuous improvement system. Ways in which feedback is gathered can include, but is not limited to, customer satisfaction surveys, client audits, and the customer complaint system, which is described within section 12.3.

We also view our fellow employees as our clients since they frequently receive the results of our labor. Meeting the requirements of the next employee in the workflow process is just as important as meeting the needs of an external client.

13.2 Review of Work Requests, Tenders, and Contracts

The laboratory places great importance on understanding and meeting client requirements for a project. We ensure, to the best of our ability, that client/project requirements are identified and communicated through the laboratory. Project evaluation can be achieved in various ways, including the review of analytical methods, protocols, business contracts, and quality project plans (QAPPs). The project review encompasses our Project Cycle process and individual topics to be evaluated for a project include, but are not limited to: scope of testing; required accreditations (i.e. individual state agencies, PALA, NELAP, DoD, and ISO 17025) held by the laboratory; appropriate and current testing methods; ability to meet project required reporting limits and QC (if applicable); inconsistencies clarified; and nonstandard work requests.

Project kick-off meetings can be arranged through the CSR or Business Development Group. These meetings allow the client and key technical personnel to discuss project issues and requirements prior to project initiation. Any differences between laboratory processes and the project requirements are discussed and addressed with the client and the laboratory staff before the project is accepted and samples arrive. Project-specific requirements are communicated to the laboratory through use of Project Notes (PNs). Accreditation-specific requirements (i.e. NJ DKQP, MA MCP, CT RCP, PALA, NELAP, DoD, and ISO 17025) have template PNs maintained by QA, and these are used to add to the project's PNs. Testing that cannot be performed at the laboratory may be subcontracted to another laboratory (see 13.4).

A key client contact, the CSR, is assigned to oversee the project. Communication between the client and laboratory staff is available and is coordinated through the CSR.

As a project continues, the CSRs provide continuous communication and status reports (if requested) about the project to the client. The CSR relays any project changes or modifications to the technical groups. If the client submits revised project documents (QAPPs, etc.) then the Project Cycle review process is repeated. The CSR also communicates any issues encountered by the technical laboratories back to the client and vice-versa.

13.3 Timely Delivery

Evaluating laboratory capacity and ability to perform specific projects is a joint responsibility between the Technical Director, Business Development, and the laboratory managers. We recognize that one of the most important aspects of the service we offer is turnaround time.

Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in the laboratory area creating operation flexibility for routine work. Larger projects are reviewed against capacity estimates before bids are submitted to ensure that the client’s schedule is met. Turnaround time is continually measured.

Regularly scheduled meetings are held with technical and support management, and project management personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Management receives a daily report of the status of all samples in the lab, including those with priority status or those that have exceeded a preset turnaround time. This enables the planning and organizing of the workload through efficient scheduling.

Any changes to the established timeline by the client or the laboratory must be communicated to the client or laboratory as soon as possible. Upon communication of changes, a new timeline is established and agreed upon by both parties. If a client requires a change in the scope of the project (e.g., number of samples submitted, change in analyses, revised protocol) the laboratory must be informed in writing and a new timeline and cost estimate is be provided.

13.4 Subcontracting

The laboratory may subcontract tests to other laboratories if the requested testing is not routinely performed in our laboratory. To a lesser extent, samples may need to be subcontracted to an overflow laboratory to ensure hold times and/or turn-around-times (TAT) are met.

Testing is only subcontracted with the client's knowledge and approval. The CSR must notify the client in writing when any of their requested analyses will be subcontracted to another lab. Client approval must be obtained in writing before samples are shipped.

Subcontract laboratories are selected based on their qualifications and accreditations. The subcontractor is requested to sign a Laboratory Analytical Services Subcontract. See form *Q-EQA-FRM6867* to review details of the contract terms and information requested from the subcontract laboratory. If projects require a specific agency certification (i.e. individual state agencies, NELAP, DoD, PALA, ISO 17025), only an appropriately accredited laboratory is used. The client may also have a list of laboratories to be used for subcontracting. In these cases, the evaluation of the subcontract laboratory is made by the client.

Data obtained from subcontract laboratories is clearly marked as such when reported by the laboratory. The data are submitted to the client in the format obtained from the subcontractor.

13.5 Use of NELAP and A2LA Logo

It is not laboratory policy to use these logos on any company letterhead, including analytical reports.

Q-EQA-FRM6867 Laboratory Analytical Services Subcontract (ELLE)
QA-SOP11886 Processing Regulatory Compliance (i.e. SDWA, NPDES) Samples

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Attachment:
Appendix A - Procedure Cross Reference List

Appendix B – Certifications, Accreditations, Registrations, and Contracts
Appendix C – Organizational Charts
Appendix D – Personnel Qualifications and Responsibilities
Appendix E – SOPs and Analytical Methods
Appendix F – Instrument and Equipment List

End of document

Version history

Version	Approval	Revision information
15.1	19.OCT.2018	Editorial updates only.
16	18.MAR.2019	
17	11.JUL.2019	

NOTE: SOPs and Forms are indicated in the table with the unique D4 document number. The topic of the document is given in parentheses.

EQPM Section #	Title	Procedure(s)
1	Introduction	
1.1.	Mission Statement	Employee Handbook
1.2.	Quality Policy	11197 (Quality Statement) Employee Handbook
1.3.	Statement of Values	Employee Handbook
1.5.	Certifications, Accreditations, and Registrations	Form 6840 (Cert Summary) Company website
2	Organization and Personnel	
2.1	Company Overview and History	
2.1.1	Business Continuity and Contingency Plans	13101 (Incident Response Plan) 14735 (Preparedness, Contingency) 12233 (Archiving SOP) Form 6843 (Deputies form)
2.2.	Organizational Structure	Organization Charts
2.3.	Management Responsibilities	PQDs (job descriptions) PMDs (individual job plans)
2.4.	Overview of the Quality Assurance Program	Dept 4052 SOP Series
2.5.	Quality Assurance Responsibilities	Dept 4052 SOP Series
2.6.	Communication of Quality Issues to Management	11912 (QA Reports)
2.7.	Personnel Qualifications and Responsibilities	16134 (Employee Training) PQDs (job descriptions) PMDs (individual job plans) Task Specific Training
2.8.	Relationship of Functional Groups and the Quality Assurance Program	Quality Orientation TQM Training PMDs (individual job plans) Dept 4052 SOP Series 11895 (Project Cycle)
2.9.	Balancing Laboratory Capacity and Workload	PMDs (individual job plans) LIMS reports for mgt
2.10.	Identification of Approved Signatories	11186 (Date Entry, Verification and Reporting)
2.11.	Personnel Training	16134 (Employee Training) 11178 (DOCs) PQDs (job descriptions) PMDs (individual job plans) Task Specific Training
2.12.	Regulatory Training	11194 (GLP)
2.13.	Employee Safety	Analytical Methods Chemical Hygiene Plan 14735 (Preparedness) Dept 6098 SOP Series PMDs (individual job plans)

EQPM Section #	Title	Procedure(s)
2.14.	Client Services/Project Management Responsibilities	Dept 4039 SOP Series 11895 (Project Cycle)
2.15.	Confidentiality	Employee Handbook 16221 (E-mail System) 6824 (Client and Agency Audits)
2.16.	Business Conduct	Employee Handbook
2.17.	Operational Integrity	11176 (Manual Integration) 11882 (Chromatographic Integration) 11177 (Ethics Policy) 11197 (Quality Statement)
3	Buildings and Facilities	
3.1.	Facility	Floor Plans
3.2.	Security	12733 (Building Security)
3.3.	Disaster Recovery	13101 (Incident Response Plan)
3.4.	Environmental Monitoring	11919 (VOA Storage) 11191 (ETM)
3.5.	Water Systems	11916 (Reagent Water)
3.6.	Housekeeping/Cleaning	15553 (Housekeeping)
3.7.	Insect & Rodent Control	16117 (Insect & Rodent Control)
3.8.	Emergency Power Supply	13101 (Incident Response Plan)
3.9.	Facility Changes	14744 (Facility Change Control) 11195 (Change Control)
4	Document Control	
4.1.	Hierarchy of Internal Operating Procedures	6823 (Writing SOPs)
4.2.	Document Approval, Issue, Control, and Maintenance	16131 (Document Control) 11189 (Method Validation)
4.3.	Client-Supplied Methods and Documentation	11193 Analytical Decision Making) 6825 (QA review of QAPPs) 11895 (Project Cycle) 12039 (Auditing Paperwork)
4.4.	Laboratory Notebooks, Logbooks, and Forms	16131 (Document Control) 11913 (Notebooks)
4.5.	Control of External Documents	16131 (Document Control) Departmental "Controlled Documents" forms
5	Sample Handling	
5.1.	Sample Collection	Dept 4031 SOP Series
5.2.	Sample Receipt and Entry	Dept 6042 SOP Series
5.3.	Sample Identification and Tracking	Dept 6042 SOP Series 11184 (LSAR)
5.4.	Sample Storage	Dept 6055 SOP Series
5.5.	Sample Return/Disposal	12042 (Sample Discard) 15553 (Hazardous Wastes - Lab) 9017756 (Hazardous Wastes − Storage)
5.6.	Legal Chain of Custody	11914 (Legal COC)
5.7.	Representativeness of Samples	Analytical Methods 11190 (Representative Solid Samples)
6	Technical Requirements - Traceability of Measurements	

EQPM Section #	Title	Procedure(s)
6.1.	Reagents and Solvents	11188 (Reagents and Standards) Analytical Methods
6.2.	Calibration Standards	11188 (Reagents and Standards) Analytical Methods
6.3.	Equipment and Instrumentation	11901 (Inst. & Equip M&C) 11880 (Balance, Syringe, Pipette Verification)
6.4.	Computerized Systems and Computer Software	11195 (Change Control) 11186 (Network Accounts) 16221 (E-mail System) 20940 (Computer Backup) Employee Handbook 16227 (Computer Viruses)
6.5.	Change Control	11195 (Change Control)
6.6.	Labware Cleaning	Departmental Procedures
7	Purchasing Equipment and Supplies	
7.1	Procurement	11192 (Procurement) 9018236 (Receipt of Lab Supplies)
7.2	Supplier Evaluation	11192 (Procurement) 11181 (Subcontracting) 11188 (Reagents and Standards) 6826 Preservative Checks)
8	Analytical Methods	
8.1.	Scope of Testing	Schedule of Services Company website
8.2.	Analytical Test Methods	11189 (Method Validation) 6853 (Writing Procedure Guidance)
8.3.	Client Supplied Methods	11189 (Method Validation)
8.4.	Method Validation	11189 (Method Validation)
8.5.	Procedural Deviations	11912 (ICARs)
9	Internal Quality Control Checks	
9.1.	Laboratory Quality Control Samples and Acceptance Criteria	11896 (QC Limits) Analytical Methods
9.2.	Quality Control Sample Frequency and Corrective Action	11912 (Noncompliant Data) Analytical Methods
9.3.	Quality Control Charts	6817 (End of Month QC Reports)
9.4.	Measurement Uncertainty	11896 (QC Limits)
10	Assuring Quality of Test Results	
10.1.	Data Management	11913 (Notebooks)
10.2.	Data Documentation	11913 (Notebooks) 11186 (Date Entry, Verification and Reporting) 11197 (Quality Statement)
10.3.	Data Calculations	11186 (Date Entry, Verification and Reporting) Analytical Methods
10.4.	Reporting Limits	11892 (MDLs & LOQs)

EQPM Section #	Title	Procedure(s)
10.5.	Data Review	11913 (Notebooks) 11186 (Date Entry, Verification and Reporting)
10.6.	Data Qualification	11912 (Noncompliant Data)
10.7.	Data Reporting	11186 (Date Entry, Verification and Reporting) 11886 (MCL Exceedance)
10.8.	Data Storage, Security, and Archival	12233 (Data Archiving) 20940 (Computer Backup)
11	Audits and Inspections	
11.1.	Internal Quality Assurance Audits	7547 (Internal Audits) 11194 (GLP) 6859 (Internal Audit Checklist)
11.2.	Review of the Quality Assurance Program	7547 (Internal Audits) 6822 (QA Reports)
11.3.	Good Laboratory Practice Critical Phase Inspections	11194 (GLP)
11.4.	Client Audits	Employee Handbook 6824 (Client and Agency Audits)
11.5.	Agency Inspections	Employee Handbook 6824 (Client and Agency Audits)
11.6.	Proficiency Testing	11185 (PT Program) 6816 (PT Entry)
12	Corrective and Preventive Action	
12.1.	Laboratory Investigations and Corrective Action	11912 (Noncompliant Data), ICARs, Client Complaints)
12.2.	Investigation Processes	10401 Missed Hold Procedure) 6832 (Missed Hold form) 11912 (ICARs)
12.3.	Client Feedback	11912 (Client Complaints) Annual Client Survey
12.4.	Preventive Actions	Corporate Training Lean Projects 11895 (Project Cycle) 1195 (Change Control) 7547 (Internal Audits)
13	Service to Clients	
13.1.	Service to Clients	Employee Handbook Ethics Statement 11197 (Quality Policy) TQM Training
13.2.	Review of Work Requests, Tenders, and Contracts	12039 (Client Paperwork) 11895 (Project Cycle) 6825 (QAPP Review)
13.3.	Timely Delivery	11166 (Tracking Rush Samples) 11160 (Scheduling Rush Samples) Departmental LIMS reports

EQPM Section #	Title	Procedure(s)
13.4.	Subcontracting	11181 (Subcontractor Checklist) 11181 Subcontracting) 11895 (Project Cycle)

Agency	Parameter	Applicable Matrices	Lab ID No.
Federal Programs:			
American Association for Laboratory Accreditation (A2LA)	Organics, inorganics, dioxin, PFAS, KY UST, WY Storage Tank Program, Food and Feed, and PFAS	Potable water, nonpotable water, solid and hazardous waste, air, tissue	0001.01
USDA Quarantine Soil Permit	All	Solid	P330-13-00350
State Programs:			
State of Alaska, Department of Environmental Conservation Drinking Water Program	Organics, inorganics, PFAS	Potable water	PA00009
State of Alaska, Department of Environmental Conservation Contaminated Sites Program	Organics, inorganics, UST analysis, PFAS	Nonpotable water, solid and hazardous waste	17-027
State of Arizona, Department of Health Services	Dioxin	Potable water, nonpotable water, solid and hazardous waste	AZ0780
State of Arkansas, Department of Environmental Quality	Organics, inorganics, dioxin	Nonpotable water, solid and hazardous waste	88-0660
State of California, Department of Health ELAP	Organics, inorganics, dioxin	Potable water, nonpotable water, solid and hazardous waste	2792
State of Colorado, Department of Public Health and Environment	Organics, inorganics, dioxin	Potable water	PA00009
State of Connecticut, Department of Public Health	Organics, inorganics, dioxin	Potable water, nonpotable water, solid and hazardous waste	PH-0746
State of Delaware, Health and Social Services	Organics, inorganics, dioxin	Potable water	None
[3]State of Florida, Department of Health	Organics, inorganics, dioxin	Air and emissions, potable water, nonpotable water, solid and chemical materials	E87997
State of Hawaii	Organics, inorganics, dioxin, PFAS	Potable water	None
[3]State of Illinois, Environmental Protection Agency	Organics, inorganics, dioxin	Nonpotable water, solid and chemical materials	200027
State of Iowa, Department of Natural Resources	Organics, inorganics, UST analysis	Nonpotable water, solid and hazardous waste	361
[3]State of Kansas, Department of Health and Environment	Organics, inorganics, dioxin	Potable water, nonpotable water, solid and chemical materials	E-10151
Commonwealth of Kentucky, Department of Environmental Protection, Drinking Water Certification Program	Organics, inorganics, dioxin	Potable water	90088
Commonwealth of Kentucky, Department of Environmental Protection, Wastewater Certification Program	Organics, inorganics, dioxin	Nonpotable water	90088
[4]Commonwealth of Kentucky, Department for Environmental Protection – UST Branch	Organics, metals, UST analysis	Nonpotable water, solids	108139
[1, 3, 5] State of Louisiana, Department of Environmental Quality	Organics, inorganics, dioxin	Air emissions, biological tissue (direct accreditation), nonpotable water, solid chemical materials	30729 02055

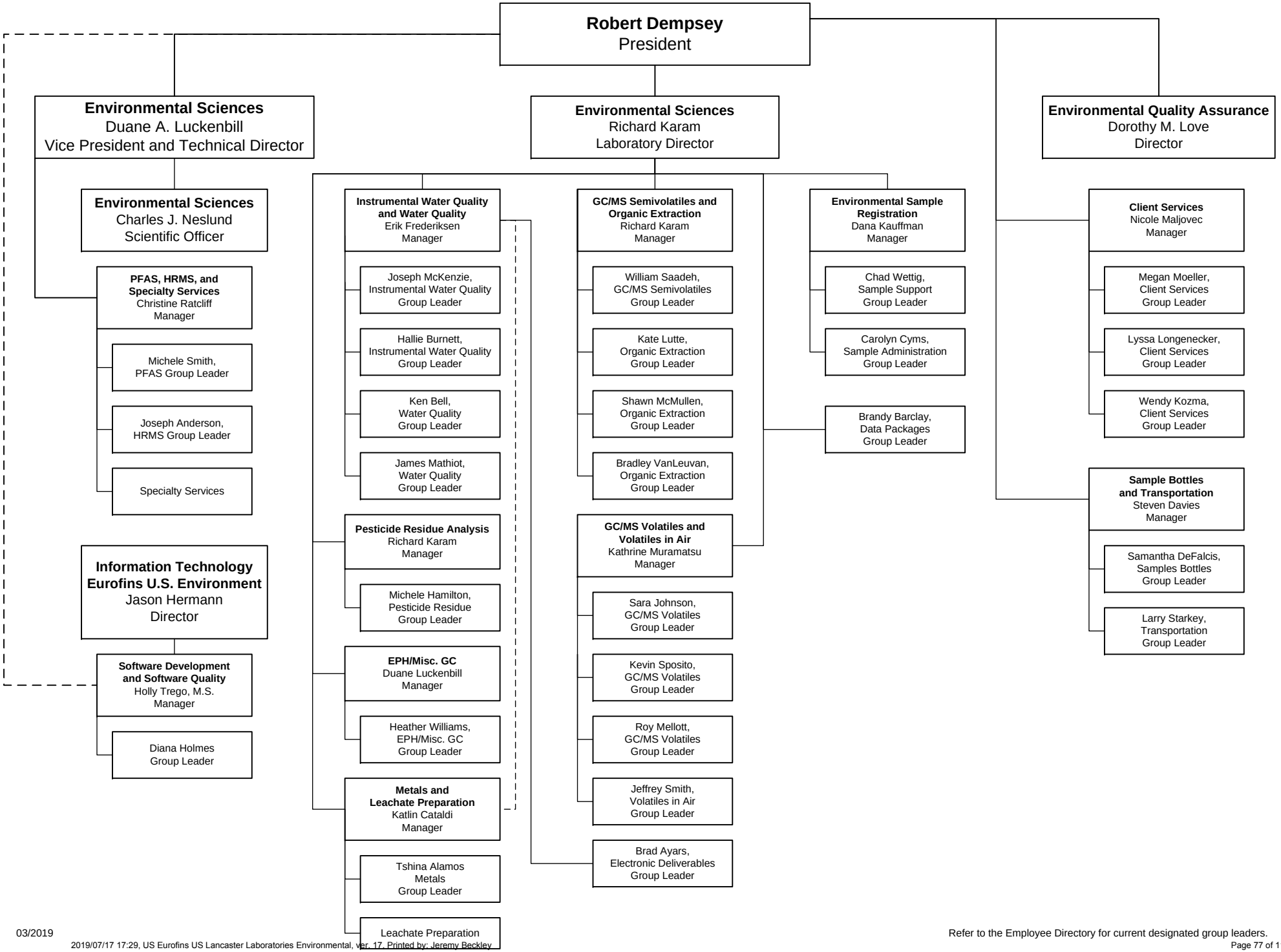
Agency	Parameter	Applicable Matrices	Lab ID No.
State of Maryland, Department of the Environment	Organics, inorganics, dioxin,	Potable water	100
State of Michigan, Department of Environmental Quality	Organics, inorganics, dioxin	Potable water	9930
State of Missouri, Department of Natural Resources	Organics, inorganics, PFAS	Potable water	450
State of Montana, Department of Public Health and Human Services	Organics, inorganics, dioxin, PFAS	Potable water	CERT0098
State of Montana, Department of Environmental Quality	Organics, UST analysis	Nonpotable water, solid and chemical materials	None
State of Nebraska, Department of Health and Human Services	Organics, inorganics, dioxin, , PFAS	Potable Water	NE-OS-32-17
[3]State of Nevada, Department of Conservation and Natural Resources	Organics, inorganics, dioxin	Potable water, nonpotable water, solid and chemical materials	PA00009
[3]State of New Hampshire, Department of Environmental Services	Organics, inorganics, dioxin, , PFAS	Potable water, nonpotable water, solid and chemical materials	2730
[3]State of New Jersey, Department of Environmental Protection (NJDEP)	Organics, inorganics, dioxin, , PFAS	Air and emissions, potable water, nonpotable water, solid and chemical materials, biological tissue	PA011
[3]State of New York, Department of Health	Organics, inorganics, dioxin, , PFAS	Air, nonpotable water, potable water, solid and chemical materials	10670
State of North Carolina, Department of the Environment and Natural Resources	Organics, inorganics	Nonpotable water	521
State of North Carolina, Department of Health and Human Services	Organics,	Potable water	42705
State of North Dakota, Department of Health	Organics, inorganics, dioxin, PFAS	Potable water, nonpotable water, solids and hazardous materials	R-205
[3] State of Oklahoma, Department of Environmental Quality	Organics, inorganics, dioxin	Nonpotable water, solid and hazardous waste	9804
[3]State of Oregon, Public Health Laboratory	Organics, inorganics, dioxin, PFAS	Air, potable water, nonpotable water, solid and chemical materials	PA200001
[2]Commonwealth of Pennsylvania, Department of Environmental Protection (Bureau of Laboratories)	Organics, inorganics, dioxin, , PFAS	Potable water, nonpotable water, solid and chemical materials (direct accreditation)	36-00037
State of Rhode Island, Department of Health	Organics, inorganics, , PFAS	Potable water, nonpotable water	LAO00338
State of South Carolina, Department of Health and Environmental Control	Organics, inorganics, dioxin	Nonpotable water, solid and hazardous waste	89002
State of Tennessee, Department of Environment & Conservation	Organics, inorganics, dioxin	Potable water	TN02838
[3] State of Texas, Commission on Environmental Quality	Organics, inorganics, dioxin,	Air and emissions, potable water, nonpotable water, solid and chemical materials, biological tissue	T104704194
[3]State of Utah, Department of Health	Organics, inorganics, dioxin, PFAS	Potable water, nonpotable water, solid and hazardous material	PA00009

Agency	Parameter	Applicable Matrices	Lab ID No.
State of Vermont, Department of Health	Organics, inorganics, dioxin, , PFAS	Potable water	VT 36037
[3] Commonwealth of Virginia, VELAP	Organics, inorganics, dioxin,	Air, Potable water, nonpotable water, solid and chemical materials	460182
State of Washington, Department of Ecology	Organics, inorganics, dioxin, PFAS	Air, Potable water, Nonpotable water, solid and chemical materials	C457
State of West Virginia, Department of Health and Human Resources	Organics, inorganics	Potable water	9906C
State of West Virginia, Department of Environmental Protection	Organics, inorganics, dioxin, , PFAS	Nonpotable water, solid and chemical materials, hazardous waste	055
State of Wisconsin, Department of Natural Resources	Organics, inorganics, dioxin	Nonpotable water, solid and hazardous waste	998035060
State of Wyoming and all Tribal Public Water Systems in Region 8	Organics, inorganics, dioxin,	Potable water	8TMS-L
[4]State of Wyoming – UST Branch	Organics, metals, UST analysis	Nonpotable water, solids and hazardous waste	None
State of Vermont, Department of Health	Organics, inorganics, dioxin, , PFAS	Potable water	VT 36037
[3] Commonwealth of Virginia, VELAP	Organics, inorganics, dioxin,	Air, Potable water, nonpotable water, solid and chemical materials	460182
State of Washington, Department of Ecology	Organics, inorganics, dioxin, PFAS	Air, Potable water, Nonpotable water, solid and chemical materials	C457
State of West Virginia, Department of Health and Human Resources	Organics, inorganics	Potable water	9906C
State of West Virginia, Department of Environmental Protection	Organics, inorganics, dioxin, , PFAS	Nonpotable water, solid and chemical materials, hazardous waste	055
State of Wisconsin, Department of Natural Resources	Organics, inorganics, dioxin	Nonpotable water, solid and hazardous waste	998035060
State of Wyoming and all Tribal Public Water Systems in Region 8	Organics, inorganics, dioxin,	Potable water	8TMS-L
[4]State of Wyoming – UST Branch	Organics, metals, UST analysis	Nonpotable water, solids and hazardous waste	None

[1] NELAP Primary AB: Air and Emissions
[2] NELAP Primary AB: Potable Water, Nonpotable water, solid and chemical materials
[3] NELAP Secondary AB
[4] Approval for UST work by A2LA
[5] NELAP Primary AB: Biological Tissue

NOTE: This list accurately reflects the certifications, accreditations, registrations, and contracts held at the time of publication and is subject to change. Check with your account manager on the status of any certification needed for a specific project. Our current scopes of accreditation can be viewed at http://www.eurofinsus.com/environment-testing/laboratories/eurofins-lancaster-laboratories-environmental/resources/certifications/ .

Eurofins Lancaster Laboratories Environmental



Job Title:	Vice President, Eurofins Lancaster Laboratories Environmental	
Reports To:	President	
Position Location:	Lancaster, PA	
Day/Shift:	Varies	
FLSA Status:	Exempt	(Exempt/Non-Exempt)

Position Summary:	Leading departments in accordance with vision, values, and strategic goals of company; overseeing and facilitating efficient operations and systems, sound business practices, consistent client service, and motivated staff

Essential Duties and Responsibilities:

- Demonstrates and promotes the company vision
- Regular attendance and punctuality
- Does everything reasonably possible to meet the annual budget
- Ensure that the quality policy/program is understood, implemented, and maintained at all levels of the organization; identify, prevent, or correct any departures from the quality system
- Oversee operations in accordance with policies set forth in the Key Group Documents
- Develop efficient and effective operations and systems that support the strategic goals of the company
- Utilize management operating system to track key performance indicators and drive continuous improvement
- Coach and develop individual and team to maximize performance
- Interact with clients as necessary to maintain and grow the business
- Build strategic relationships within the organization to achieve company goals
- Identify and evaluate issues and explore continuous improvement initiatives
- Perform administrative functions as needed, e.g., attend meetings and share information; prepare reports, job plans, and performance reviews
- Stay technologically current in field; attend seminars and/or training courses; publicize technical expertise through writing an article, presenting a poster session, or speaking at a seminar or technical meeting
- Perform other duties as requested by President
- Perform all functions in support of and in compliance with all state and federal employment regulations
- Conducts all activities in a safe and efficient manner
- Performs other duties as assigned

Basic Minimum Qualifications (BMQ):	To perform this job successfully, the individual must be able to perform each essential duty satisfactorily. The requirements below are representative of the knowledge, skill or ability required. (List three to five key quantifiable skills or position requirements that the candidate must have to be considered for this position.)
Education/Experience (BMQ):	At least fifteen years related experience at ELLE or equivalent experience elsewhere
Additional preferences:	Bachelor's degree in appropriate field or equivalent experience; graduate courses are recommended; experience in a variety of technical areas
Certificates and/or Licenses (BMQ):	N/A
Additional preferences:	
Supervisory Responsibility:	Responsible for the direct management of Directors, Managers, and other leadership employees
Ability and/or Skills (BMQ):	Demonstrated expertise in laboratory operations and leadership skills; communicate effectively and to relate well to people in direct communication, as well as formal presentation; manage the work of other personnel; understand and promote company policy; excellent business sense; motivation to excel, both in technical matters and in management; professional appearance and conduct; consciousness of and a positive attitude toward quality, service, and safety procedures; sound reasoning and decision making; technical expertise; organization and problem-solving skills; good judgement, versatility and flexibility in dealing with people; ability to coordinate multiple priorities; foresight and planning; ability to synthesize and retain information; computer skills; ability to communicate effectively in written and oral forms; leadership skills
Additional preferences:	
Other Factors:	N/A

Disclaimer:

This position description is written as a guideline to inform employees of what is generally expected of them at each job level. The description is not intended to be all encompassing or limiting in any manner; rather, it is hoped it will add understanding and better reflect the work performed at all levels of employment. Duties and responsibilities other than those listed may be included as needed within the work group or the company as a whole.

The above information may not be used or duplicated by others without written consent.

Job Title:	Operations Director, Eurofins Lancaster Laboratories Environmental	
Reports To:	President	
Position Location:	Lancaster, PA	
Day/Shift:	Varies	
FLSA Status:	Exempt	(Exempt/Non-Exempt)

Position Summary:	Leading departments in accordance with vision, values, and strategic goals of company; overseeing and facilitating efficient operations and systems, sound business practices, consistent client service, and motivated staff

Essential Duties and Responsibilities:

- Applies GMP/GLP in all areas of responsibility, as appropriate
- Demonstrates and promotes the company vision
- Regular attendance and punctuality
- Does everything reasonably possible to meet the annual budget
- Ensure that the quality policy/program is understood, implemented, and maintained at all levels of the organization; identify, prevent, or correct any departures from the quality system
- Develop efficient and effective operations and systems that support the strategic goals of the company
- Utilize management operating system to track key performance indicators and drive continuous improvement
- Coach and develop individual and team to maximize performance
- Interact with clients as necessary to maintain and grow the business
- Build strategic relationships within the organization to achieve company goals
- Identify and evaluate issues and explore continuous improvement initiatives
- Perform administrative functions as needed, e.g., attend meetings and share information; prepare reports, job plans, and performance reviews
- Stay technologically current in field; attend seminars and/or training courses; publicize technical expertise through writing an article, presenting a poster session, or speaking at a seminar or technical meeting
- Perform other duties as requested by President or designee
- Perform all functions in support of and in compliance with all state and federal employment regulations
- Conducts all activities in a safe and efficient manner
- Performs other duties as assigned

Basic Minimum Qualifications (BMQ):	To perform this job successfully, the individual must be able to perform each essential duty satisfactorily. The requirements below are representative of the knowledge, skill or ability required. (List three to five key quantifiable skills or position requirements that the candidate must have to be considered for this position.)
Education/Experience (BMQ):	At least five years related experience at ELLE or equivalent experience elsewhere
Additional preferences:	Bachelor's degree in appropriate field or equivalent experience; graduate courses are recommended; experience in a variety of technical areas
Certificates and/or Licenses (BMQ):	N/A
Additional preferences:	
Supervisory Responsibility:	Responsible for the direct management of Managers and other leadership employees
Ability and/or Skills (BMQ):	Demonstrated expertise in laboratory operations and leadership skills; communicate effectively and to relate well to people in direct communication, as well as formal presentation; manage the work of other personnel; understand and promote company policy; excellent business sense; motivation to excel, both in technical matters and in management; professional appearance and conduct; consciousness of and a positive attitude toward quality, service, and safety procedures; sound reasoning and decision making; technical expertise; organization and problem-solving skills; good judgement, versatility and flexibility in dealing with people; ability to coordinate multiple priorities; foresight and planning; ability to synthesize and retain information; computer skills; ability to communicate effectively in written and oral forms; leadership skills
Additional preferences:	
Other Factors:	N/A

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Job Title:	Quality Assurance Director	
Reports To:	President and/or designee	
Position Location:	Lancaster, PA	
Day/Shift:	Varies	
FLSA Status:	Exempt	(Exempt/Non-Exempt)

Position Summary:

Overseeing all managerial and quality operations of the company; providing leadership and mentoring/coaching to QA staff; participating in short-term and long-term planning and goal setting for the company; facilitating adherence to government regulations; sustaining quality improvement and providing quality policy development; providing sound consultation to laboratories and clients on problems or interpretation of quality/compliance issues; keeping abreast of evolving regulatory and industry quality assurance requirements

Essential Duties and Responsibilities:

- Applies GMP/GLP in all areas of responsibility, as appropriate
- Demonstrates and promotes the company vision
- Regular attendance and punctuality
- Ensure that the quality policy program is understood, implemented, and maintained at all levels of the organization; identify, prevent, or correct any departures from the quality system
- Ensure that corrective action is appropriate; ensure that follow-up requirements are completed
- Encourage employee participation in process improvement initiatives
- Interview and make recommendations for new hires; train and develop staff; maintain job plans; handle personnel issues
- Handle agency audits, client audits, visits, and phone calls; prepare letters to clients; attendance at some local and national industry meetings
- Keep abreast of regulatory climate; assist technical operations with interpretation; advise on adjustment of lab policy as appropriate
- Perform all functions in support of and in compliance with all state and federal employment regulations
- Coach/mentor other members of the quality team
- Oversee regulatory training program; assist with, and present departmental and corporate training at a frequency to meet regulatory expectations and ensure compliance
- Work with operations and clients to drive challenging/complex resolutions and/or negotiate appropriate position or compromise; offer compliance options
- Identify and drive system improvements; diagnose complex issues
- Conducts all activities in a safe and efficient manner
- Performs other duties as assigned

Basic Minimum Qualifications (BMQ):	To perform this job successfully, the individual must be able to perform each essential duty satisfactorily. The requirements below are representative of the knowledge, skill or ability required. (List three to five key quantifiable skills or position requirements that the candidate must have to be considered for this position.)
Education/Experience (BMQ):	At least six years' experience with QA
Additional preferences:	Bachelor's degree in chemistry or biology
Certificates and/or Licenses (BMQ):	N/A
Additional preferences:	
Supervisory Responsibility:	Provide leadership and direct management of any Group Leaders (if applicable) and other non-management employees in the department
Ability and/or Skills (BMQ):	Exhibit self-confidence and leadership; expertise in laboratory quality operations and regulatory environment; sound reasoning, decision making and problem-solving skills; good judgment and flexibility in dealing with others; ability to coordinate multiple priorities; communicate effectively in written and oral form; ability to manage the work of others and see projects through to completion; translate government regulations into laboratory policy/processes; utilize planning, organization and work management tools; ability to manage stress in self and others; dedication to quality, ethics, and customer service
Additional preferences:	
Other Factors:	N/A

Disclaimer:

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Job Title:	Technical Department Manager	
Reports To:	Director or designee	
Position Location:	Lancaster, PA	
Day/Shift:	Varies	
FLSA Status:	Exempt	(Exempt/Non-Exempt)

Position Summary:	Performing a variety of technical and administrative tasks to develop, evaluate, and supervise staff; planning and monitoring work flow; designing, implementing, and utilizing departmental operations systems; promoting safety; remaining current on technical developments; communicating with clients; maintaining a strong commitment to quality

Essential Duties and Responsibilities:

- Applies GMP/GLP in all areas of responsibility, as appropriate
- Demonstrates and promotes the company vision
- Regular attendance and punctuality
- Ensure that the quality policy program is understood, implemented, and maintained at all levels of the organization; identify, prevent, or correct any departures from the quality system
- Utilize the MOS to track key performance indicators and drive continuous improvement
- Produce motivated and satisfied employees
- Encourage employee participation in process improvement initiatives
- Oversee inventory, maintenance, and repair of departmental machines, tools, equipment, materials, and/or products
- Manage scheduling of personnel; evaluate personnel performance
- Participate in interview process, make recommendations for new hires; train and develop staff
- Review, prepare, and approve methods, data, and SOPs
- Communicate with clients on technical matters; meet with clients to discuss operations and conduct tours and audits
- Maintain client confidentiality
- Investigate and solve laboratory problems
- Perform all functions in support of and in compliance with all state and federal employment regulations
- Conducts all activities in a safe and efficient manner
- Performs other duties as assigned

Basic Minimum Qualifications (BMQ):	To perform this job successfully, the individual must be able to perform each essential duty satisfactorily. The requirements below are representative of the knowledge, skill or ability required. (List three to five key quantifiable skills or position requirements that the candidate must have to be considered for this position.)
Education/Experience (BMQ):	At least five years related experience
Additional preferences:	Bachelor's degree in chemistry or related science; supervisory experience preferred
Certificates and/or Licenses (BMQ):	N/A
Additional preferences:	
Supervisory Responsibility:	Responsible for the direct management of the departmental Group Leaders
Ability and/or Skills (BMQ):	Knowledge of departmental techniques; manage personnel, resolve conflicts, and correct poor performance; attention to detail; tolerance for stress; integrity; computer skills; communicate effectively (verbally and written); perform multiple tasks simultaneously; logical thought; make decisions for self and others; independently develop solutions to complex problems
Additional preferences:	
Other Factors:	N/A

Disclaimer:

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Job Title:	Support Department Manager	
Reports To:	Director	
Position Location:	Lancaster, PA	
Day/Shift:	Varies	
FLSA Status:	Exempt	(Exempt/Non-Exempt)

Position Summary:	Overseeing all managerial operations of the department, managing the department in an efficient and financially sound manner; providing leadership and coaching to assigned individuals; participating in long- and short-term planning and goal-setting for the group; coordinating functions and responsibilities of assigned department members to provide consistent service; coordinating internal efforts between departments; relaying corporate information appropriately

Essential Duties and Responsibilities:

- Applies GMP/GLP in all areas of responsibility, as appropriate
- Demonstrates and promotes the company vision
- Regular attendance and punctuality
- Ensure that the quality policy program is understood, implemented, and maintained at all levels of the organization; identify, prevent, or correct any departures from the quality system
- Administrative including human resource interviews, job plans, performance reviews, personnel issues, group meetings, and sharing of corporate information
- Training of and delegation to members of the department to provide consistent service to internal and external clients
- Work with other departments to set goals, develop pricing strategies, manage workload, and resolve problems
- Create, implement, and oversee budgets and goals for the department in the context of corporate philosophy
- Evaluate, plan for, and provide adequate staffing, equipment, consumables, etc., for the department to function in an effective manner
- Communicate verbally, in writing, and face-to-face with clients to discuss and resolve problems, build strong relationships, and increase sales
- Perform all functions in support of and in compliance with all state and federal employment regulations
- Administrative activities (photocopying, word processing, paperwork delivery, etc.)
- Assist with financial and purchase order issues as needed
- Help coordinate interdepartmental cross-training and/or assistance as needed to balance workload
- Conducts all activities in a safe and efficient manner
- Performs other duties as assigned

Basic Minimum Qualifications (BMQ):	To perform this job successfully, the individual must be able to perform each essential duty satisfactorily. The requirements below are representative of the knowledge, skill or ability required. (List three to five key quantifiable skills or position requirements that the candidate must have to be considered for this position.)
Education/Experience (BMQ):	Five years of related experience at LL or demonstrated equivalent experience elsewhere; computer skills in a variety of software; supervisory experience
Additional preferences:	Bachelor's degree in science (chemistry preferred)
Certificates and/or Licenses (BMQ):	N/A
Additional preferences:	
Supervisory Responsibility:	Responsible for the direct management of the Group Leaders of the department
Ability and/or Skills (BMQ):	Self confidence and leadership, ability to reason, make sound decisions, and delegate; empathy and sensitivity towards others; motivation to excel and inspire excellence in others; ability to develop strong relationships with clients resulting in client satisfaction and additional sales; ability to manage the work of others and see projects through to completion; strong communication including verbal, writing, and presentation skills; ability to communicate effectively and relate well to people; mental and emotional stability and maturity, ability to handle personal stress and diffuse stress in others; strong organizational and financial skills, ability to handle multiple priorities; good judgement and tact recognizing and solving problems; recognized as understanding, interpreting, and following company policy; sets example for others; dedication to quality, ethics, and customer service; pride in appearance, conduct, and company; sound persuasion and negotiation abilities; ability to view situations from a variety of perspectives; foresight and planning ability
Additional preferences:	
Other Factors:	N/A

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Document Number	Document Name	Document Responsible[1]
1.01 Document Control		
Standard Operating Procedure		
G-DC-SOP12233	Data and Record Storage, Security, Retention, Archival, and Disposal	5_EUUSLA_Env Quality Assurance_Director
G-DC-SOP16131	Document Control	5_EUUSLA_Env Quality Assurance_Director
G-DC-SOP16196	Position Qualification Descriptions (PQDs) and Essential Job Functions (EJFs)	5_EUUSLA_Env Quality Assurance_Director
G-DC-SOP16244	Writing and Reviewing ELLE Policies and Operating Procedures	5_EUUSLA_Env Quality Assurance_Director
1.02 EHS		
Policies		
G-EHS-QP12356	Chemical Hygiene Plan	5_EUUSLA_Env Quality Assurance_Director
G-EHS-QP14735	Preparedness, Prevention, and Contingency Plan	5_EUUSLA_Env Quality Assurance_Director
	Standard Operating Procedure	
G-EHS-SOP14741	Emergency Evacuation Plan	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP13101	Incidence Response Plan	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP14740	Lockout/Tagout	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP22000	Management of Hazardous Wastes in the Laboratory	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP14739	Reporting Work Related Incidents	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP14738	Safety Glasses	5_EUUSLA_Env Quality Assurance_Director
1.03 Facilities		
Standard Operating Procedure		
G-FAC-SOP12733	Building Security	5_EUUSLA_Env Quality Assurance_Director
G-FAC-SOP14744	Facility Change Control Procedure	5_EUUSLA_Env Quality Assurance_Director
G-FAC-SOP15553	Facility Operation Manual	5_EUUSLA_Env Quality Assurance_Director
G-FAC-SOP16117	Insect and Rodent Control	5_EUUSLA_Env Quality Assurance_Director
G-FAC-SOP16118	Maintenance Connection Service Requestor Guidelines	5_EUUSLA_Env Quality Assurance_Director
1.04 Lists		
List		
G-LI9946	Document List - Sorted by Chapter	5_EUUSLA_Env Quality Assurance_All
G-LI9949	List of documents by Expiration Date	5_EUUSLA_Env Quality Assurance_All
G-LI9947	List of Documents Under Revision by Chapter	5_EUUSLA_Env Quality Assurance_All
G-LI9950	Training Lists	5_EUUSLA_Env Quality Assurance_All
G-LI9948	Version List - Sorted by Chapter	5_EUUSLA_Env Quality Assurance_All
1.05 Templates		
Work Instruction		
G-TEMP-WI24324	Change Plan Template	5_EUUSLA_Env Quality Assurance_Director
G-TEMP-WI12535	Level 2 Standard Operating Procedure Template	5_EUUSLA_Env Quality Assurance_All
G-TEMP-WI12532	Level 3 Template for Work Instruction for Analysis	5_EUUSLA_Env Quality Assurance_All

G-TEMP-WI12548	Template for Revision Log for Existing SOPs	5_EUUSLA_Env Quality Assurance_All
1.06 External Documents		
2.01 Forms		
2.02 Training Forms		
3 Quality		
Policies		
QA-QP11177	Laboratory Ethics and Data Integrity Policy	5_EUUSLA_Env Quality Assurance_All
QA-QP11176	Manual Integration for ELLE	5_EUUSLA_Env Quality Assurance_All
	Quality Manual	
QA-QM11872	Environmental Quality Policy Manual	5_EUUSLA_Env Quality Assurance_All
Standard Operating Procedure		
QA-SOP11880	Balance, Syringe, Pipette, and Labware Verification	5_EUUSLA_Env Quality Assurance_All
QA-SOP11195	Change Control Procedures for ELLE	5_EUUSLA_Env Quality Assurance_All
QA-SOP11882	Chromatography Integration and Documentation	5_EUUSLA_Env Quality Assurance_All
QA-SOP11194	Compliance with Environmental GLP Regulations	5_EUUSLA_Env Quality Assurance_All
QA-SOP11197	Conflict of Interest Plan	5_EUUSLA_Env Quality Assurance_All
QA-SOP11186	Data Entry, Verification and Reporting	5_EUUSLA_Env Quality Assurance_All
QA-SOP11178	Demonstrations of Capability	5_EUUSLA_Env Quality Assurance_All
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation	5_EUUSLA_Env Quality Assurance_All
QA-SOP16134	Employee Training Program	5_EUUSLA_Env Quality Assurance_Director
QA-SOP11893	Environmental Hazardous Sample Communication Procedure	5_EUUSLA_Env Quality Assurance_All
QA-SOP11895	Environmental Project Cycle	5_EUUSLA_Env Quality Assurance_All
QA-SOP11896	Establishing Control Limits	5_EUUSLA_Env Quality Assurance_All
QA-SOP11193	Guidelines for Analytical Decision Making in Environmental Testing	5_EUUSLA_Env Quality Assurance_All
QA-SOP11180	Guidelines for Writing Technical Reports	5_EUUSLA_Env Quality Assurance_All
QA-SOP11900	HP-UX Target 3.5 Data System Accounts and Electronic Signature Security	5_EUUSLA_Env Quality Assurance_All
QA-SOP11901	Instrument Maintenance and Calibration	5_EUUSLA_Env Quality Assurance_All
QA-SOP11912	Investigation and Corrective Action for Client Complaints, Noncompliant Data, and Laboratory Problems	5_EUUSLA_Env Quality Assurance_All
QA-SOP11913	Laboratory Notebooks, Logbooks, and Documentation	5_EUUSLA_Env Quality Assurance_All
QA-SOP11184	Laboratory Sample Analysis Record (LSAR) Documentation	5_EUUSLA_Env Quality Assurance_All
QA-SOP11196	Laboratory/Quality Systems Procedures Summary	5_EUUSLA_Env Quality Assurance_All
QA-SOP11914	Legal Chain-of-Custody Documentation	5_EUUSLA_Env Quality Assurance_All
QA-SOP10401	Missed Holding Time Reports	5_EUUSLA_Env Quality Assurance_All
QA-SOP11919	Monitoring of the Volatile Organics Analysis (VOA) Storage Areas for Contamination	5_EUUSLA_Env Quality Assurance_All

QA-SOP11191	Monitoring Temperatures in Refrigerators, Freezers, Incubators, and Ovens Using the ETM	5_EUUSLA_Env Quality Assurance_All
QA-SOP11190	Obtaining a Representative Environmental Solid Sample Aliquot	5_EUUSLA_Env Quality Assurance_All
QA-SOP11886	Processing Regulatory Compliance (i.e. SDWA, NPDES) Samples	5_EUUSLA_Env Quality Assurance_All
QA-SOP11192	Procurement of Environmental Laboratory Supplies	5_EUUSLA_Env Quality Assurance_All
QA-SOP11185	Proficiency Test Samples	5_EUUSLA_Env Quality Assurance_All
QA-SOP11915	Quarantine Soils Procedures	5_EUUSLA_Env Quality Assurance_All
QA-SOP11188	Reagents and Standards	
QA-SOP11182	Sample Requisition	5_EUUSLA_Env Quality Assurance_All
QA-SOP11181	Subcontracting Analytical Testing	5_EUUSLA_Env Quality Assurance_All
QA-SOP11183	Thermometer Use and Calibration	5_EUUSLA_Env Quality Assurance_All
QA-SOP11916	Use and Maintenance of Reagent Water Supply	5_EUUSLA_Env Quality Assurance_All
QA-SOP11189	Validation and Authorization of Analytical Methods	5_EUUSLA_Env Quality Assurance_All
3.01 Environmental Quality Assurance		
Work Instruction		
Q-EQA-WI12060	Director	5_EUUSLA_Env Quality Assurance_Director
Q-EQA-WI6822	ELLE QA Reports to Management	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6818	Environmental Quality Assurance Functions for GLP Compliance	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6825	Environmental Quality Assurance Review of Client Project and Bid Documents	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6815	ETM System Probe Calibration	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6824	Hosting of Environmental Client and Agency Audits	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6820	Maintenance of Environmental Certifications and Accreditations	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6819	Performing Electronic Data Audits using Mint Miner Software	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI7547	Performing Environmental Quality Assurance Audits	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI7671	Principal Specialist	5_EUUSLA_Env Quality Assurance_Director
Q-EQA-WI6816	Proficiency Test and Double Blind Samples	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6823	QA Approval of Environmental Analytical Procedures and Standard Operating Procedures	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6826	QA Processing for Bottle Lot and Preservative Checks	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6817	Quality Assurance Review of End-of-Month QC Reports	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI7670	Senior Specialist	5_EUUSLA_Env Quality Assurance_Director
Q-EQA-WI14178	Specialist (Support)	5_EUUSLA_Env Quality Assurance_Director
4.06 IT/Software Development		
Standard Operating Procedure		
R-SD-SOP20940	Computer Backup, Recovery, and Archive	5_EUUSLA_Env Quality Assurance_Director

R-SD-SOP16221	E-Mail System	5_EUUSLA_Env Quality Assurance_Director
R-SD-SOP16227	Utilizing the Services and Support of the NSC Service Desk	5_EUUSLA_Env Quality Assurance_Director
4.07 Transportation		
Work Instruction		
R-TR-WI11282	Administrator	5_EUUSLA_Transportation_Manager
R-TR-WI11284	Director, Environmental Support Services	5_EUUSLA_Transportation_Manager
R-TR-WI11285	Manager	5_EUUSLA_Transportation_Manager
R-TR-WI11289	Sample Administrator	5_EUUSLA_Transportation_Manager
R-TR-WI11288	Sample Pick-Up, Transportation, and Delivery	5_EUUSLA_Transportation_Manager
R-TR-WI11290	Specialist	5_EUUSLA_Transportation_Manager
R-TR-WI11294	Transportation Summary SOP	5_EUUSLA_Transportation_Manager
R-TR-WI11297	What to Do in Case of Vehicular Accident or Breakdown	5_EUUSLA_Transportation_Manager
5.01 Sample Bottles		
Work Instruction		
S-BOT-WI10641	Bottle Preparation	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10655	Director, Environmental Support Services	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10657	Manager	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10642	Packing Bottle Orders	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10643	Preparation of Acid Dilutions	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10644	Preparation of Trip Blanks	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10645	Processing Bottle Orders	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10660	Senior Administrator	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10661	Specialist	5_EUUSLA_Sample Bottles_Manager
5.02 Client Services		
Work Instruction		
S-CS-WI12039	Auditing Client Paperwork	5_EUUSLA_Client Services_Manager
S-CS-WI10251	Client Concern and ISPD Code Entry	5_EUUSLA_Client Services_Manager
S-CS-WI11140	Client/Prospects Visits	5_EUUSLA_Client Services_Manager
S-CS-WI11141	Creating Bottle Orders	5_EUUSLA_Client Services_Manager
S-CS-WI11142	Creating Project Information Lists	5_EUUSLA_Client Services_Manager
S-CS-WI11143	Daily or Weekly DEP Reporting	5_EUUSLA_Client Services_Manager
S-CS-WI11144	Director, Environmental Services	5_EUUSLA_Client Services_Manager
S-CS-WI11149	Group Leader	5_EUUSLA_Client Services_Manager
S-CS-WI11151	Manager	5_EUUSLA_Client Services_Manager

S-CS-WI11152	Monthly DEP Reporting	5_EUUSLA_Client Services_Manager
S-CS-WI11155	Phone Log and Email Documentation	5_EUUSLA_Client Services_Manager
S-CS-WI11157	Principal Specialist (Client Services)	5_EUUSLA_Client Services_Manager
S-CS-WI11159	Sample Set-Up Form Creation Guide	5_EUUSLA_Client Services_Manager
S-CS-WI11160	Scheduling and Pricing of Rush Samples	5_EUUSLA_Client Services_Manager
S-CS-WI11161	Senior Administrator (Client Services)	5_EUUSLA_Client Services_Manager
S-CS-WI11162	Senior Specialist (Client Services)	5_EUUSLA_Client Services_Manager
S-CS-WI11163	Specialist (Client Services)	5_EUUSLA_Client Services_Manager
S-CS-WI11166	Tracking and Communicating Rush Results	5_EUUSLA_Client Services_Manager
5.03 Sample Administration		
Work Instruction		
S-SA-WI10713	Administrator (Unpacking)	5_EUUSLA_Sample
S-SA-WI10714	Assigning Sample Delivery Group Numbers and Five-Digit Sample Codes to Sample Groups	5_EUUSLA_Sample Administration_Manager
S-SA-WI10716	Director, Environmental Support Services	5_EUUSLA_Sample
S-SA-WI10717	Entry of Environmental Samples Requiring Subcontracting	5_EUUSLA_Sample
S-SA-WI10723	Environmental Sample Entry	5_EUUSLA_Sample Administration_Manager
S-SA-WI10725	Environmental Sample Receipt and Unpacking	5_EUUSLA_Sample Administration_Manager
S-SA-WI10726	Filing of Sample Information	5_EUUSLA_Sample Administration_Manager
S-SA-WI10727	Group Leader	5_EUUSLA_Sample Administration_Manager
S-SA-WI10730	Manager	5_EUUSLA_Sample Administration_Manager
S-SA-WI12043	Sample Receipt at the Sample Receipt Desk	5_EUUSLA_Sample Administration_Manager
S-SA-WI10736	Senior Administrator (Sample Administration)	5_EUUSLA_Sample Administration_Manager
S-SA-WI10737	Senior Administrator (Unpacking)	5_EUUSLA_Sample Administration_Manager
S-SA-WI10738	Senior Specialist (Sample Administration)	5_EUUSLA_Sample Administration_Manager
S-SA-WI10741	Specialist (Sample Administration)	5_EUUSLA_Sample Administration_Manager
S-SA-WI10742	Specialist (Unpacking)	5_EUUSLA_Sample Administration_Manager
S-SA-WI10743	Taking the Temperature of Environmental Samples Upon Arrival at the Lab	5_EUUSLA_Sample Administration_Manager
5.04 Sample Support		
Work Instruction		
S-SS-WI10697	% Moisture Calculation (Gravimetric) by SM 2540 G-1997	5_EUUSLA_Sample Support_Manager
S-SS-WI10662	Accounts to be held after Client Hold Discard	5_EUUSLA_Sample Support_Manager
S-SS-WI10666	ASRS Emergency Failure Procedure	5_EUUSLA_Sample Support_Manager
S-SS-WI10668	Automated Storage and Retrieval System (ASRS) Lockout/Tagout Procedure	5_EUUSLA_Sample Support_Manager
S-SS-WI12042	Automated Storage, Retrieval, and Discarding of Samples	5_EUUSLA_Sample Support_Manager

S-SS-WI10673	Chemist	5_EUUSLA_Sample Support_Manager
S-SS-WI10678	Director, Environmental Support Services	5_EUUSLA_Sample Support_Manager
S-SS-WI10682	GC/MS - Bulk Solids Matrix Sample Preparation	5_EUUSLA_Sample Support_Manager
S-SS-WI10683	Glassware Cleaning	5_EUUSLA_Sample Support_Manager
S-SS-WI10684	Group Leader	5_EUUSLA_Sample Support_Manager
S-SS-WI10685	Hardware Procedures for ASRS	5_EUUSLA_Sample Support_Manager
S-SS-WI10686	Homogenization, Sample Splitting, and Subsampling of Solid Waste Samples from Environmental Sources	5_EUUSLA_Sample Support_Manager
S-SS-WI10690	Instructions for Collecting Data on the LLENS System	5_EUUSLA_Sample Support_Manager
S-SS-WI10692	Laboratory Assistant	5_EUUSLA_Sample Support_Manager
S-SS-WI10693	Laboratory Technician	5_EUUSLA_Sample Support_Manager
S-SS-WI10695	Liquid Sample Preservation, Sample Splitting, and Turbidity for metals by EPA Methods 200.7 and 200.8	5_EUUSLA_Sample Support_Manager
S-SS-WI10696	Maintenance of Dessicators	5_EUUSLA_Sample Support_Manager
S-SS-WI10699	Non-Automated Storage, Retrieval, and Discarding of Samples	5_EUUSLA_Sample Support_Manager
S-SS-WI10702	Outlier Quality Control Data	5_EUUSLA_Sample Support_Manager
S-SS-WI10705	Percent Solids by SM 2540G - 1997	5_EUUSLA_Sample Support_Manager
S-SS-WI11168	Pipette Dispenser Calibration Procedure	5_EUUSLA_Sample Support_Manager
S-SS-WI11169	Preparation of Soil and Solid Samples for GC Volatile Analyses	5_EUUSLA_Sample Support_Manager
S-SS-WI11170	Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035 and Method 5035A	5_EUUSLA_Sample Support_Manager
S-SS-WI11242	Preparation of Vials for Field Preservation of Soils for Volatile Analysis	5_EUUSLA_Sample Support_Manager
S-SS-WI11259	Prescreening Water and Soil Samples for Volatile Organic Compounds	5_EUUSLA_Sample Support_Manager
S-SS-WI11260	Preservation and Bottles Room Preservative Traceability	5_EUUSLA_Sample Support_Manager
S-SS-WI11268	Sample Preparation of Solid Samples Including Sieving and Milling for Extraction and Analysis by SW-846 8330B	5_EUUSLA_Sample Support_Manager
S-SS-WI11220	Sample Support Ovens	5_EUUSLA_Sample Support_Manager
S-SS-WI11270	Senior Technician	5_EUUSLA_Sample Support_Manager
S-SS-WI11225	Subsampling for Subcontracted Analyses	5_EUUSLA_Sample Support_Manager
S-SS-WI11272	Water Content (Moisture) by ASTM D 2216	5_EUUSLA_Sample Support_Manager
5.05 Data Deliverables		
Work Instruction		
S-DD-WI10752	Administrator (Data Package Archivist)	5_EUUSLA_Data Deliverables_Manager
S-DD-WI10753	Administrator (Data Package Assembly)	5_EUUSLA_Data Deliverables_Manager
S-DD-WI10754	Administrator (Data Package Review)	5_EUUSLA_Data Deliverables_Manager
S-DD-WI10755	Archiving Department 4025 Raw Sample Data and Other Miscellaneous Data	5_EUUSLA_Data Deliverables_Manager

S-DD-WI12037	Assembly and Review of Environmental Data Packages	5_EUUSLA_Data Deliverables_Manager
S-DD-WI10804	Director, Environmental Support Services	5_EUUSLA_Data Deliverables_Manager
S-DD-WI10806	Generation and Content Review of GLP Compliant Data Packages	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11121	Group Leader	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11122	Manager	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11123	Overchecking the Electronic Data Deliverable	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11124	Preparation of Data Packages on CD ROM	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11125	Processing and Sending Data Packages	5_EUUSLA_Data Deliverables_Manager
S-DD-WI12068	Senior Administrator (Data Package Assembly)	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11126	Senior Administrator (Data Package Review)	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11127	Senior Specialist (Data Package Assembly)	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11128	Senior Specialist (Data Packages)	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11129	Senior Specialist (Electronic Data Deliverables)	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11130	Specialist (Data Package Assembly)	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11131	Specialist (Data Package Review)	5_EUUSLA_Data Deliverables_Manager
S-DD-WI11132	Specialist (Electronic Data Deliverables)	5_EUUSLA_Data Deliverables_Manager
5.06 Service Centers		
Work Instruction		
S-SC-WI13221	Preparation of Trip Blanks at BASC and STSC	5_EUUSLA_Sample Bottles_Manager
5.06.01 Bay Area Service Center		
Work Instruction		
S-SC-BA-WI11313	Administrator	5_EUUSLA_Sample Bottles_Manager
S-SC-BA-WI11314	BASC Sample Pick-Up, Transportation, and Delivery	5_EUUSLA_Sample Bottles_Manager
S-SC-BA-WI11323	Group Leader	5_EUUSLA_Sample Bottles_Manager
S-SC-BA-WI12044	Handling Non-Routine Analytical Services for Chevron Texaco	5_EUUSLA_Client Services_Manager
S-SC-BA-WI11324	Laboratory Technician	5_EUUSLA_Sample Bottles_Manager
S-SC-BA-WI11326	Packing Bottle Orders at Bay Area Service Center	5_EUUSLA_Sample Bottles_Manager
S-SC-BA-WI12309	Preparation of Acid Dilutions	5_EUUSLA_Sample Bottles_Manager
S-SC-BA-WI12045	Processing Bay Area Service Center (BASC) Bottle Orders	5_EUUSLA_Sample Bottles_Manager
S-SC-BA-WI11329	Project Manager	5_EUUSLA_Sample Bottles_Manager
S-SC-BA-WI11332	Sample Receipt for the Bay Area Service Center	5_EUUSLA_Sample Bottles_Manager
S-SC-BA-WI11333	Senior Specialist	5_EUUSLA_Sample Bottles_Manager
S-SC-BA-WI11334	Specialist	5_EUUSLA_Sample Bottles_Manager

	External Documents	
S-SC-BA-EX11330	Reagent Log Book for Eurofins Service Centers	5_EUUSLA_Client Services_Manager
5.07 Business Development		
Work Instruction		
S-BD-WI10778	Director	5_EUUSLA_Env Sciences_Manager
S-BD-WI10788	Legal Review Process of Client Supplied Documents	5_EUUSLA_Env Sciences_Manager
S-BD-WI10783	Manager	5_EUUSLA_Env Sciences_Manager
S-BD-WI11156	Preparing Quotations	5_EUUSLA_Env Sciences_Manager
S-BD-WI10785	Principal Specialist (Business Development)	5_EUUSLA_Env Sciences_Manager
S-BD-WI10786	Principal Specialist Account Manager	5_EUUSLA_Env Sciences_Manager
S-BD-WI10787	Proposal Preparation	5_EUUSLA_Env Sciences_Manager
S-BD-WI10791	Senior Specialist (Business Development)	5_EUUSLA_Env Sciences_Manager
S-BD-WI10792	Senior Specialist Account Manager	5_EUUSLA_Env Sciences_Manager
S-BD-WI10793	Specialist (Business Development)	5_EUUSLA_Env Sciences_Manager
S-BD-WI10794	Specialist II (Support)	5_EUUSLA_Env Sciences_Manager
S-BD-WI10795	Vice President, Eurofins Lancaster Laboratories Environmental	5_EUUSLA_Env Sciences_Manager
8.02 Volatiles		
Work Instruction		
T-VOA-WI7865	Associate Chemist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7613	Calibrating the 1-µL Standard Delivery Groove on the Archon Model 5100A and O.I 4660 Autosampler Systems	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7620	Chemist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7627	Client Specific - Determination of Client Specific Target Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) in Soils	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8221	Client Specific - Method AK101 for the Determination of Gasoline Range Organics in Soil Analysis for the State of Alaska	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7711	Client-specific Determination of Client Specific Target Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) in Waters	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7706	Determination of GRO by GC in Waters and Wastewaters by Method AK101	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8614	Determination of Target Compounds by GC/MS using Selective Ion Monitoring (SIM) by Method 8260C	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8194	Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 8260C	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8225	Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by GC/MS in Soils and Solids by Method 8260B	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8236	Determination of Volatile Target compounds and Gasoline Range Organics (GRO) by GC/MS in Soils and Solids by Method 8260C	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8197	Determination of Volatile Target Compounds and Gasoline Range Organics (GRO) by GCMS in Waters and Wastewaters by Method 8260B	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8584	Determination of Volatile Target Compounds by Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS) in Waters and Wastewaters by Method 6200B	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8224	Determination of Volatiles Gasoline Range Organics in Soil and Water - Northwest GX Method	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7615	Director	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7619	GC and GC/MS Instrumentation Maintenance	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8220	GC/MS Determination of 1,2,3-Trichloropropane Using Isotope Dilution and Selective Ion Monitoring (SIM) by EPA Method 524.2, Modified	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8480	GC/MS Determination of Purgeable Organic Compounds in Water by EPA Method 524.2	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7629	GC/MS Volatile Standards Traceability	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8373	GC/MS Volatiles Audit Process	5_EUUSLA_GC/MS Volatiles_Manager

T-VOA-WI7691	Glassware Washing	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7675	GRO in Soils by GC by SW-846, Methods 8015B, 8015C, 8015D	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8213	GRO in Soils for South Carolina	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7727	GRO in Water for South Carolina	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7690	GRO in Waters and Wastewaters by GC by SW-846, Methods 8015B, 8015C, 8015D	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7624	Group Leader	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7614	Laboratory Technician	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8400	Level II Review of GC/MS Volatiles	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8338	Low Concentration Waters for Volatile Organic Analysis by EPA SOW 10/92	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7861	Manager	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7692	Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7870	Preparation and Testing of Storage Blanks for GC/MS Volatile Analysis	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7605	Preparation and Testing of Trip Blanks for GC/MS Volatile Analyses	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8196	Preparation of Oil Samples	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7869	Preservation and Residual Chlorine Checks of Samples for GC/MS Volatile Water Analysis	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7626	Principal Chemist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7625	Principal Specialist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8183	Purgeable Aromatics by GC in High-Level Soils by Method 8021B	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8119	Purgeable Aromatics in Water Samples by Method 602	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8139	Purgeable Aromatics in Water Samples by Method 8021B	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7621	Senior Chemist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7622	Senior Specialist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7623	Senior Technician	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7866	Specialist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7607	Statistical Calculations Used in the Analysis of Samples by EPA Methodology	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7717	Targeted Library Search by GC/MS	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8515	The Determination of 1,4-Dioxane by GC/MS using Isotope Dilution and Selective Ion Monitoring (SIM) by Method 8260B and 8260C	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7720	The Determination of Ethylene Oxide and Crotonaldehyde by Gas Chromatography/Mass Spectrometry (GC/MS) in Water and Soil by SW-846 Method 8260B	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8544	Toxicity Characteristic Leachate Procedure (TCLP); Determination of Volatile Target Compounds by GCMS in Zero Headspace Extraction (ZHE) by 8260B	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7606	Use of 40-mL Vials for Volatile Organic Analyses	5_EUUSLA_GC/MS Volatiles_Manager

T-VOA-WI7630	Vinyl Chloride and Carbon Disulfide by GC/MS using Selective Ion Monitoring (SIM) in Waters by Method 8260B	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8265	Volatile Organic Compounds in Wastewater by Isotope Dilution and GC/MS by EPA Method 1666	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8330	Volatile Organics Tentatively identified Compound Method	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8633	Volatile Organics Tentatively Identified Compound Method (Interpretive)	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8423	Waters for Volatile Organic Compounds by Purge and Trap Gas Chromatography/Mass Spectrometry using EPA Method 624	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI18576	Waters for Volatile Organic Compounds by Purge and Trap Gas Chromatography/Mass Spectrometry using EPA Method 624.1	5_EUUSLA_GC/MS Volatiles_Manager
8.03 Metals		
Work Instruction		
T-MET-WI7882	Associate Chemist	5_EUUSLA_Metals_Manager
T-MET-WI7886	Bottletop Dispensers	5_EUUSLA_Metals_Manager
T-MET-WI7887	Chemist	5_EUUSLA_Metals_Manager
T-MET-WI11925	Client Specific - 3030 C. Treatment for Acid-Extractable Metals for North Carolina Groundwater Samples	5_EUUSLA_Metals_Manager
T-MET-WI11939	Digestion by EPA 200.8 for the Analysis of Total Recoverable Metals in Water by ICPMS	5_EUUSLA_Metals_Manager
T-MET-WI11938	Digestion of Waters by EPA 200.7 for Analysis of Total Recoverable Metals by ICP	5_EUUSLA_Metals_Manager
T-MET-WI11924	Digestion of Aqueous Samples by SW-846 Method 7470A, EPA 245.1	5_EUUSLA_Metals_Manager
T-MET-WI11926	Digestion of Oils by EPA 3050B mod. for ICP Analysis	5_EUUSLA_Metals_Manager
T-MET-WI7920	Dilute/Run and AVS/SEM Sample Handling for Metals	5_EUUSLA_Metals_Manager
T-MET-WI8732	Direct Analysis Preparation of Potable Water for ICP (EPA 200.7) or ICP-MS (EPA 200.8)	5_EUUSLA_Metals_Manager
T-MET-WI7921	Director	5_EUUSLA_Metals_Manager
T-MET-WI11927	Fixed-Volume Hand-Held Pipettes	5_EUUSLA_Metals_Manager
T-MET-WI7922	Glassware Cleaning	5_EUUSLA_Metals_Manager
T-MET-WI7923	Group Leader	5_EUUSLA_Metals_Manager
T-MET-WI18028	Instrument Maintenance for Agilent 7500	5_EUUSLA_Metals_Manager
T-MET-WI18026	Instrument Operations for Agilent 7500	5_EUUSLA_Metals_Manager
T-MET-WI18027	Instrument Operations for Agilent 7700	5_EUUSLA_Metals_Manager
T-MET-WI7941	Laboratory Technician	5_EUUSLA_Metals_Manager
T-MET-WI7943	Langelier Index in Water	5_EUUSLA_Metals_Manager
T-MET-WI7963	Maintenance and Calibration of HACH Model 2100Q Laboratory Turbidimeter	5_EUUSLA_Metals_Manager
T-MET-WI7964	Manager	5_EUUSLA_Metals_Manager
T-MET-WI7965	Mercury in Aqueous, Solid and Tissue Samples by Cold Vapor AA	5_EUUSLA_Metals_Manager
T-MET-WI11931	Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)	5_EUUSLA_Metals_Manager
T-MET-WI11933	Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A/6020B(aqueous, solid, tissue) and EPA 200.8 (aqueous)	5_EUUSLA_Metals_Manager
T-MET-WI7971	Metals Use of the LLENS System	5_EUUSLA_Metals_Manager
T-MET-WI11948	Preparation of Solids by EPA 7471A or B for Mercury Analysis	5_EUUSLA_Metals_Manager
T-MET-WI7972	Principal Chemist	5_EUUSLA_Metals_Manager
T-MET-WI8636	Sample Prep of Sediments, Sludges, Soils, and Tissues by SW846 3050B for ICP and ICP-MS	5_EUUSLA_Metals_Manager
T-MET-WI11937	Sample Preparation of Leachates and Other Wastewater for Analysis of Total Metals by Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)	5_EUUSLA_Metals_Manager
T-MET-WI11941	Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry	5_EUUSLA_Metals_Manager
T-MET-WI8639	Sample Preparation of Waters for Analysis of Total Recoverable Metals by Inductively Coupled Plasma Optical Emission Spectrometry	5_EUUSLA_Metals_Manager
T-MET-WI8640	Senior Chemist	5_EUUSLA_Metals_Manager
T-MET-WI8641	Senior Specialist	5_EUUSLA_Metals_Manager
T-MET-WI8721	Senior Technician (Instrument Room)	5_EUUSLA_Metals_Manager
T-MET-WI8723	Senior Technician (Prep Room)	5_EUUSLA_Metals_Manager
T-MET-WI8729	Specialist	5_EUUSLA_Metals_Manager
T-MET-WI9082	Working Instructions for Prep Solutions and Standards	5_EUUSLA_Metals_Manager
T-MET-WI12063	Working Instructions for Preparation of ICP Solutions and Standards	5_EUUSLA_Metals_Manager
T-MET-WI12065	Working Instructions for Preparation of ICP-MS Solutions and Standards	5_EUUSLA_Metals_Manager

T-MET-WI9084	Working Instructions for Preparation of Mercury Solutions and Standards	5_EUUSLA_Metals_Manager
8.04 Pesticides		
Work Instruction		
T-PEST-WI9202	Analysis of Chlorinated Herbicides by 8151A in Water	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9232	Analysis of Pesticides by 8081B in Solid Samples using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9238	Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9842	Associate Chemist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9843	Captan and Captafol by Method 8081A in Waters and Solids using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9844	Chemist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9845	Chlorinated Herbicides by 8151A in Solids by GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9846	Client Specific - HPLC Analysis for Cyclopamine in Biomass	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9851	Creating Calibration Timed Events in Chrom Perfect	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9854	Data Audit Procedure for Department 4024	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9859	Director	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9860	EDB, DBCP and TCP by Method 8011 in Solids using Microextraction and GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9952	EDB/DBCP/and TCP by Method 504.1 or 8011 in Waters Using Microextraction and GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI11965	Formaldehyde and Other Aldehydes by Method 8315A in Aqueous and Solid Samples using HPLC	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9953	Group Leader	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9954	Interpretation of Chromatographic Data	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9961	Low Level PCBs in Water by Method 8082/8082A using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9962	Manager	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9980	Monitoring QC Data Acceptance Limits	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9981	Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9982	Nitroaromatics and Nitroamines in Water and Solids by HPLC with UV Detection by Method 8330/A	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9983	N-Methylcarbamate Pesticides by Method 8318/8318A in Solids	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9984	N-Methylcarbamates by Method 531.1 in Groundwater and Drinking Water using High Performance Liquid Chromatography (HPLC)	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI11966	OP Pesticides (Acephate and Methamidophos) by 8141A in Aqueous and Solid Samples using GC-NPD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI11967	Organic Acids in Water by Methods 8015B/D or 8321B using HPLC/UV	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI11968	Organophosphorous Pesticides by Method 8141A/8141B in Solid Samples using GC-NPD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI11970	Organophosphorous Pesticides by Methods 8141A/8141B/622 in Aqueous Samples using GC-NPD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9987	PCBs in Oil by SW-846 Method 8082/8082A	5_EUUSLA_Pesticide Residue Analysis_Manager

T-PEST-WI9989	Perchlorate by Method 6850 in Waters and Solids by LC/MS/MS	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9992	Pesticides by Method 8081A in Solid Samples using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9997	Pesticides in Aqueous Samples by Method 608	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI17994	Pesticides in Aqueous Samples by Method 608.3	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9998	Pesticides in Water by Method 8081A using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9999	Pesticides in Water by Method 8081B using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9858	Picric Acid in Solid Matrix By HPLC with UV by Method 8015B	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10000	Picric Acid in Water by Method 8015B Using HPLC with UV Detection	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI11971	Polychlorinated Biphenyls (PCBs) by Method 608 or 8082 in Waters	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI18000	Polychlorinated Biphenyls (PCBs) by Method 608.3	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI11972	Polychlorinated Biphenyls (PCBs) by Method 8082 in Solids and Wipes	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10004	Polychlorinated Biphenyls (PCBs) in Solid Samples by 8082A Using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10006	Prescreening Water and Soil Samples for Pesticides and PCBs	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10007	Preventative and Corrective GC Maintenance	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10008	Preventative and Corrective HPLC Maintenance for the Pesticide Residue Analysis Department	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10009	Principal Chemist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10010	Principal Specialist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10011	QC Data Acceptability and Corrective Action	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10012	Senior Chemist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10013	Senior Specialist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10014	Setting Retention Time Windows	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10015	Setting Up Analysis Numbers in the Departmental Database	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10016	Setting Up Single Component Initial Calibrations	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10017	Specialist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10018	Standards Preparation, Coding, and Storage	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10019	Standards Traceability and Monitoring	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10020	Uploading Data to the LIMS	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10022	Using "Datalog" Software for Data Acquisition of Multicomponent Pesticides/PCBs	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10023	Using "Datalog" Software for Single-component Data Acquisition	5_EUUSLA_Pesticide Residue Analysis_Manager
8.05 GCMS Semivolatiles		
Work Instruction		
T-SVOA-WI11981	Analysis of Chlorinated Herbicides in Water by Selective Ion Monitoring Gas Chromatography/Mass Spectroscopy (SIM/GC/MS)	5_EUUSLA_GC/MS Semivolatiles_Manager

T-SVOA-WI11979	Associate Chemist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9592	Chemist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9514	Client Specific - Methyl Stearate in Plastic, Method 8270D, by GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9535	Determination of Benz(a)pyrene in Smokeless Tobacco by Selective Ion Monitoring Gas Chromatography/Mass Spectrometry (SIM/GC/MS)	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9252	Determination of Parent and Alkyl Substituted Polynuclear Aromatic Hydrocarbons (PAHs), Alkanes and Geochemical Biomarkers by Gas Chromatography/Mass Spectrometry (GC/MS-SIM)	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9577	Determination of Priority Pollutants by Method 625	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9590	Dioxin Screening (2,3,7,8-TCDD) of Aqueous and Solid Matrices using GC-MS SIM	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9593	Director	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9594	GC/MS Audit Process	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9596	GC/MS Electronic Data Management and Handling	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9598	GC/MS Preventative and Corrective Maintenance	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9603	Group Leader	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9604	Monitoring QC Data Acceptance Limits	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9610	Principal Chemist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI11980	Principal Specialist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI18565	Priority Pollutants by Method 625.1 in Water Using GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9611	Quality Control Spike Mix Verification	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9613	Semivolatile Compounds by Method 525.2 in Drinking Water using GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9617	Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9623	Semivolatile Organic Compounds, Including DRO/ORO, by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC-MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI11997	Semivolatile Organics Tentatively Identified Compound Method	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9624	Semivolatile Run/Injection Log Generation	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9995	Semivolatiles by Methods 8270C/D SIM	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9634	Senior Chemist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9635	Senior Specialist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9587	Tetraethyl lead (TEL) and Tetramethyl lead (TML) in Water and Solids by 8270C GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI13634	The Determination of 1,4-Dioxane by GC/MS using Isotope Dilution and Selective Ion Monitoring (SIM) by Method 8270C/D	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9625	The Determination of d-Limonene in Plastic by Gas Chromatography/Mass Spectrometry (GC/MS)	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9626	THPA, PHPI and PA by 8270C Mod. or CEPH 440 in Waters and Solids Using GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
8.06 Instrumental Water Quality		

Work Instruction		
T-WC-WI9861	Accusterilizer - Steam Sterilizer	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10024	Ammonia Nitrogen by EPA 350.1 in Waters and Solids Using Segmented Flow Analysis and Gas Diffusion	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11619	Automated Determination of Phenols in Water, Wastewater, and Soils By Automated Flow Analyzer EPA 420.4, SW-846, 9066	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10287	Chemist	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11621	Client Specific - Determination of Total Cyanide in Water, Wastewater, and Soils (Department of Defense) SW-846 9012B, SW-846 9012A	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11622	Client Specific - Total Cyanide Distillation (Department of Defense)	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11624	Department 4027 Chemical Inventory and Review Procedures	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11625	Determination of Hexavalent Chromium by Ion Chromatography in Solids and Waters SW-846 7199 and EPA 218.6	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11626	Determination of Inorganic Anions by Ion Chromatography in Waters and Soil by EPA 300.0, SW 846 9056, and SW 846 9056A	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11627	Determination of TOC and TC in Solids and Sludges by Combustion by SM 5310B, EPA 415.1, SW-846 9060/9060A	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11635	Determination of Total and Available Cyanide in Water using Amperometric Detection by ASTM D 7511-09e2, -12 and Method OIA-1677-09	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11636	Determination of Total and Soluble Phosphorus in Water, Wastewater, and Soils (Colorimetric, Ascorbic Acid, Automated) by EPA 365.1 or SM 4500-P F-2011	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10037	Determination of Total Carbon in Water and Wastewater by SM-5310 C and EPA 415.1	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10038	Determination of Total Organic Carbon in Water and Wastewater (Quadruplicate Studies)	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10039	Digestion of Total and Soluable Phosphorus in Water, Wastewater, and Soils EPA 361.1, SM20 4500 P B, and SM20 4500 P E	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10289	Director	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10290	Group Leader	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI12054	Hexavalent Chromium by EPA 218.7 in Drinking Water	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11640	ICS-1000, ICS 1100, ICS-2000 and ICS-3000 Ion Chromatography Systems	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10291	Laboratory Technician	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11641	Low Level Hexavalent Chromium by Ion Chromatography in Waters by EPA 218.6	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI9889	Maintenance and Calibration of A.I. Scientific AIM600 Digestor	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11643	Maintenance of Continuous Flow Analyzers	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI9890	Maintenance of the OI Analytical Model 1030 Total Organic Carbon Analyzer	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10292	Manager	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10070	Moisture by Moisture Analyzer in Solids by SM 2540 G-2011	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11649	Nitrate Nitrogen in Water and Wastewater (Colorimetric, Automated Cadmium Reduction)	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11650	Nitrite Nitrogen in Water and Wastewater (Colorimetric, Automated)	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI9891	pH Electrodes and Meters	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11651	Phenol Distillation in Solids by EPA SW-846 9065	5_EUUSLA_Instrumental Water Quality_Manager

T-WC-WI11652	Quality Control for Analyses Performed in Instrumental Water Quality	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10083	Reagent Water Extraction of Ions in soil, for analysis by method EPA 300.0 or SW 846 9056	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10293	Senior Chemist	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10294	Senior Technician	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI22922	Sulfate (turbidimetric) by EPA 375.4 in Waters by Spectrophotometry	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10085	Total and Amenable Cyanide Distillation in Waters and Solids by SW-846 9012A/B, EPA 335.1/3/4, and SM 4500-CN G-1999/2011	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10105	Total Cyanide Analysis of Waters and Solids by Massachusetts Contingency Plan (MCP)/NJ DKQP	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10106	Total Kjedahl Nitrogen Digestion of Solids and Soils by EPA 351.2	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10107	Total Kjedahl Nitrogen Digestion of Water and Wastewater by EPA 351.2	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI12055	Total Kjeldahl Nitrogen (TKN) by EPA 351.2, EPA 351.2 mod, SM4500-Norg or SM4500-N in Waters and Solids using Automated Flow Analysis or Discrete Analysis	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11637	Total Organic Carbon (TOC), Dissolved Organic Carbon (DOC), and Total Inorganic Carbon (TIC) by SM 5310C or EPA 415.1 in Waters	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11629	Total, Amenable and Weak Acid Dissociable Cyanide in Waters and Soils, Free Cyanide in Water, Reactive Cyanide of Solids, by SW-846 Method 9012A/B, EPA 335.4/3, and SM 4500-CN G/E-1999/2011	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10285	Weak Acid Dissociable Cyanide Distillation (as preparation for Analysis on the Flow Analyzer)	5_EUUSLA_Instrumental Water Quality_Manager
8.07 Leachate Preparation		
Work Instruction		
T-TL-WI14428	Associate Chemist	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7142	Calibration of the Leachate Tumblers	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7562	Cation Exchange Capacity of Soils (Sodium Acetate) by Method 9081	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7139	Director	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7143	Glassware Cleaning for Leachate Extractions	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7144	Leachate Blank Evaluations	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7140	Manager	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7146	Manually Pressurized Zero Headspace Extractor (ZHE)	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7141	pH Meters and Probes	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7257	Procedure for Calculating and Reporting Weighted Average Results for TCLP Extracts	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7148	Shake Extraction of Solid Waste with Water ASTM Method #D3987-85	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7145	Subsampling and Preservation of Leachates	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7558	Synthetic Precipitation Leaching Procedure (SPLP) for Nonvolatile Leachates	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7561	Synthetic Precipitation Leaching Procedure (SPLP) Zero headspace Leachates	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7151	Toxicity Characteristic Leaching Procedure (TCLP) Nonvolatile Leachates	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7258	Toxicity Characteristic Leaching Procedure TCLP Zero Headspace Leachates, Method 1311	5_EUUSLA_Leachate Preparation_Manager

T-TL-WI7563	Waste Extraction Test Leaching Procedure for Volatile and Non-Volatile Analytes	5_EUUSLA_Leachate Preparation_Manager
8.08 Water Quality		
Work Instruction		
T-WC-WI10421	#1443 Specific Gravity by SM 2710F-1997, #6569 Bulk Density by ASTM E868-82 Sec 9.9	5_EUUSLA_Water Quality_Manager
T-WC-WI9862	Accumet Model AB30 pH/Ion/Conductivity Meter	5_EUUSLA_Water Quality_Manager
T-WC-WI10422	Acid Volatile Sulfide in Solids	5_EUUSLA_Water Quality_Manager
T-WC-WI9897	Adjustable Volume Handheld Pipettes	5_EUUSLA_Water Quality_Manager
T-WC-WI10423	Ammonia Nitrogen by Ion-Selective Electrode Method (ISE) in Solids by EPA 350.3 and SM 4500-NH3B-1997, 2011	5_EUUSLA_Water Quality_Manager
T-WC-WI10424	Ammonia-Nitrogen for Soils (Tritrimetric Distillation Procedure) by 4500-NH3 B/C - 2011, or EPA 350.2	5_EUUSLA_Water Quality_Manager
T-WC-WI11474	Ammonia-Nitrogen for Waters (Titrimetric Distillation Procedure) by 4500-NH3 B/C -2011, or EPA 350.2	5_EUUSLA_Water Quality_Manager
T-WC-WI10425	Bellack Distillation for Fluoride in Waters and Solids by SM 4500 F B-2011, EPA 340.1 Procedure 6.1 or SM 4500 F B-1997	5_EUUSLA_Water Quality_Manager
T-WC-WI10426	BOD and CBOD in Waters by SM 5210 B-2011, Hach 10360, EPA 405.1, SM 5210 B-2001	5_EUUSLA_Water Quality_Manager
T-WC-WI9898	Calibration of Hach 2100AN Turbidimeter	5_EUUSLA_Water Quality_Manager
T-WC-WI12050	Chemical Oxygen Demand (COD) in Water by EPA 410.4	5_EUUSLA_Water Quality_Manager
T-WC-WI11478	Chemical Oxygen Demand (Low-Level) by 410.4	5_EUUSLA_Water Quality_Manager
T-WC-WI10358	Chemical Review	5_EUUSLA_Water Quality_Manager
T-WC-WI11479	Chemist	5_EUUSLA_Water Quality_Manager
T-WC-WI10431	Chloride (Titrimetric Determination) in Water by SM 4500-CL C-2011	5_EUUSLA_Water Quality_Manager
T-WC-WI11480	Chlorine Residual for waters by 4500 Cl F-2011, or EPA 330.4	5_EUUSLA_Water Quality_Manager
T-WC-WI10436	Client Specific - Hexavalent Chromium in Waters (Colorimetric) (Department of Defense)	5_EUUSLA_Water Quality_Manager
T-WC-WI11482	Color by 2120 B-2011, or EPA 110.2	5_EUUSLA_Water Quality_Manager
T-WC-WI11483	Colorimetric Sulfide in Waters (#0230), Sulfide as H2S (#10293 Calculation), Dissolved Sulfide in Waters (#10499) by 4500-S2 D-2011, 4500-S2 H-2011, or EPA 376.2	5_EUUSLA_Water Quality_Manager
T-WC-WI11493	Director	5_EUUSLA_Water Quality_Manager
T-WC-WI10609	Dissolved Oxygen by 4500 O G-2011, EPA 360.1 or Hach Method 10360	5_EUUSLA_Water Quality_Manager
T-WC-WI11616	Dissolved Oxygen Meter Calibration	5_EUUSLA_Water Quality_Manager
T-WC-WI11494	Dissolved Silica (Colormetric) in Water by SM4500SIO2 C-2011, SM4500SIO2 C-1997 or EPA 370.1	5_EUUSLA_Water Quality_Manager
T-WC-WI9900	Equipment Incubators and Refrigerators	5_EUUSLA_Water Quality_Manager
T-WC-WI9901	Equipment Muffle Furnaces and Ovens	5_EUUSLA_Water Quality_Manager
T-WC-WI11495	Ferrous Iron (colorimetric) in Waters and Solids by Method 3500-Fe B-2011	5_EUUSLA_Water Quality_Manager
T-WC-WI11496	Fixed Dissolved Solids (Calculation) by 2540 E - 2011 or EPA 160.4	5_EUUSLA_Water Quality_Manager
T-WC-WI10610	Fixed Suspended Solids (Gravimetric) (#207) Volatile Suspended Solids (Gravimetric) (#208) by SM 2540 E - 2011 or EPA 160.4 in Water	5_EUUSLA_Water Quality_Manager
T-WC-WI10348	Fixed Volume Hand-Held Pipettes	5_EUUSLA_Water Quality_Manager
T-WC-WI10437	Flash Point for Liquids and Solids by ASTM D93 or EPA 1010 A	5_EUUSLA_Water Quality_Manager
T-WC-WI10612	Flash Point for Liquids and Solids by ASTM Method D93-07, ASTM D93-90 or SW-846 1010A	5_EUUSLA_Water Quality_Manager
T-WC-WI11499	Group Leader	5_EUUSLA_Water Quality_Manager
T-WC-WI11500	Hexane Extractable Material (HEM) and Silica Gel Treated Hexane Extractable materials (SGT-HEM) in Waters by EPA Method 1664A, 1664B, and 1664.	5_EUUSLA_Water Quality_Manager
T-WC-WI10614	Hexavalent Chromium (Colorimetric) in Waters by CTRCP	5_EUUSLA_Water Quality_Manager
T-WC-WI10615	Hexavalent Chromium (Colorimetric) in Waters by MCP	5_EUUSLA_Water Quality_Manager
T-WC-WI10616	Hexavalent Chromium (Colorimetric) in Waters by SM846 7196A NJ DKQP	5_EUUSLA_Water Quality_Manager
T-WC-WI10618	Hexavalent Chromium in Solids (Alkaline Digestion and Analysis Methods) by SW-846 3060A and SW-846 7196A	5_EUUSLA_Water Quality_Manager
T-WC-WI10617	Hexavalent Chromium in Solids (Alkaline Digestion and Analysis Methods) by SW846 3060A, SW846 7196A NJ DKQP	5_EUUSLA_Water Quality_Manager
T-WC-WI10432	Hexavalent Chromium in Solids Alkaline Digestion and Analysis Methods (Department of Defense) by SW-846 3060A and SW-846 7196A	5_EUUSLA_Water Quality_Manager
T-WC-WI10619	Hexavalent Chromium in Solids by CTRCP (Alkaline Digestion and Analysis Methods)	5_EUUSLA_Water Quality_Manager
T-WC-WI10622	Hexavalent Chromium in Solids by MCP (Alkaline Digestion and Analysis Method)	5_EUUSLA_Water Quality_Manager

T-WC-WI11501	Hexavalent Chromium in waters (Colorimetric) by SW-846 7196A	5_EUUSLA_Water Quality_Manager
T-WC-WI10627	Ignitability of Solids by 40 CFR, Part 261.21	5_EUUSLA_Water Quality_Manager
T-WC-WI10359	Instructions for Collecting Data on the LLENS System	5_EUUSLA_Water Quality_Manager
T-WC-WI11504	Laboratory Assistant	5_EUUSLA_Water Quality_Manager
T-WC-WI11505	Laboratory Technician	5_EUUSLA_Water Quality_Manager
T-WC-WI11506	Low-Level Hexavalent Chromium in waters (Colorimetric) by 3500-Cr B-2011	5_EUUSLA_Water Quality_Manager
T-WC-WI10350	Maintenance of Desiccators	5_EUUSLA_Water Quality_Manager
T-WC-WI10351	Maintenance of Hot Plates	5_EUUSLA_Water Quality_Manager
T-WC-WI11507	Manager	5_EUUSLA_Water Quality_Manager
T-WC-WI10629	Methylene-Blue-Active Substances (MBAS) by 5540 C-2011 or EPA 425.1	5_EUUSLA_Water Quality_Manager
T-WC-WI11509	Moisture (Gravimetric), Total Residue (#0521), Volatile Residue (#0522), Total Fixed Residue/Ash (#1029) by SM 2540 G-2011 or SM 2540 E-2011 in Solids	5_EUUSLA_Water Quality_Manager
T-WC-WI11475	Multi-Parameters in Solids and Waters by ManTech Multi-Parameter System	5_EUUSLA_Water Quality_Manager
T-WC-WI11510	n-Hexane Extractable Material (HEM) and Silica Gel Treated HEM (SGT-HEM) in Solids by EPA 9071B	5_EUUSLA_Water Quality_Manager
T-WC-WI11511	Orthophosphate (Colorimetric) by EPA 365.3 in Waters	5_EUUSLA_Water Quality_Manager
T-WC-WI15537	Orthophosphate in waters by Colorimetry SM 4500 P E-2011	5_EUUSLA_Water Quality_Manager
T-WC-WI11512	Oxidation-Reduction Potential for Wastewaters and Soils by ASTM D1498, SM 2580 B-2011	5_EUUSLA_Water Quality_Manager
T-WC-WI11513	Paint Filter Liquids Test (Free Liquids Test)	5_EUUSLA_Water Quality_Manager
T-WC-WI11514	Particle Size Distribution of Soils and Solids/Grain Size Classification by ASTM D422-63 (reapproved 2007)	5_EUUSLA_Water Quality_Manager
T-WC-WI11515	Percent Solids for GC/MS by EPA 1666, Revision A - 1998	5_EUUSLA_Water Quality_Manager
T-WC-WI11518	pH by EPA 9045C, 9045D and Corrosivity by SW-846 Chap 7 of Solids, Soils, and Solvents using Electrometic Methods	5_EUUSLA_Water Quality_Manager
T-WC-WI11519	pH Probes and Meters	5_EUUSLA_Water Quality_Manager
T-WC-WI11521	Principal Chemist	5_EUUSLA_Water Quality_Manager
T-WC-WI10360	Quality Control Data for Wet Chemistry	5_EUUSLA_Water Quality_Manager
T-WC-WI11572	Reactive Sulfide	5_EUUSLA_Water Quality_Manager
T-WC-WI11574	Reactivity of Waste	5_EUUSLA_Water Quality_Manager
T-WC-WI11575	Senior Chemist	5_EUUSLA_Water Quality_Manager
T-WC-WI11577	Senior Specialist	5_EUUSLA_Water Quality_Manager
T-WC-WI11576	Senior Technician	5_EUUSLA_Water Quality_Manager
T-WC-WI11578	Settleable Solids in waters by 2540 F-2011, or EPA 160.5	5_EUUSLA_Water Quality_Manager
T-WC-WI10349	SKALAR COD Robot Analyzer and COD Spectrophotometers	5_EUUSLA_Water Quality_Manager
T-WC-WI11584	Specific Conductance in Solids by 2510B-2011, SW-846 9050, or EPA 120.1	5_EUUSLA_Water Quality_Manager
T-WC-WI10352	Spectronic Genesys 2 and Genesys 10 Vis Spectrophotometers	5_EUUSLA_Water Quality_Manager
T-WC-WI10362	Standardization of 0.02 and 0.1 Normal Sulfuric Acid	5_EUUSLA_Water Quality_Manager
T-WC-WI11585	Standardization of 0.02 Normal Sodium Hydroxide	5_EUUSLA_Water Quality_Manager
T-WC-WI11586	Sulfate (turbidimetric) by EPA 375.4 in Waters	5_EUUSLA_Water Quality_Manager
T-WC-WI11587	Sulfide Titration for Waters by 4500 S2 F-2011, EPA 376.1, SW-846 Method 9034 or 4500 S2 F-2000	5_EUUSLA_Water Quality_Manager
T-WC-WI11589	Sulfite in waters by 4500-SO3 B-2011, or EPA 377.1	5_EUUSLA_Water Quality_Manager
T-WC-WI11597	Total Dissolved Solids (Calculation)	5_EUUSLA_Water Quality_Manager
T-WC-WI11598	Total Dissolved Solids (TDS)(Gravimetric) by SM 2540 C-2011, SM 2540 C-1997 or EPA 160.1 in Waters and Wastewaters	5_EUUSLA_Water Quality_Manager
T-WC-WI11599	Total Dissolved Solids by 2540 C	5_EUUSLA_Water Quality_Manager
T-WC-WI11600	Total Fixed Solids (TFS), Total Volatile Solids (TVS) Gravimetric by SM 2540 E-2011, SM 2540 G-2011 or EPA 160.4 in Waters	5_EUUSLA_Water Quality_Manager
T-WC-WI11603	Total Solids (Gravimetric) by SM 2540 B-2011, SM 2540 G-2011, EPA 160.3, SM 2540 G-1991, SM 2540 B-1997, or SM 2540 G-1997 in Waters and Wastewaters	5_EUUSLA_Water Quality_Manager
T-WC-WI11604	Total Suspended Solids (TSS)-Gravimetric by SM 2540 D-2011 or SM 2540 D-1997 and Total Filtered: Total Volume Test by NJDEP in Waters	5_EUUSLA_Water Quality_Manager
T-WC-WI15618	Turbidity by EPA 180.1 Rev. 2 or SM 2130 B-2011	5_EUUSLA_Env Quality Assurance_All
T-WC-WI11605	Volatile Dissolved Solids (Calculation) by SM 2540 E - 2011 or EPA 160.4	5_EUUSLA_Water Quality_Manager
T-WC-WI10364	Water Quality Washroom Procedures	5_EUUSLA_Water Quality_Manager
8.09 Air Quality		
Work Instruction		
T-AQ-WI7174	Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photo Using EPA Method 18 and 25	5_EUUSLA_Volatiles in Air_Manager

T-AQ-WI7162	Calibration of Pressure Gauges	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7157	Chemist	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7165	Cleaning and Handling of Flow Controllers	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7164	Cleaning and Handling of Summa Canisters	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7270	Director	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7159	Group Leader	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7172	Helium as a Tracer Gas	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7275	Low-Level Volatile Organic Compounds in Air by EPA Method TO-15 Using GC/MSD in SIM Mode	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7161	Manager	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7170	Oxygen and Carbon Dioxide in Air	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7168	Preparing Summa Can Order	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7160	Principal Specialist	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7167	Procedure for Compositing Samples from a Tedlar Bag	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7163	Routine Instrument Maintenance for Volatiles in Air by GC and GC/MS	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7158	Senior Chemist	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7169	Standards Preparation, Validation, and Documentation Using EPA Method TO-14 and TO-15	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7436	The Determination of Volatile Organic Compounds in Air by GC/MS Using EPA MEthod TO-14 or TO-15	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7271	Volatiles in Air Audit Process	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7173	Volatiles in Air Tentatively Identified Compound Method	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7171	Volatiles in Air Tentatively Identified Compound Method (Interpretive)	5_EUUSLA_Volatiles in Air_Manager
8.10 EPH/Miscellaneous GC		
Work Instruction		
T-GC-WI9253	Analysis of DRO/RRO by Alaska 102/103 in Waters and Soils	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9643	Associate Chemist	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI15025	Associate Specialist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-GC-WI9644	Carbon Dioxide in Water Using Headspace Sampling Techniques and GC-TCD, Method RSK-175 or 8015	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9649	CCWE Water Miscible Solvents by Method 8015B	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9650	Chemist	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9656	Client Specific - Total Extractable Hydrocarbons (TEH) by Method 8015B Modified Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9657	Common Equations Used During Chromatographic Analyses	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9663	Determination of Diesel and Residual Range Organics using Alaska 102/103 Small Volume (SV) Protocols in Aqueous Samples	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9665	Determination of Petroleum Range Organics in Waters and Solids using FL-PRO	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9668	Director	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI12071	DRO(C12-C23) and ORO(>C23-C32) by Method 8015B/CA LUFT in Water using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9669	DRO/ORO by 8015B/C/D and TPH by NWTPH-Dx (Modified) in Water using Mini-Extraction and GC-FID	5_EUUSLA_EPH/Misc. GC_Manager

T-GC-WI9671	DRO/TPH by Method 8015 (B, C, of D) in Waters using Microextraction and GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9672	EPH by Massachusetts Protocol (MAEPH) in Waters and Solids Using GC	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9673	EPH in Waters and Solids Using GC-FID by Method ECY97-602 WA EPH	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9675	Extractable Petroleum Products by Method OA-2 (Iowa Protocol) in Waters and Solids Using GC/FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9676	Extraction of Soils/Solids for Glycol Analysis	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9677	Extraction of Solids/Soils for Analysis of Alcohols by Method 8015B	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9678	Fractionated EPH using LA RECAP Ranges in Waters and Solids by GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9679	GC Routine and Nonroutine Maintenance for Instrumentation Used for VPH Analysis	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9680	Glycols by Method 8015B/8015C in Water and Solid Matrices Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9681	Group Leader	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9683	Interpretation and Integration of Chromatographic Data	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9684	Laboratory Technician	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9685	MA DEP VPH in Waters and Solids Using GC	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9689	Maintenance and Troubleshooting Procedures for GC-FID Instrumentation	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9690	Manager	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9698	Monitoring QC Data Acceptance Limits	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9736	New Jersey Extractable Petroleum Hydrocarbons (NJEPH) in Waters and Solids using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9740	PMI VOCs (Direct Injection) by Method 1671A in Waters Using GC/FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9748	Principal Chemist	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9749	QC Data Acceptability and Corrective Action	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9756	Qualitative/Quantitative GC Fingerprint in Petroleum Distillates, Fuels, and Oils by 8015B Mod/8015C Mod/ or 8015D Mod	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9757	Senior Chemist	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9758	Senior Specialist	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9759	Senior Technician	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9769	Terphenyls by Method 8015B in Water and Solids Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9770	TNRCC TX Method 1005 - Total Petroleum Hydrocarbons (Gasoline Range, Diesel Range, and Extended Range Organics) in Waters and Solids	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9771	Total Petroleum Hydrocarbons with Ranges by Methods 8015B/8015C/8015D in Waters and Solids by GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9772	Total Saturated Hydrocarbons by Method 8015C in Waters and Solids using GC/FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9773	TPH by CT ETPH	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9778	TPH by Methods 8015B/C/D mod. in Waters and Solids Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9781	TPH by NWTPH-Dx (modified) in Soils using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9783	TPH by NWTPH-Dx (modified) in Waters using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9784	TPH by TN EPH in Water and Soil using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9788	TPH DRO and TPH ORO by 8015B/8015C/8015D in Solids using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9786	TPH DRO and TPH ORO by 8015B/C/D in Water using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9790	TPH-DRO by 8015C South Carolina Methodology Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9791	TPH-DX with Fuel Identification in Waters and Solids by NWTPH-DX	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9792	TX 1006 Characterization of C6-C35 Petroleum Hydrocarbons in Waters and Solids	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9794	Using "Range Compound Analysis" Software for Range Data Acquisition	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI24004	Volatile Hydrocarbons in Water by ASTM Standard Test Method D8028-17 Using Headspace Sampling Techniques and GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9796	Volatile Hydrocarbons in Water by Method RSK-175 and SW-846 8015 Using Headspace Sampling Techniques and GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9798	Volatile Organic Concentration of Waste Samples by Method 25D Using FID and ELCD	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9822	VPH in Waters and Solids Using GC-FID by Method ECY 97-602 WA VPH	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9824	Water Miscible Solvents by Method 8015B/8015C/8015D Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
8.11.01 Prep for Pesticides		
Work Instruction		
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10959	Client Specific - Drying and Grinding for Cyclopamine	5_EUUSLA_Organic Extraction_Manager

T-OE-PEST-WI10958	Client Specific - Microwave Extraction of Cyclopamine for a Biomass	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10886	Client Specific - Soxhlet Extraction of Cyclopamine	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10907	Extraction By Method 8318/8318A for Carbamate and Urea Pesticides in Solids	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10940	Extraction for Perchlorate by Method 6850 in Solids	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10919	Extraction of Chlorinated Herbicides in Water by SW-846 8151A	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI11372	Extraction of Formaldehyde and Other Aldehydes in a Water by Method 8315A	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10942	Extraction of Nitroaromatics and Nitroamines by Method 8330/A/B in Water	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI11373	Extraction of Solid Samples for Formaldehyde and Aldehydes by Method 8315A	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10881	Liquid/Liquid Extraction Procedure for the Determination of Organophosphorous Pesticides in a Wastewater Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI11381	Microextraction by Method 504.1 or 8011 for EDB, DBCP, and TCP in Water	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10956	Microextraction of EDB, DBCP, and TCP in Solids by Method 8011	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10927	Microwave Extraction Method 3546 for PCBs in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10926	Microwave Extraction Method 3546 for Pesticides in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI11410	Pesticide Extract Cleanup Using GPC by Method 3640A	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10920	Separatory Funnel Extraction by Method 3510C, 608 or 622 for Pesticides and PCBs in a Wastewater	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10941	Soxhlet Extraction (Method 3540C) for Triazine Herbicides and Organophosphorous Pesticides in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10922	Ultrasonic Extraction for PCBs in a Solid Matrix by Method 3550C	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10939	Ultrasonic Extraction for Pesticides in a Solid Matrix by Method 3550	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10912	Ultrasonic Extraction of Chlorinated Herbicides by Method 3550B/C in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10943	Ultrasonic Extraction of Nitroaromatics and Nitroamines by Method 8330/A/B in Solids	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10918	Waste Dilution by EPA 3580A for PCBs in Oil	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI10921	Waste Dilution by EPA 3580A for Pesticides in a Non-Water Soluble Leachate Matrix	5_EUUSLA_Organic Extraction_Manager
8.11.02 Prep for SVOA		
Work Instruction		
T-OE-SVOA-WI10280	Alumina Column Cleanup for DRO	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10938	Extraction of Semi-Volatile Organic Compounds by Method 525.2 in Drinking Waters	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI11374	Extraction Procedure for the Determination of PAHs in an XAD Air Tube Sample by TO-15A	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10882	Extraction Procedure the the Determination of 2-Chlorobenzalmalonotrile (CS) and 3-Quinuclidinyl Benzilate (BZ) in Water and Wastewater	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10933	Liquid -Liquid Extraction Procedure for the Determination of Target Compound list Analytes in a Water Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10923	Liquid/Liquid Extraction Procedure for the Determination of Base-Neutrals and Acid Extractables in a Wastewater Matrix by Method 8270	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10904	Liquid/Liquid Extraction Procedure for the Determination of Neutral Extractables in a Wastewater Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10916	Low-Level Sonic Probe Extraction Procedure by Method 3550C for the Determination of Semivolatiles in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager

T-OE-SVOA-WI10915	Low-Level Ultrasonic Extraction by Method 3550C for PAHs in a Solid Matrix by GC/MS	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10928	Microwave Extraction by Method 3546 for Semivolatiles	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10880	Microwave Extraction for the Determination of Semivolatiles in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10554	Semivolatile Extract Cleanup Using Gel Permeation Chromatography	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10935	Separatory Funnel Extraction (Method 3510C) or Waste Dilution (Method 3580A) of Base Neutrals and Acid Extractables in Leachates	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10931	Separatory Funnel Extraction by Method 3510C for BNAs by 8270 SIM in Wastewater	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI11432	Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10924	Separatory Funnel Extraction by Method 3510C for Tetraethyl Lead in Waters	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10947	Separatory Funnel Extraction for BNAs in Wastewater by Method 625	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10946	Separatory Funnel Extraction for PAHs in Water by GC/MS Using Method 3510C	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI18058	Separatory Funnel Extraction of Chlorinated Herbicides in Water by SW-846 Method 8151A	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10884	Solid Phase Extraction Procedure for the Determination of THPA, THPI, and PA in a Water Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10925	Sonic Probe Extraction Procedure for the Determination of Semivolatiles in a Solid Matrix by SIM	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10936	Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Leachate Matrix by Method 3580A	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI10917	Waste Dilution, EPA 3580A for Acid Extractables and Base-Neutrals in a Non-Water Soluble Matrix	5_EUUSLA_Organic Extraction_Manager
8.11.03 Prep for GC		
Work Instruction		
T-OE-GC-WI10278	10g Silica Gel Cleanup by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10949	3 g Silica Gel Column Cleanup for DRO	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10944	Client Specific - Separatory Funnel Extraction Method 3510C for DRO in Water or Wastewater	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI11367	Client Specific - Separatory Funnel Extraction Procedure for the Determination of Extractable Petroleum Hydrocarbons in a Water Matrix by Washington Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10932	Extraction by EPA 3546 or 3550 for DRO and/or RRO in Solids for Alaska Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI11364	Extraction of Total Petroleum Hydrocarbon Organics in Waters by Texas Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI11365	Extraction of Total Petroleum Hydrocarbons in a Solid Matrix by Texas Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10906	Microextraction by Method 3511 for DRO in Water and Wastewater	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10899	Microwave Extraction for EPH in a Solid Matrix by Montana Protocol	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10900	Microwave Extraction for EPH in a Solid Matrix by Washington Protocol	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10930	Microwave Extraction Method 3546 for DRO and Saturated Hydrocarbons in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10883	Microwave Extraction Method 3546 for NJ EPH in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10909	Microwave Extraction, Method 3546, for MA EPH in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10910	Quick Silica Gel Cleanup for Hydrocarbons by GC in Solid and Water Matrices	5_EUUSLA_Organic Extraction_Manager

T-OE-GC-WI10911	Separatory Funnel Extraction by Method 3510C for DRO in Water by California Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10894	Separatory Funnel Extraction for DRO and RRO by AK 102/103 in a Water Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10890	Separatory Funnel Extraction for EPH in Water or Wastewater by Montana Protocol	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10893	Separatory Funnel Extraction for EPH in Water or Wastewater by Tennessee Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10914	Separatory Funnel Extraction for EPH in Waters by Massachusetts, New Jersey, and Louisiana Protocol	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10892	Separatory Funnel Extraction for ETPH in Water or Wastewater Matrix by Connecticut Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10889	Separatory Funnel Extraction for TPH in Water or Wastewater by FL-PRO	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10908	Separatory Funnel Extraction Method ECY 97-602 NWTPH-DX for TPH in a Water or Wastewater Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10879	Silica Gel Fractionation by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10898	Sonic Probe Extraction by FL-PRO for Petroleum Range Organics in Solids	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10913	Sonic Probe Extraction for TPH in Solids by Washington DX	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10957	Sonic Probe Extraction of Glycols by Method 3550C from a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10897	Sonication Extraction Method 3550B and C for DRO (CA) in Solids	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10945	Sonication Extraction Method 3550C for DRO in Soils or Solids	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10937	Ultrasonic Extraction by Method 3550C for Fingerprint on Petroleum Products in Solid Matrices	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10902	Ultrasonic Extraction for EPH in a Solid Matrix by Tennessee Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10901	Ultrasonic Extraction for ETPH in Solid Matrix by Connecticut Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10905	Waste Dilution for the Determination of Saturated Hydrocarbons in an Oil Matrix	5_EUUSLA_Organic Extraction_Manager
8.11.04 General		
Work Instruction		
T-OE-GEN-WI14427	Associate Chemist	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11363	Chemist	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10808	Concentration Using a TurboVap LV Concentration Workstation	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11369	Determining QC Sample Volume for Organic Extractions	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11370	Director	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10862	Electrothermal Heating Mantles	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI7154	Food and Tissue Preparation	5_EUUSLA_Leachate Preparation_Manager
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10873	Glassware Cleaning Using Automatic Washers for non-Organic Extraction Glassware	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11376	Group Leader	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11377	Laboratory Assistant	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11378	Laboratory Technician	5_EUUSLA_Organic Extraction_Manager

T-OE-GEN-WI10877	Maintenance and Calibration of the Microwave Accelerated Reaction System	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10872	Maintenance of Accelerated Solvent Extractor (ASE) and the Pressurized Solvent Extractor (PSE)	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11379	Manager	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11400	Multipette Stream Operation and Calibration	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10863	N-Evap	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11408	Percentage Lipids Using Soxhlet Extraction by Method 3540C	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10871	Pesticide Extract Concentration Using a Zymark TurboVap II Concentration Workstation	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10866	pH Meters and Electrodes	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI13363	Pore Water Generation Procedure	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11415	Principle Chemist	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10867	Procedure for Containment and Clean Up of Hazardous materials Spills in Organic Prep Lab	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11418	Refrigerated Recirculators	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11420	Routine Maintenance of Miele Glass Washers	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11424	Sampling Equiment Cleaning and Validation for Metals Analysis	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10868	Scheduling Extraction Batches	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11427	Semivolatile Extract Concentration Using a Zymark TurboVap II Concentration Workstation	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11428	Senior Administrator	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11429	Senior Chemist	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11430	Senior Specialist	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11431	Senior Technician	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10865	Solvent, Reagent, and Amber GC Vial Lot Testing for Organic Extractions	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11440	Soxhlet Extraction Procedure for Extractable Matter in Textiles	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10869	Spike Solution Testing and Approval	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10861	Steam Bath and N-Evap Usage, Calibration and Maintenance	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10870	Ultrasonic Probe Horn Cleaning	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10860	Ultrasonic Processor Maintenance and Tuning	5_EUUSLA_Organic Extraction_Manager
8.12 PFAS by LC/MS/MS		
Work Instruction		
T-PFAS-WI7732	Associate Chemist	5_EUUSLA_PFAS_Manager
T-PFAS-WI20032	Associate Specialist	5_EUUSLA_PFAS_Manager
T-PFAS-WI7733	Chemist	5_EUUSLA_PFAS_Manager
T-PFAS-WI21864	Client Specific Table 3 PFAS in Water and Soil Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI20127	Client Specific: Table 3 Compounds by Direct Injection Using LC/MS/MS	5_EUUSLA_PFAS_Manager

T-PFAS-WI7745	Director	5_EUUSLA_Specialty Services_Manager
T-PFAS-WI18142	Extraction and Analysis of Perfluoroethercarboxylic Acids (PFECA) in Solid Samples by Method 537, Ver. 1.1, Modified	5_EUUSLA_PFAS_Manager
T-PFAS-WI7746	Group Leader	5_EUUSLA_PFAS_Manager
T-PFAS-WI7737	Laboratory Technician	5_EUUSLA_PFAS_Manager
T-PFAS-WI20005	Manager	5_EUUSLA_PFAS_Manager
T-PFAS-WI21568	Manifold Cleaning for PFAS Extractions	5_EUUSLA_PFAS_Manager
T-PFAS-WI21398	New Jersey - Polyfluorinated Alkyl Substances (PFAS) in Aqueous Samples by Method 537 Version 1.1 Modified Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI12017	Perfluorinated Alkyl Substances (PFASs) in Drinking Water by Method 537 Version 1.1	5_EUUSLA_PFAS_Manager
T-PFAS-WI18003	Perfluoroethercarboxylic Acids (PFECA) in Aqueous Samples	5_EUUSLA_PFAS_Manager
T-PFAS-WI21252	PFAS Data Review Procedure	5_EUUSLA_PFAS_Manager
T-PFAS-WI22030	Polyfluorinated Alkyl Substances (PFAS) in Aqueous Samples by Method 537 Version 1.1 Modified QSM5.1 Table B-15 Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI14355	Polyfluorinated Alkyl Substances (PFAS) in Aqueous Samples by Method 537 Version 1.1 Modified Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI22283	Polyfluorinated Alkyl Substances (PFAS) in Solids by Method 537 Version 1.1 Modified QSM 5.1 Table B-15 Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI12031	Polyfluorinated Alkyl Substances (PFAS) in Solids by Method 537 Version 1.1 Modified Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI23588	Preventative and Corrective Maintenance for the API 4000 and AB Sciex 4500 Liquid Chromatograph Mass Spectrometers (LC/MS/MS)	5_EUUSLA_PFAS_Manager
T-PFAS-WI7742	Principal Chemist	5_EUUSLA_PFAS_Manager
T-PFAS-WI7743	Principal Specialist	5_EUUSLA_PFAS_Manager
T-PFAS-WI7744	Senior Chemist	5_EUUSLA_PFAS_Manager
T-PFAS-WI20052	Senior Specialist	5_EUUSLA_PFAS_Manager
T-PFAS-WI20034	Specialist	5_EUUSLA_PFAS_Manager
T-PFAS-WI13881	Standards Management in the PFAS Laboratory	5_EUUSLA_PFAS_Manager
T-PFAS-WI18548	Total Oxidizable Precursors in Aqueous Samples by LC/MS/MS with Isotope Dilution	5_EUUSLA_PFAS_Manager
8.13 Specialty Services		
Work Instruction		
T-SSG-WI7750	Analysis of Fluorotelemer Alcohols in Water and Wastewater	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14557	Associate Chemist	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14572	Chemist	5_EUUSLA_Specialty Services_Manager
T-SSG-WI7753	Client Specific - 1,4-Dioxane by Head Space (HS) GC/MS in Cosmetics	5_EUUSLA_Specialty Services_Manager
T-SSG-WI9093	Client Specific - Analysis of Glycerol Monolaurate and Propylene Glycol Monolaurate in BioPolySan by Gas Chromatography Mass Spectroscopy (GC/MS)	5_EUUSLA_Specialty Services_Manager
T-SSG-WI12014	Client Specific - Analysis of Iodoacetamide in Aqueous Samples by LC/MS/MS	5_EUUSLA_Specialty Services_Manager
T-SSG-WI12002	Client Specific - Analysis of Piperonyl Butoxide (PBO) in Wastewater by GC/MS/MS	5_EUUSLA_Specialty Services_Manager
T-SSG-WI9160	Client Specific - Analysis of p-tert-Octylphenol (PTOP) in Water by LC/MS/MS	5_EUUSLA_Specialty Services_Manager
T-SSG-WI9419	Client Specific - Method for the Analysis of Dioxathion in Water and Solid Samples	5_EUUSLA_Specialty Services_Manager
T-SSG-WI9420	Client Specific - Trace Analysis of 16 Phthalates in Cosmetic Products by Gas Chromatography Selective Ion Monitoring Mass Spectroscopy (GC/SIM/MS) or Selective Reaction Monitoring (GC/SRM/MS) (Client Specific Method)	5_EUUSLA_Specialty Services_Manager
T-SSG-WI13642	Determination of Endothall in Aqueous Samples Using LC-MS by Method 8321B	5_EUUSLA_Specialty Services_Director
T-SSG-WI12005	Determination of Endothall in Solid Matrix Using LC-MS by Method 8231B	5_EUUSLA_Specialty Services_Manager
T-SSG-WI12008	Determination of Glycols in Waters by Direct Injection LC/MS/MS following SW-846 8321A Modified Method	5_EUUSLA_Specialty Services_Manager

T-SSG-WI9448	Determination of Hydrazine Monomethylhydrazine and 1,1-Dimethylhydrazine in Aqueous Samples by LC/MS/MS Using SW-846 8315A Modified	5_EUUSLA_Specialty Services_Manager
T-SSG-WI9431	Determination of Hydrazine, Monomethylhydrazine and 1,1-Dimethylhydrazine in Soil samples by LC/MS/MS	5_EUUSLA_Specialty Services_Manager
T-SSG-WI9553	Determination of N-Nitrosodimethylamine (NDMA) in Water and Soil by EPA 1625C	5_EUUSLA_Specialty Services_Manager
T-SSG-WI9451	Determination of Perchlorate in Milk and Milk Powder by LCMSMS	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14624	Director	5_EUUSLA_Specialty Services_Director
T-SSG-WI9483	Extraction of Waters for Fluorotelomer Alcohols by Method 3510C	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14626	Group Leader	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14575	Laboratory Technician	5_EUUSLA_Specialty Services_Manager
T-SSG-WI12019	Maintenance and Tuning for Thermo Scientific TSQ Quantum Access Tandem Mass Spectrometer with a Thermo Electron Accela HPLC System (LC/MS/MS)	5_EUUSLA_Specialty Services_Manager
T-SSG-WI20054	Manager	5_EUUSLA_Specialty Services_Director
T-SSG-WI9963	Micromass Quattro Micro Tandem Mass Spectrometer with a Waters 2795 HPLC System (LC/MS/MS)	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14578	Principal Chemist	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14614	Principal Specialist	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14620	Senior Chemist	5_EUUSLA_Specialty Services_Manager
T-SSG-WI7748	Thermo Scientific Trace 1310 Gas Chromatograph Tandem Mass Spectrometer (GC/MS/MS) Preventative and Corrective Maintenance	5_EUUSLA_Specialty Services_Manager
8.14 HRMS Group		
Work Instruction		
T-HRMS-WI14558	Associate Chemist	5_EUUSLA_HRMS_Manager
T-HRMS-WI14574	Chemist	5_EUUSLA_HRMS_Manager
T-HRMS-WI20818	Determination of % Moisture by Freeze Drying using ASTM D3974	5_EUUSLA_HRMS_Manager
T-HRMS-WI12003	Determination of Dioxin-like Polychlorinated Biphenyls by HRGC/HRMS in Aqueous and Solid Matrices by Methods 1613B and 1668C	5_EUUSLA_Specialty Services_Manager
T-HRMS-WI9452	Determination of PCB Homologs in Waters and Solids by Method 680	5_EUUSLA_HRMS_Manager
T-HRMS-WI12013	Determination of Percentage Lipids in Animal and Marine Tissue using EPA Method 1613B	5_EUUSLA_Specialty Services_Manager
T-HRMS-WI21311	Determination of Tetra- Through Octa- Chlorinated Dioxins and Furans in water and solid samples using HRGC/HRMS	5_EUUSLA_HRMS_Manager
T-HRMS-WI9476	Determination of Tetra- Through Octa- Chlorinated Dioxins and Furans in water/solid/food/feed samples using HRGC/HRMS by EPA 1613B or SW-846 Method 8290A	5_EUUSLA_HRMS_Manager
T-HRMS-WI19229	DFS HRGC/HRMS Preventative and Corrective Maintenance	5_EUUSLA_Specialty Services_Manager
T-HRMS-WI14625	Director	5_EUUSLA_HRMS_Director
T-HRMS-WI9480	Extraction of Water and Soil Samples by Method 680	5_EUUSLA_Specialty Services_Manager
T-HRMS-WI9485	Glassware Cleaning for HRMS Extractions	5_EUUSLA_HRMS_Manager
T-HRMS-WI14627	Group Leader	5_EUUSLA_HRMS_Manager
T-HRMS-WI14577	Laboratory Technician	5_EUUSLA_HRMS_Manager
T-HRMS-WI20068	Manager	5_EUUSLA_HRMS_Director
T-HRMS-WI21285	PCB Congeners by HRGC/HRMS in Aqueous and Solid Matrices	5_EUUSLA_HRMS_Manager
T-HRMS-WI9432	PCB Congeners by Method 1668 HRGC/HRMS in Aqueous and Solid Matrices	5_EUUSLA_HRMS_Manager
T-HRMS-WI9487	Preparation of Aqueous and Solid Samples for Food and Feed Analysis by HRMS	5_EUUSLA_Specialty Services_Manager
T-HRMS-WI9489	Preparation of Oils and Oleoresins for Food and Feed Analysis by HRMS	5_EUUSLA_Specialty Services_Manager
T-HRMS-WI14579	Principal Chemist	5_EUUSLA_HRMS_Manager
T-HRMS-WI14616	Principal Specialist	5_EUUSLA_HRMS_Manager

T-HRMS-WI9433	Processing High Resolution Mass Spectrometry Data Using TargetQuan	5_EUUSLA_Specialty Services_Manager
T-HRMS-WI14623	Senior Chemist	5_EUUSLA_HRMS_Manager
T-HRMS-WI21528	Separatory Funnel Extraction Procedure for HRMS Analysis in an Aqueous Matrix	5_EUUSLA_HRMS_Manager
T-HRMS-WI12032	Separatory Funnel Extraction Procedure for HRMS Analysis in an Aqueous Matrix Using Method 1613B, 8290A, 1668A, and 1668C	5_EUUSLA_Specialty Services_Manager
T-HRMS-WI21536	Soxhlet Extraction Procedure for HRMS Analysis in a Solid matrix	5_EUUSLA_HRMS_Manager
T-HRMS-WI9488	Soxhlet Extraction Procedure for HRMS Analysis in a Solid Matrix by Methods: 1613B, 8290A, 1668C, and 1668A	5_EUUSLA_HRMS_Manager
T-HRMS-WI9446	Standards Management in the High Resolution Mass Spectrometry Laboratory	5_EUUSLA_HRMS_Manager

Instrument	# of Units	Detector Type/Manufacturer
Liquid Chromatography/Gas Chromatography/Mass Spectrometry (LC/GC/MS)		
LC/MS/MS	6	AB Sciex 4000 with Exion LC
LC/MS/MS	1	Agilent
LC/MS/MS	2	Agilent LC with Micromass Quattro micro MS/MS and Waters 2996 Photodiode Array UV-Vis Detector
LC/MS/MS	1	Thermo Scientific TSQ Quantum Access with Acella LC
GC/MS	30	Agilent
GC/MS	1	Shimadzu
GC/MS	1	DSQ II MS
GC/MS/MS	1	Thermo TSQ 8000 MSMS
HRGC/HRMS	5	Thermo Scientific DFS
Gas Chromatograph	3	Flame Ionization / Photoionization
Gas Chromatograph	2	Thermal Conductivity
Gas Chromatograph	17	Electron Capture
Gas Chromatograph	2	Nitrogen/Phosphorus
Gas Chromatograph	14	Flame Ionization
Auxiliary Equipment for Gas Chromatographs		
Most of the GC/MS and GC systems include autosamplers and approximately half are fitted with purge and trap concentrators for analysis of volatiles.		

High Performance Liquid Chromatography		
High Performance Liquid Chromatograph	2	Agilent 1100 LC
High Performance Liquid Chromatograph	2	Agilent 1200 HPLC
High Performance Liquid Chromatograph	1	Waters alliance 2695
High Performance Liquid Chromatograph	1	Waters alliance 2795

Gel Permeation Chromatography		
Gel Permeation Chromatograph	3	J2Scientific AccuPrep

Ion Chromatography		
Ion Chromatograph	1	Metrohm 881 IC Pro
Ion Chromatograph	1	Dionex ICS1000
Ion Chromatograph	1	Dionex ICS3000
Ion Chromatograph	1	Dionex ICS2000
Ion Chromatograph	4	Dionex ICS1100
Ion Chromatograph (Specialty Services)	1	Dionex ICS5000 with UltimMate 3000 Aux Pump

Atomic Absorption/Emission Spectrophotometry		
ICP	1	Thermo ICAP™ 7400 Duo ICP Analyzer
ICP	5	Thermo ICAP™ 6500 Duo ICP Analyzer
ICP/MS	1	Agilent 7500ce
ICP/MS	1	Agilent 7700cx
ICP/MS	1	Agilent 7700x
ICP/MS	1	Agilent 7900
Mercury Analyzer	3	Leeman Labs Hydra II
Prep Station	3	Thomas Cain DEENA 60

UV Vis/IR Spectrophotometry:		
UV-Vis Spectrophotometer	3	Thermo Genesys 30
UV-Vis Spectrophotomenter	1	Hach DR2800

Miscellaneous Chemistry Instrumentation		
Auto-titrator System	2	Mantech
Automated COD Analyzer	1	Skalar
Turbidimeter	1	Hach 2100AN
Block Digestion Systems	8	Environmental Express SC150
Block Digestion Systems	6	Environmental Express SC154
Centrifuge	5	Various
Chilled water recirculators		Various
Closed Cup Flashpoint Apparatus, Pensky-Martin	1	Fisher Scientific TA6
Automated SPE HEM Extractor	2	Horizon SPE-DEX 3100
Automated SPE HEM Extractor	2	Environmental Exprerss SPE-Express
Cyanide Midi Distillation Kits	3	Various
Automated BOD Analyzer	3	Mantech
Dissolved Oxygen Meter	6	YSI
Flow Solution Autoanalyzer	1	Astoria Pacific 302
Flow Solution Autoanalyzer	2	OI FS3700
Flow Solution Autoanalyzer	1	OI FS3100
Flow Solution Autoanalyzer	1	Skalar San++
Discrete Autoanalyzer	1	Thermo Gallery Plus
Glassware washer - automated	6	Miele – (2) PG8257 (1) G7827 (1) G7704 (2) G7883
Kjehldal Distillation Apparatus	2	Fisher
Microwave Extractors	3	CEM MarsXpress
pH meters	13	Various
Phenol Midi Distillation	2	Andrews Glass
Pressurized Solvent Extractor	2	Dionex ASE200
Puck Mill	1	ESSA/2000
Sonicators	12	Various
Total Organic Carbon Analyzer	4	O.I. Corp. 1030
Total Organic Carbon Automated Combustion Analyzer	1	Skalar Primacs ATC-100
Turbidimeter	1	Hach 2100AN
Zero Headspace Extractor	74	Various Models

Microbiology Equipment		
Autoclave	2	Steris – Amsco,
Balance	5	Mettler, PB 3002
Balance	1	Mettler-Toledo, AT200
Balance	2	Mettler-Toledo, PR2002
Balance	1	Sartorius BP4100
Biological Safety Cabinet	4	NuAire NU-425-600 Type A/B 3
Biological Safety Cabinet	1	NuAire NU-435-600 Type B2 Fume Hood
Colony Counter	1	Quebec Dark Field
Incubator	1	PGC 9311-1127
Incubator	1	PS WFY20SAWI
Microscope	1	Stereoscope with Zoom, AO Model 570
Microscope	1	Zeiss
pH Meter	2	Orion Model 410A
Quanti-Tray Sealer	1	IDEXX Model 2X
Water Bath	1	Boekel Grant with Removal Heater Circulator
Water Bath	1	Thermo Electron Corp.
Water Bath	1	Precision Coliform Incubator Bath
Water Bath	1	VWR 1275PC
Water Bath	2	Thermo Scientific Model 2862
UV Light	1	Spectronics

Computer Equipment

Our laboratories make extensive use of computers for business applications, technical operations (e.g., our sample management system), and QA Program (see section on Quality Assurance). Numerous physical and virtual servers are used to support the systems. Internet access is provided with an ASA firewall to control incoming and outgoing traffic. The laboratory uses 3 phase power supply and backup generators for life safety and sample integrity preservation.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2020
Issued April 01, 2019

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. DUANE LUCKENBILL
EUROFINS LANCASTER LABORATORIES
ENVIRONMENTAL LLC
2425 NEW HOLLAND PIKE
LANCASTER, PA 17601-5994

NY Lab Id No: 10670

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES AIR AND EMISSIONS
All approved analytes are listed below:

Acrylates	
Acetonitrile	EPA TO-15
Acrylonitrile	EPA TO-15
Ethyl acrylate	EPA TO-15
Methyl methacrylate	EPA TO-15
Chlorinated Hydrocarbons	
1,2,4-Trichlorobenzene	EPA TO-14A
	EPA TO-15
Hexachlorobutadiene	EPA TO-14A
	EPA TO-15
Hexachloroethane	EPA TO-15
Polynuclear Aromatics	
Naphthalene	EPA TO-15
Purgeable Aromatics	
1,2,4-Trimethylbenzene	EPA TO-14A
	EPA TO-15
1,2-Dichlorobenzene	EPA TO-14A
	EPA TO-15
1,3,5-Trimethylbenzene	EPA TO-14A
	EPA TO-15
1,3-Dichlorobenzene	EPA TO-14A
	EPA TO-15
1,4-Dichlorobenzene	EPA TO-14A
	EPA TO-15
2-Chlorotoluene	EPA TO-15

Purgeable Aromatics	
Benzene	EPA TO-14A
	EPA TO-15
Chlorobenzene	EPA TO-14A
	EPA TO-15
Ethyl benzene	EPA TO-14A
	EPA TO-15
Isopropylbenzene	EPA TO-15
m/p-Xylenes	EPA TO-15
o-Xylene	EPA TO-15
Styrene	EPA TO-14A
	EPA TO-15
Toluene	EPA TO-14A
	EPA TO-15
Total Xylenes	EPA TO-14A
	EPA TO-15
Purgeable Halocarbons	
1,1,1-Trichloroethane	EPA TO-14A
	EPA TO-15
1,1,2,2-Tetrachloroethane	EPA TO-14A
	EPA TO-15
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA TO-14A
	EPA TO-15
1,1,2-Trichloroethane	EPA TO-14A
	EPA TO-15
1,1-Dichloroethane	EPA TO-14A

Serial No.: 59378

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Purgeable Halocarbons	
1,1-Dichloroethane	EPA TO-15
1,1-Dichloroethene	EPA TO-14A
	EPA TO-15
1,2-Dibromo-3-chloropropane	EPA TO-15
1,2-Dibromoethane	EPA TO-14A
	EPA TO-15
1,2-Dichloroethane	EPA TO-14A
	EPA TO-15
1,2-Dichloropropane	EPA TO-14A
	EPA TO-15
3-Chloropropene (Allyl chloride)	EPA TO-15
Bromodichloromethane	EPA TO-14A
	EPA TO-15
Bromoform	EPA TO-15
Bromomethane	EPA TO-14A
	EPA TO-15
Carbon tetrachloride	EPA TO-14A
	EPA TO-15
Chloroethane	EPA TO-14A
	EPA TO-15
Chloroform	EPA TO-14A
	EPA TO-15
Chloromethane	EPA TO-14A
	EPA TO-15
cis-1,2-Dichloroethene	EPA TO-14A
	EPA TO-15

Purgeable Halocarbons	
cis-1,3-Dichloropropene	EPA TO-14A
	EPA TO-15
Dibromochloromethane	EPA TO-15
Dichlorodifluoromethane	EPA TO-14A
	EPA TO-15
Methylene chloride	EPA TO-14A
	EPA TO-15
Tetrachloroethene	EPA TO-14A
	EPA TO-15
trans-1,2-Dichloroethene	EPA TO-14A
	EPA TO-15
trans-1,3-Dichloropropene	EPA TO-14A
	EPA TO-15
Trichloroethene	EPA TO-14A
	EPA TO-15
Trichlorofluoromethane	EPA TO-14A
	EPA TO-15
Vinyl bromide	EPA TO-15
Vinyl chloride	EPA TO-14A
	EPA TO-15
Volatile Chlorinated Organics	
Benzyl chloride	EPA TO-14A
	EPA TO-15
Volatile Organics	
1,2-Dichlorotetrafluoroethane	EPA TO-14A

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All approved analytes are listed below:

Volatile Organics

1,2-Dichlorotetrafluoroethane	EPA TO-15
1,3-Butadiene	EPA TO-15
1,4-Dioxane	EPA TO-15
2,2,4-Trimethylpentane	EPA TO-15
2-Butanone (Methylethyl ketone)	EPA TO-15
4-Methyl-2-Pentanone	EPA TO-15
Acetone	EPA TO-15
Acrolein (Propenal)	EPA TO-15
Carbon Disulfide	EPA TO-15
Cyclohexane	EPA TO-15
Hexane	EPA TO-15
Isopropanol	EPA TO-15
Methyl iodide	EPA TO-15
Methyl tert-butyl ether	EPA TO-15
n-Heptane	EPA TO-15
tert-butyl alcohol	EPA TO-15
Vinyl acetate	EPA TO-15

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All approved analytes are listed below:

Dissolved Gases	
Acetylene	RSK-175
Ethane	RSK-175
Ethene (Ethylene)	RSK-175
Methane	RSK-175
Fuel Additives	
Methyl tert-butyl ether	EPA 524.2
Naphthalene	EPA 524.2
Metals I	
Arsenic, Total	EPA 200.8 Rev. 5.4
Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Cadmium, Total	EPA 200.8 Rev. 5.4
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Iron, Total	EPA 200.7 Rev. 4.4
Lead, Total	EPA 200.8 Rev. 5.4
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Mercury, Total	EPA 245.1 Rev. 3.0
Selenium, Total	EPA 200.8 Rev. 5.4
Silver, Total	EPA 200.7 Rev. 4.4
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Metals II	
Aluminum, Total	EPA 200.8 Rev. 5.4
Antimony, Total	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.8 Rev. 5.4
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Thallium, Total	EPA 200.8 Rev. 5.4
Vanadium, Total	EPA 200.7 Rev. 4.4
Metals III	
Calcium, Total	EPA 200.7 Rev. 4.4
Magnesium, Total	EPA 200.7 Rev. 4.4
Potassium, Total	EPA 200.7 Rev. 4.4
Sodium, Total	EPA 200.7 Rev. 4.4
Methylcarbamate Pesticides	
3-Hydroxy Carbofuran	EPA 531.1
Aldicarb	EPA 531.1
Aldicarb Sulfone	EPA 531.1
Aldicarb Sulfoxide	EPA 531.1
Carbaryl	EPA 531.1
Carbofuran	EPA 531.1
Methomyl	EPA 531.1
Oxamyl	EPA 531.1
Miscellaneous	
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 1613B
Methyl iodide	EPA 524.2

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All approved analytes are listed below:

Miscellaneous	
Organic Carbon, Total	SM 21-23 5310C (-00)
Surfactant (MBAS)	SM 21-23 5540C (-00)
Turbidity	SM 21-23 2130 B (-01)
	EPA 180.1 Rev. 2.0
Non-Metals	
Alkalinity	SM 21-23 2320B (-97)
Calcium Hardness	SM 18-22 2340C (-97)
	SM 18-22 2340B (-97)
Chloride	EPA 300.0 Rev. 2.1
Color	SM 21-23 2120B (-01)
Cyanide	EPA 335.4 Rev. 1.0
Fluoride, Total	EPA 300.0 Rev. 2.1
	SM 21-23 4500-F C (-97)
Nitrate (as N)	EPA 353.2 Rev. 2.0
	EPA 300.0 Rev. 2.1
Nitrite (as N)	EPA 353.2 Rev. 2.0
	EPA 300.0 Rev. 2.1
Orthophosphate (as P)	SM 19, 21-23 4500-P E (-99)
Silica, Dissolved	SM 21-23 4500-SiO2 C (-97)
Solids, Total Dissolved	SM 21-23 2540C (-97)
Specific Conductance	SM 21-23 2510B (-97)
Sulfate (as SO4)	EPA 300.0 Rev. 2.1
Perfluorinated Alkyl Acids	
Perfluorooctanesulfonic acid (PFOS)	EPA 537
	EPA 537.1
Perfluorinated Alkyl Acids	
Perfluorooctanoic acid (PFOA)	EPA 537
	EPA 537.1
Trihalomethanes	
Bromodichloromethane	EPA 524.2
Bromoform	EPA 524.2
Chloroform	EPA 524.2
Dibromochloromethane	EPA 524.2
Total Trihalomethanes	EPA 524.2
Volatile Aromatics	
1,2,3-Trichlorobenzene	EPA 524.2
1,2,4-Trichlorobenzene	EPA 524.2
1,2,4-Trimethylbenzene	EPA 524.2
1,2-Dichlorobenzene	EPA 524.2
1,3,5-Trimethylbenzene	EPA 524.2
1,3-Dichlorobenzene	EPA 524.2
1,4-Dichlorobenzene	EPA 524.2
2-Chlorotoluene	EPA 524.2
4-Chlorotoluene	EPA 524.2
Benzene	EPA 524.2
Bromobenzene	EPA 524.2
Chlorobenzene	EPA 524.2
Ethyl benzene	EPA 524.2
Hexachlorobutadiene	EPA 524.2
Isopropylbenzene	EPA 524.2
n-Butylbenzene	EPA 524.2

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All approved analytes are listed below:

Volatile Aromatics

n-Propylbenzene	EPA 524.2
p-Isopropyltoluene (P-Cymene)	EPA 524.2
sec-Butylbenzene	EPA 524.2
Styrene	EPA 524.2
tert-Butylbenzene	EPA 524.2
Toluene	EPA 524.2
Total Xylenes	EPA 524.2

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 524.2
1,1,1-Trichloroethane	EPA 524.2
1,1,2,2-Tetrachloroethane	EPA 524.2
1,1,2-Trichloroethane	EPA 524.2
1,1-Dichloroethane	EPA 524.2
1,1-Dichloroethene	EPA 524.2
1,1-Dichloropropene	EPA 524.2
1,2,3-Trichloropropane	EPA 524.2
1,2-Dichloroethane	EPA 524.2
1,2-Dichloropropane	EPA 524.2
1,3-Dichloropropane	EPA 524.2
2,2-Dichloropropane	EPA 524.2
Bromochloromethane	EPA 524.2
Bromomethane	EPA 524.2
Carbon tetrachloride	EPA 524.2
Chloroethane	EPA 524.2
Chloromethane	EPA 524.2

Volatile Halocarbons

cis-1,2-Dichloroethene	EPA 524.2
cis-1,3-Dichloropropene	EPA 524.2
Dibromomethane	EPA 524.2
Dichlorodifluoromethane	EPA 524.2
Methylene chloride	EPA 524.2
Tetrachloroethene	EPA 524.2
trans-1,2-Dichloroethene	EPA 524.2
trans-1,3-Dichloropropene	EPA 524.2
Trichloroethene	EPA 524.2
Trichlorofluoromethane	EPA 524.2
Vinyl chloride	EPA 524.2

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All approved analytes are listed below:

Acrylates	
Acrolein (Propenal)	EPA 8260C
	EPA 624.1
Acrylonitrile	EPA 8260C
	EPA 624.1
Ethyl methacrylate	EPA 8260C
Methyl acrylonitrile	EPA 8260C
Methyl methacrylate	EPA 8260C
Amines	
1,2-Diphenylhydrazine	EPA 625.1
	EPA 8270D
1,4-Phenylenediamine	EPA 8270D
1-Naphthylamine	EPA 8270D
2,3-Dichloroaniline	EPA 625.1
2-Naphthylamine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4,4'-Methylenebis(2-chloroaniline)	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
5-Nitro-o-toluidine	EPA 8270D
a,a-Dimethylphenethylamine	EPA 8270D
Aniline	EPA 625.1
	EPA 8270D
Carbazole	EPA 625.1
	EPA 8270D

Amines	
Diphenylamine	EPA 8270D
Methapyrilene	EPA 8270D
Pronamide	EPA 8270D
Propionitrile	EPA 8260C
Pyridine	EPA 625.1
	EPA 8270D
Benzidines	
3,3'-Dichlorobenzidine	EPA 625.1
	EPA 8270D
3,3'-Dimethylbenzidine	EPA 8270D
Benzidine	EPA 625.1
	EPA 8270D
Chlorinated Hydrocarbon Pesticides	
4,4'-DDD	EPA 8081B
	EPA 608.3
4,4'-DDE	EPA 8081B
	EPA 608.3
4,4'-DDT	EPA 8081B
	EPA 608.3
Aldrin	EPA 8081B
	EPA 608.3
alpha-BHC	EPA 8081B
	EPA 608.3
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 8081B

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Chlorinated Hydrocarbon Pesticides

beta-BHC	EPA 608.3
Chlordane Total	EPA 8081B
	EPA 608.3
Chlorobenzilate	EPA 8270D
delta-BHC	EPA 8081B
	EPA 608.3
Diallate	EPA 8270D
Dieldrin	EPA 8081B
	EPA 608.3
Endosulfan I	EPA 8081B
	EPA 608.3
Endosulfan II	EPA 8081B
	EPA 608.3
Endosulfan sulfate	EPA 8081B
	EPA 608.3
Endrin	EPA 8081B
	EPA 608.3
Endrin aldehyde	EPA 8081B
	EPA 608.3
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
	EPA 608.3
Heptachlor epoxide	EPA 8081B
	EPA 608.3
Isodrin	EPA 8270D

Chlorinated Hydrocarbon Pesticides

Kepone	EPA 8081B
	EPA 8270D
Lindane	EPA 8081B
	EPA 608.3
Methoxychlor	EPA 8081B
	EPA 608.3
Mirex	EPA 8081B
	EPA 608.3
PCNB	EPA 8270D
Toxaphene	EPA 8081B
	EPA 608.3

Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 625.1
	EPA 8270D
1-Chloronaphthalene	EPA 8270D
2-Chloronaphthalene	EPA 625.1
	EPA 8270D
Hexachlorobenzene	EPA 625.1
	EPA 8270D
Hexachlorobutadiene	EPA 625.1
	EPA 8270D
Hexachlorocyclopentadiene	EPA 625.1
	EPA 8270D

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Chlorinated Hydrocarbons	
Hexachloroethane	EPA 8260C
	EPA 625.1
	EPA 8270D
Hexachloropropene	EPA 8270D
Pentachlorobenzene	EPA 8270D
Chlorophenoxy Acid Pesticides	
2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
2,4-DB	EPA 8151A
Dalapon	EPA 8151A
Dicamba	EPA 8151A
Dichloroprop	EPA 8151A
Dinoseb	EPA 8151A
	EPA 8270D
Pentachlorophenol	EPA 8151A
Demand	
Biochemical Oxygen Demand	SM 5210B-2011
Carbonaceous BOD	SM 5210B-2011
Chemical Oxygen Demand	EPA 410.4, Rev. 2.0 (1993)
Dioxins and Furans	
1,2,3,4,6,7,8,9-Octachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-diox	EPA 8290A

Dioxins and Furans	
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-diox	EPA 1613B
1,2,3,4,6,7,8-Heptachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxi	EPA 8290A
	EPA 1613B
1,2,3,4,7,8,9-Heptachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,4,7,8-Hexachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	EPA 8290A
	EPA 1613B
1,2,3,6,7,8-Hexachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	EPA 8290A
	EPA 1613B
1,2,3,7,8,9-Hexachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	EPA 8290A
	EPA 1613B
1,2,3,7,8-Pentachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	EPA 8290A
	EPA 1613B
2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290A
	EPA 1613B
2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290A

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CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. DUANE LUCKENBILL
EUROFINS LANCASTER LABORATORIES
ENVIRONMENTAL LLC
2425 NEW HOLLAND PIKE
LANCASTER, PA 17601-5994

NY Lab Id No: 10670

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Dioxins and Furans	
2,3,4,7,8-Pentachlorodibenzofuran	EPA 1613B
2,3,7,8-Tetrachlorodibenzofuran	EPA 8290A
	EPA 1613B
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 8290A
	EPA 1613B
Dissolved Gases	
Acetylene	RSK-175
Ethane	RSK-175
Ethene (Ethylene)	RSK-175
Methane	RSK-175
Propane	RSK-175
Fuel Oxygenates	
Di-isopropyl ether	EPA 8260C
Ethanol	EPA 1671
	EPA 8260C
	EPA 8015D
	EPA 8015C
Methyl tert-butyl ether	EPA 8260C
	EPA 624.1
tert-amyl alcohol	EPA 8260C
tert-amyl methyl ether (TAME)	EPA 8260C
tert-butyl alcohol	EPA 1666
	EPA 8260C
	EPA 624.1
tert-butyl ethyl ether (ETBE)	EPA 8260C
Haloethers	
2,2'-Oxybis(1-chloropropane)	EPA 625.1
	EPA 8270D
4-Bromophenylphenyl ether	EPA 625.1
	EPA 8270D
4-Chlorophenylphenyl ether	EPA 625.1
	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 625.1
	EPA 8270D
Bis(2-chloroethyl)ether	EPA 625.1
	EPA 8270D
Low Level Halocarbons	
1,2-Dibromo-3-chloropropane, Low Level	EPA 8011
1,2-Dibromoethane, Low Level	EPA 8011
Low Level Polynuclear Aromatics	
Acenaphthene Low Level	EPA 8270D SIM
Acenaphthylene Low Level	EPA 8270D SIM
Anthracene Low Level	EPA 8270D SIM
Benzo(a)anthracene Low Level	EPA 8270D SIM
Benzo(a)pyrene Low Level	EPA 8270D SIM
Benzo(b)fluoranthene Low Level	EPA 8270D SIM
Benzo(g,h,i)perylene Low Level	EPA 8270D SIM
Benzo(k)fluoranthene Low Level	EPA 8270D SIM
Chrysene Low Level	EPA 8270D SIM
Dibenzo(a,h)anthracene Low Level	EPA 8270D SIM
Fluoranthene Low Level	EPA 8270D SIM

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

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MR. DUANE LUCKENBILL
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LANCASTER, PA 17601-5994

NY Lab Id No: 10670

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All approved analytes are listed below:

Low Level Polynuclear Aromatics	
Fluorene Low Level	EPA 8270D SIM
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270D SIM
Naphthalene Low Level	EPA 8270D SIM
Phenanthrene Low Level	EPA 8270D SIM
Pyrene Low Level	EPA 8270D SIM
Metals I	
Barium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Cadmium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Calcium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Chromium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Copper, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
Metals I	
Copper, Total	EPA 200.8, Rev. 5.4 (1994)
Iron, Total	SM 3500-Fe B-2011
	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Lead, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Magnesium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Manganese, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Nickel, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Potassium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)

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Metals I	
Silver, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
Sodium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Strontium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Metals II	
Aluminum, Total	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Antimony, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Arsenic, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Beryllium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Metals II	
Chromium VI	EPA 218.6, Rev. 3.3 (1994)
	EPA 7196A
	EPA 7199
	SM 3500-Cr B-2011
Mercury, Total	EPA 245.1, Rev. 3.0 (1994)
	EPA 7470A
Selenium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Vanadium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Zinc, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Metals III	
Cobalt, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Molybdenum, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D

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Metals III

Molybdenum, Total	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Thallium, Total	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Tin, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Titanium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
Uranium (Mass)	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)

Mineral

Acidity	SM 2310B-2011
Alkalinity	SM 2320B-2011
Chloride	EPA 300.0, Rev. 2.1 (1993)
	SM 4500-Cl- C-2011
	EPA 9056A
Fluoride, Total	EPA 300.0, Rev. 2.1 (1993)
	SM 4500-F- C-2011
	EPA 9056A
Hardness, Total	SM 2340C-2011
	SM 2340B-2011
Sulfate (as SO4)	EPA 300.0, Rev. 2.1 (1993)
	EPA 9056A

Miscellaneous

Boron, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
Bromide	EPA 300.0, Rev. 2.1 (1993)
	EPA 9056A
Color	SM 2120B-2011
Cyanide, Available	OIA-1677-09
	SM 4500-CN G-2011
Cyanide, Free	OIA-1677-09
Cyanide, Total	EPA 335.4, Rev. 1.0 (1993)
	EPA 9012B
	ASTM D7511-12
Formaldehyde	EPA 8315A
non-Polar Extractable Material (TPH)	EPA 1664A
Oil and Grease Total Recoverable (HEM)	EPA 1664A
	EPA 1664B
Organic Carbon, Total	SM 5310C-2011
	EPA 9060A
Perchlorate	EPA 6850
Phenols	EPA 420.4, Rev. 1.0 (1993)
	EPA 9066
Silica, Dissolved	SM 4500-SiO2 C-2011
Specific Conductance	SM 2510B-2011
	EPA 9050A
Sulfide (as S)	SM 4500-S2- F-2011
	SM 4500-S2- D-2011
Surfactant (MBAS)	SM 5540C-2011

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Miscellaneous	
Turbidity	EPA 180.1, Rev. 2.0 (1993)
Nitroaromatics and Isophorone	
1,3,5-Trinitrobenzene	EPA 8270D
	EPA 8330B
1,3-Dinitrobenzene	EPA 8270D
	EPA 8330B
1,4-Naphthoquinone	EPA 8270D
2,4,6-Trinitrotoluene	EPA 8330B
2,4-Dinitrotoluene	EPA 625.1
	EPA 8270D
	EPA 8330B
2,6-Dinitrotoluene	EPA 625.1
	EPA 8270D
	EPA 8330B
2-Amino-4,6-dinitrotoluene	EPA 8330B
2-Nitrotoluene	EPA 8330B
3,5-Dinitroaniline	EPA 8330B
3-Nitrotoluene	EPA 8330B
4-Amino-2,6-dinitrotoluene	EPA 8330B
4-Nitroquinoline-1-oxide	EPA 8270D
4-Nitrotoluene	EPA 8330B
Hexahydro-1,3,5-trinitro-1,3,5-triazine	EPA 8330B
Isophorone	EPA 625.1
	EPA 8270D
Methyl-2,4,6-trinitrophenylnitramine	EPA 8330B

Nitroaromatics and Isophorone	
Nitrobenzene	EPA 625.1
	EPA 8270D
	EPA 8330B
Nitroglycerine	EPA 8330B
Octahydro-tetranitro-tetrazocine	EPA 8330B
Pentaerythritol tetranitrate	EPA 8330B
Nitrosoamines	
N-Nitrosodiethylamine	EPA 8270D
N-Nitrosodimethylamine	EPA 625.1
	EPA 8270D
N-Nitrosodi-n-butylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 625.1
	EPA 8270D
N-Nitrosodiphenylamine	EPA 625.1
	EPA 8270D
N-nitrosomethylethylamine	EPA 8270D
N-nitrosomorpholine	EPA 8270D
N-nitrosopiperidine	EPA 8270D
N-Nitrosopyrrolidine	EPA 8270D
Nutrient	
Ammonia (as N)	SM 4500-NH3 C-2011
	EPA 350.1, Rev. 2.0 (1993)
	SM 4500-NH3 D-2011 or E-2011
Kjeldahl Nitrogen, Total	EPA 351.2, Rev. 2.0 (1993)
Nitrate (as N)	EPA 353.2, Rev. 2.0 (1993)

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Nutrient	
Nitrate (as N)	EPA 300.0, Rev. 2.1 (1993)
	EPA 9056A
Nitrate-Nitrite (as N)	EPA 353.2, Rev. 2.0 (1993)
Nitrite (as N)	EPA 353.2, Rev. 2.0 (1993)
	EPA 300.0, Rev. 2.1 (1993)
	EPA 9056A
Orthophosphate (as P)	EPA 365.3 (Issued 1978)
	SM 4500-P E-2011
Phosphorus, Total	EPA 365.1, Rev. 2.0 (1993)
	SM 4500-P (F-H)-2011
Organophosphate Pesticides	
Atrazine	EPA 8141B
	EPA 8270D
Azinphos methyl	EPA 8141B
Chlorpyriphos	EPA 8141B
Demeton-O	EPA 8141B
Demeton-S	EPA 8141B
Diazinon	EPA 8141B
Dimethoate	EPA 8270D
Disulfoton	EPA 8141B
	EPA 8270D
Famphur	EPA 8141B
	EPA 8270D
Malathion	EPA 8141B
Parathion ethyl	EPA 8141B
Organophosphate Pesticides	
Parathion ethyl	EPA 8270D
Parathion methyl	EPA 8141B
	EPA 8270D
Phorate	EPA 8141B
	EPA 8270D
Simazine	EPA 8141B
Sulfotepp	EPA 8270D
Thionazin	EPA 8270D
Petroleum Hydrocarbons	
Diesel Range Organics	EPA 8015D
	EPA 8015C
Gasoline Range Organics	EPA 8015D
	EPA 8015C
Phthalate Esters	
Benzyl butyl phthalate	EPA 625.1
	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 625.1
	EPA 8270D
Diethyl phthalate	EPA 625.1
	EPA 8270D
Dimethyl phthalate	EPA 625.1
	EPA 8270D
Di-n-butyl phthalate	EPA 625.1
	EPA 8270D
Di-n-octyl phthalate	EPA 625.1

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Phthalate Esters	
Di-n-octyl phthalate	EPA 8270D
Polychlorinated Biphenyls	
Aroclor 1016 (PCB-1016)	EPA 8082A
	EPA 608.3
Aroclor 1221 (PCB-1221)	EPA 8082A
	EPA 608.3
Aroclor 1232 (PCB-1232)	EPA 8082A
	EPA 608.3
Aroclor 1242 (PCB-1242)	EPA 8082A
	EPA 608.3
Aroclor 1248 (PCB-1248)	EPA 8082A
	EPA 608.3
Aroclor 1254 (PCB-1254)	EPA 8082A
	EPA 608.3
Aroclor 1260 (PCB-1260)	EPA 8082A
	EPA 608.3
Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A
PCB 1	EPA 1668A
	EPA 1668C
PCB 10	EPA 1668A
	EPA 1668C
PCB 100	EPA 1668A
	EPA 1668C
PCB 101	EPA 1668A

Polychlorinated Biphenyls	
PCB 101	EPA 1668C
PCB 102	EPA 1668A
	EPA 1668C
PCB 103	EPA 1668A
	EPA 1668C
PCB 104	EPA 1668A
	EPA 1668C
PCB 105	EPA 1668A
	EPA 1668C
PCB 106	EPA 1668A
	EPA 1668C
PCB 107	EPA 1668A
	EPA 1668C
PCB 108	EPA 1668A
	EPA 1668C
PCB 109	EPA 1668A
	EPA 1668C
PCB 11	EPA 1668A
	EPA 1668C
PCB 110	EPA 1668A
	EPA 1668C
PCB 111	EPA 1668A
	EPA 1668C
PCB 112	EPA 1668A
	EPA 1668C
PCB 113	EPA 1668A

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Polychlorinated Biphenyls		Polychlorinated Biphenyls	
PCB 113	EPA 1668C	PCB 125	EPA 1668C
PCB 114	EPA 1668A	PCB 126	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 115	EPA 1668A	PCB 127	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 116	EPA 1668A	PCB 128	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 117	EPA 1668A	PCB 129	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 118	EPA 1668A	PCB 13	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 119	EPA 1668A	PCB 130	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 12	EPA 1668A	PCB 131	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 120	EPA 1668A	PCB 132	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 121	EPA 1668A	PCB 133	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 122	EPA 1668A	PCB 134	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 123	EPA 1668A	PCB 135	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 124	EPA 1668A	PCB 136	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 125	EPA 1668A	PCB 137	EPA 1668A

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Polychlorinated Biphenyls	
PCB 137	EPA 1668C
PCB 138	EPA 1668A
	EPA 1668C
PCB 139	EPA 1668A
	EPA 1668C
PCB 14	EPA 1668A
	EPA 1668C
PCB 140	EPA 1668A
	EPA 1668C
PCB 141	EPA 1668A
	EPA 1668C
PCB 142	EPA 1668A
	EPA 1668C
PCB 143	EPA 1668A
	EPA 1668C
PCB 144	EPA 1668A
	EPA 1668C
PCB 145	EPA 1668A
	EPA 1668C
PCB 146	EPA 1668A
	EPA 1668C
PCB 147	EPA 1668A
	EPA 1668C
PCB 148	EPA 1668A
	EPA 1668C
PCB 149	EPA 1668A

Polychlorinated Biphenyls	
PCB 149	EPA 1668C
PCB 15	EPA 1668A
	EPA 1668C
PCB 150	EPA 1668A
	EPA 1668C
PCB 151	EPA 1668A
	EPA 1668C
PCB 152	EPA 1668A
	EPA 1668C
PCB 153	EPA 1668A
	EPA 1668C
PCB 154	EPA 1668A
	EPA 1668C
PCB 155	EPA 1668A
	EPA 1668C
PCB 156	EPA 1668A
	EPA 1668C
PCB 157	EPA 1668A
	EPA 1668C
PCB 158	EPA 1668A
	EPA 1668C
PCB 159	EPA 1668A
	EPA 1668C
PCB 16	EPA 1668A
	EPA 1668C
PCB 160	EPA 1668A

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2020
Issued April 01, 2019
Revised September 26, 2019

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. DUANE LUCKENBILL
EUROFINS LANCASTER LABORATORIES
ENVIRONMENTAL LLC
2425 NEW HOLLAND PIKE
LANCASTER, PA 17601-5994

NY Lab Id No: 10670

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Polychlorinated Biphenyls	
PCB 160	EPA 1668C
PCB 161	EPA 1668A
	EPA 1668C
PCB 162	EPA 1668A
	EPA 1668C
PCB 163	EPA 1668A
	EPA 1668C
PCB 164	EPA 1668A
	EPA 1668C
PCB 165	EPA 1668A
	EPA 1668C
PCB 166	EPA 1668A
	EPA 1668C
PCB 167	EPA 1668A
	EPA 1668C
PCB 168	EPA 1668A
	EPA 1668C
PCB 169	EPA 1668A
	EPA 1668C
PCB 17	EPA 1668A
	EPA 1668C
PCB 170	EPA 1668A
	EPA 1668C
PCB 171	EPA 1668A
	EPA 1668C
PCB 172	EPA 1668A

Polychlorinated Biphenyls	
PCB 172	EPA 1668C
PCB 173	EPA 1668A
	EPA 1668C
PCB 174	EPA 1668A
	EPA 1668C
PCB 175	EPA 1668A
	EPA 1668C
PCB 176	EPA 1668A
	EPA 1668C
PCB 177	EPA 1668A
	EPA 1668C
PCB 178	EPA 1668A
	EPA 1668C
PCB 179	EPA 1668A
	EPA 1668C
PCB 18	EPA 1668A
	EPA 1668C
PCB 180	EPA 1668A
	EPA 1668C
PCB 181	EPA 1668A
	EPA 1668C
PCB 182	EPA 1668A
	EPA 1668C
PCB 183	EPA 1668A
	EPA 1668C
PCB 184	EPA 1668A

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Polychlorinated Biphenyls	
PCB 184	EPA 1668C
PCB 185	EPA 1668A
	EPA 1668C
PCB 186	EPA 1668A
	EPA 1668C
PCB 187	EPA 1668A
	EPA 1668C
PCB 188	EPA 1668A
	EPA 1668C
PCB 189	EPA 1668A
	EPA 1668C
PCB 19	EPA 1668A
	EPA 1668C
PCB 190	EPA 1668A
	EPA 1668C
PCB 191	EPA 1668A
	EPA 1668C
PCB 192	EPA 1668A
	EPA 1668C
PCB 193	EPA 1668A
	EPA 1668C
PCB 194	EPA 1668A
	EPA 1668C
PCB 195	EPA 1668A
	EPA 1668C
PCB 196	EPA 1668A

Polychlorinated Biphenyls	
PCB 196	EPA 1668C
PCB 197	EPA 1668A
	EPA 1668C
PCB 198	EPA 1668A
	EPA 1668C
PCB 199	EPA 1668A
	EPA 1668C
PCB 2	EPA 1668A
	EPA 1668C
PCB 20	EPA 1668A
	EPA 1668C
PCB 200	EPA 1668A
	EPA 1668C
PCB 201	EPA 1668A
	EPA 1668C
PCB 202	EPA 1668A
	EPA 1668C
PCB 203	EPA 1668A
	EPA 1668C
PCB 204	EPA 1668A
	EPA 1668C
PCB 205	EPA 1668A
	EPA 1668C
PCB 206	EPA 1668A
	EPA 1668C
PCB 207	EPA 1668A

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Polychlorinated Biphenyls	
PCB 207	EPA 1668C
PCB 208	EPA 1668A
	EPA 1668C
PCB 209	EPA 1668A
	EPA 1668C
PCB 21	EPA 1668A
	EPA 1668C
PCB 22	EPA 1668A
	EPA 1668C
PCB 23	EPA 1668A
	EPA 1668C
PCB 24	EPA 1668A
	EPA 1668C
PCB 25	EPA 1668A
	EPA 1668C
PCB 26	EPA 1668A
	EPA 1668C
PCB 27	EPA 1668A
	EPA 1668C
PCB 28	EPA 1668A
	EPA 1668C
PCB 29	EPA 1668A
	EPA 1668C
PCB 3	EPA 1668A
	EPA 1668C
PCB 30	EPA 1668A

Polychlorinated Biphenyls	
PCB 30	EPA 1668C
PCB 31	EPA 1668A
	EPA 1668C
PCB 32	EPA 1668A
	EPA 1668C
PCB 33	EPA 1668A
	EPA 1668C
PCB 34	EPA 1668A
	EPA 1668C
PCB 35	EPA 1668A
	EPA 1668C
PCB 36	EPA 1668A
	EPA 1668C
PCB 37	EPA 1668A
	EPA 1668C
PCB 38	EPA 1668A
	EPA 1668C
PCB 39	EPA 1668A
	EPA 1668C
PCB 4	EPA 1668A
	EPA 1668C
PCB 40	EPA 1668A
	EPA 1668C
PCB 41	EPA 1668A
	EPA 1668C
PCB 42	EPA 1668A

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Polychlorinated Biphenyls		Polychlorinated Biphenyls	
PCB 42	EPA 1668C	PCB 54	EPA 1668C
PCB 43	EPA 1668A	PCB 55	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 44	EPA 1668A	PCB 56	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 45	EPA 1668A	PCB 57	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 46	EPA 1668A	PCB 58	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 47	EPA 1668A	PCB 59	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 48	EPA 1668A	PCB 6	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 49	EPA 1668A	PCB 60	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 5	EPA 1668A	PCB 61	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 50	EPA 1668A	PCB 62	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 51	EPA 1668A	PCB 63	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 52	EPA 1668A	PCB 64	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 53	EPA 1668A	PCB 65	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 54	EPA 1668A	PCB 66	EPA 1668A

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Polychlorinated Biphenyls	
PCB 66	EPA 1668C
PCB 67	EPA 1668A
	EPA 1668C
PCB 68	EPA 1668A
	EPA 1668C
PCB 69	EPA 1668A
	EPA 1668C
PCB 7	EPA 1668A
	EPA 1668C
PCB 70	EPA 1668A
	EPA 1668C
PCB 71	EPA 1668A
	EPA 1668C
PCB 72	EPA 1668A
	EPA 1668C
PCB 73	EPA 1668A
	EPA 1668C
PCB 74	EPA 1668A
	EPA 1668C
PCB 75	EPA 1668A
	EPA 1668C
PCB 76	EPA 1668A
	EPA 1668C
PCB 77	EPA 1668A
	EPA 1668C
PCB 78	EPA 1668A

Polychlorinated Biphenyls	
PCB 78	EPA 1668C
PCB 79	EPA 1668A
	EPA 1668C
PCB 8	EPA 1668A
	EPA 1668C
PCB 80	EPA 1668A
	EPA 1668C
PCB 81	EPA 1668A
	EPA 1668C
PCB 82	EPA 1668A
	EPA 1668C
PCB 83	EPA 1668A
	EPA 1668C
PCB 84	EPA 1668A
	EPA 1668C
PCB 85	EPA 1668A
	EPA 1668C
PCB 86	EPA 1668A
	EPA 1668C
PCB 87	EPA 1668A
	EPA 1668C
PCB 88	EPA 1668A
	EPA 1668C
PCB 89	EPA 1668A
	EPA 1668C
PCB 9	EPA 1668A

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Polychlorinated Biphenyls

PCB 9	EPA 1668C
PCB 90	EPA 1668A
	EPA 1668C
PCB 91	EPA 1668A
	EPA 1668C
PCB 92	EPA 1668A
	EPA 1668C
PCB 93	EPA 1668A
	EPA 1668C
PCB 94	EPA 1668A
	EPA 1668C
PCB 95	EPA 1668A
	EPA 1668C
PCB 96	EPA 1668A
	EPA 1668C
PCB 97	EPA 1668A
	EPA 1668C
PCB 98	EPA 1668A
	EPA 1668C
PCB 99	EPA 1668A
	EPA 1668C
PCB Congeners, Total	EPA 1668C

Polynuclear Aromatics

2-Acetylaminofluorene	EPA 8270D
3-Methylcholanthrene	EPA 8270D

Polynuclear Aromatics

7,12-Dimethylbenzyl (a) anthracene	EPA 8270D
Acenaphthene	EPA 625.1
	EPA 8270D
Acenaphthylene	EPA 625.1
	EPA 8270D
Anthracene	EPA 625.1
	EPA 8270D
Benzo(a)anthracene	EPA 625.1
	EPA 8270D
Benzo(a)pyrene	EPA 625.1
	EPA 8270D
Benzo(b)fluoranthene	EPA 625.1
	EPA 8270D
Benzo(g,h,i)perylene	EPA 625.1
	EPA 8270D
Benzo(k)fluoranthene	EPA 625.1
	EPA 8270D
Chrysene	EPA 625.1
	EPA 8270D
Dibenzo(a,h)anthracene	EPA 625.1
	EPA 8270D
Fluoranthene	EPA 625.1
	EPA 8270D
Fluorene	EPA 625.1
	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 625.1

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Polynuclear Aromatics	
Indeno(1,2,3-cd)pyrene	EPA 8270D
Naphthalene	EPA 625.1
	EPA 8270D
Phenanthrene	EPA 625.1
	EPA 8270D
Pyrene	EPA 625.1
	EPA 8270D
Priority Pollutant Phenols	
2,3,4,6 Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 625.1
	EPA 8270D
2,4,6-Trichlorophenol	EPA 625.1
	EPA 8270D
2,4-Dichlorophenol	EPA 625.1
	EPA 8270D
2,4-Dimethylphenol	EPA 625.1
	EPA 8270D
2,4-Dinitrophenol	EPA 625.1
	EPA 8270D
2,6-Dichlorophenol	EPA 8270D
2-Chlorophenol	EPA 625.1
	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 625.1
	EPA 8270D
2-Methylphenol	EPA 625.1

Priority Pollutant Phenols	
2-Methylphenol	EPA 8270D
2-Nitrophenol	EPA 625.1
	EPA 8270D
3-Methylphenol	EPA 8270D
4-Chloro-3-methylphenol	EPA 625.1
	EPA 8270D
4-Methylphenol	EPA 8270D
4-Nitrophenol	EPA 625.1
	EPA 8270D
Pentachlorophenol	EPA 625.1
	EPA 8270D
Phenol	EPA 625.1
	EPA 8270D
Residue	
Settleable Solids	SM 2540 F-2011
Solids, Total	SM 2540 B-2011
Solids, Total Dissolved	SM 2540 C-2011
Solids, Total Suspended	SM 2540 D-2011
Semi-Volatile Organics	
1,1'-Biphenyl	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
2-Picoline	EPA 8270D

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Semi-Volatile Organics

4-Amino biphenyl	EPA 8270D
Acetophenone	EPA 625.1
	EPA 8270D
alpha-Terpineol	EPA 625.1
Aramite	EPA 8270D
Benzaldehyde	EPA 8270D
	EPA 8315A
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D
Ethyl methanesulfonate	EPA 8270D
Isosafrole	EPA 8270D
Methyl methanesulfonate	EPA 8270D
n-Decane	EPA 625.1
n-Octadecane	EPA 625.1
O,O,O-Triethyl phosphorothioate	EPA 8270D
p-Dimethylaminoazobenzene	EPA 8270D
Phenacetin	EPA 8270D
Safrole	EPA 8270D

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C
	EPA 624.1

Volatile Aromatics

1,2-Dichlorobenzene	EPA 524.2
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C
	EPA 624.1
1,4-Dichlorobenzene	EPA 8260C
	EPA 624.1
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
	EPA 624.1
	EPA 524.2
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
	EPA 624.1
	EPA 524.2
Ethyl benzene	EPA 8260C
	EPA 624.1
Isopropylbenzene	EPA 8260C
m/p-Xylenes	EPA 8260C
	EPA 624.1
Naphthalene, Volatile	EPA 8260C
	EPA 624.1
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
o-Xylene	EPA 8260C
	EPA 624.1

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Volatile Aromatics	
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
	EPA 624.1
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
	EPA 624.1
	EPA 524.2
Total Xylenes	EPA 1666
	EPA 8260C
	EPA 624.1
Volatile Chlorinated Organics	
Benzyl chloride	EPA 8260C
Epichlorohydrin	EPA 8260C
Volatile Halocarbons	
1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C
	EPA 624.1
1,1,2,2-Tetrachloroethane	EPA 8260C
	EPA 624.1
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
	EPA 624.1
1,1,2-Trichloroethane	EPA 8260C
	EPA 624.1
1,1-Dichloroethane	EPA 8260C

Volatile Halocarbons	
1,1-Dichloroethane	EPA 624.1
1,1-Dichloroethene	EPA 8260C
	EPA 624.1
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloro-1,1,2-Trifluoroethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
	EPA 624.1
	EPA 524.2
1,2-Dichloropropane	EPA 8260C
	EPA 624.1
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloro-1,3-butadiene (Chloroprene)	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C
	EPA 624.1
3-Chloropropene (Allyl chloride)	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
	EPA 624.1
Bromoform	EPA 8260C
	EPA 624.1
Bromomethane	EPA 8260C
	EPA 624.1

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Volatile Halocarbons	
Carbon tetrachloride	EPA 8260C
	EPA 624.1
Chloroethane	EPA 8260C
	EPA 624.1
Chloroform	EPA 8260C
	EPA 624.1
	EPA 524.2
Chloromethane	EPA 8260C
	EPA 624.1
cis-1,2-Dichloroethene	EPA 8260C
	EPA 624.1
cis-1,3-Dichloropropene	EPA 8260C
	EPA 624.1
Dibromochloromethane	EPA 8260C
	EPA 624.1
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
	EPA 624.1
Hexachlorobutadiene, Volatile	EPA 8260C
Methyl iodide	EPA 8260C
Methylene chloride	EPA 8260C
	EPA 624.1
	EPA 524.2
Tetrachloroethene	EPA 8260C
	EPA 624.1
trans-1,2-Dichloroethene	EPA 8260C

Volatile Halocarbons	
trans-1,2-Dichloroethene	EPA 624.1
trans-1,3-Dichloropropene	EPA 8260C
	EPA 624.1
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 8260C
	EPA 624.1
Trichlorofluoromethane	EPA 8260C
	EPA 624.1
Vinyl chloride	EPA 8260C
	EPA 624.1
Volatiles Organics	
1,4-Dioxane	EPA 8260C
	EPA 8260C SIM
	EPA 8270D
	EPA 8270D SIM
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
2-Nitropropane	EPA 8260C
4-Methyl-2-Pentanone	EPA 1666
	EPA 8260C
	EPA 624.1
Acetone	EPA 8260C
	EPA 624.1
	EPA 524.2
Acetonitrile	EPA 1671

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

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CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. DUANE LUCKENBILL
EUROFINS LANCASTER LABORATORIES
ENVIRONMENTAL LLC
2425 NEW HOLLAND PIKE
LANCASTER, PA 17601-5994

NY Lab Id No: 10670

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Volatiles Organics	
Acetonitrile	EPA 8260C
	EPA 624.1
Carbon Disulfide	EPA 8260C
Cyclohexane	EPA 8260C
Di-ethyl ether	EPA 8260C
Diethylamine	EPA 1671
Dimethyl sulfoxide	EPA 1671
Ethyl Acetate	EPA 1666
	EPA 8260C
Ethylene Glycol	EPA 8015C
Hexane	EPA 1666
Isobutyl alcohol	EPA 8260C
	EPA 8015D
	EPA 8015C
Isobutyraldehyde	EPA 1666
Isopropanol	EPA 1666
	EPA 8260C
Isopropyl Acetate	EPA 1666
Methanol	EPA 1671
	EPA 8015D
	EPA 8015C
Methyl acetate	EPA 8260C
Methyl cellosolve (2-Methoxyethanol)	EPA 1671
Methyl cyclohexane	EPA 8260C
Methyl formate	EPA 1666
n-Amyl Acetate	EPA 1666

Volatiles Organics	
n-Amyl alcohol	EPA 1666
n-Butanol	EPA 8260C
n-Butyl Acetate	EPA 1666
n-Heptane	EPA 1666
n-Propanol	EPA 1671
o-Toluidine	EPA 8270D
Tetrahydrofuran	EPA 1666
	EPA 8260C
	EPA 624.1
	EPA 524.2
Triethylamine	EPA 1671
Vinyl acetate	EPA 8260C
	EPA 624.1

Sample Preparation Methods
SM 4500-P B(5)-2011
EPA 5030C
EPA 200.2
EPA 3010A
EPA 3005A
EPA 3510C
EPA 3520C
EPA 3020A
SM 4500-NH3 B-2011
SM 4500-F B-2011

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Acrylates	
Acrolein (Propenal)	EPA 8260C
Acrylonitrile	EPA 8260C
Ethyl methacrylate	EPA 8260C
Methyl acrylonitrile	EPA 8260C
Methyl methacrylate	EPA 8260C
Amines	
1,2-Diphenylhydrazine	EPA 8270D
1,4-Phenylenediamine	EPA 8270D
1-Naphthylamine	EPA 8270D
2-Naphthylamine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4,4'-Methylenebis(2-chloroaniline)	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
5-Nitro-o-toluidine	EPA 8270D
a,a-Dimethylphenethylamine	EPA 8270D
Aniline	EPA 8270D
Carbazole	EPA 8270D
Diphenylamine	EPA 8270D
Methapyrilene	EPA 8270D
Pronamide	EPA 8270D
Benzidines	
3,3'-Dichlorobenzidine	EPA 8270D
3,3'-Dimethylbenzidine	EPA 8270D

Benzidines	
Benzidine	EPA 8270D
Carbamate Pesticides	
Aldicarb	EPA 8318A
Aldicarb Sulfone	EPA 8318A
Carbofuran	EPA 8318A
Characteristic Testing	
Corrosivity	EPA 9045D
Free Liquids	EPA 9095B
Ignitability	EPA 1010A
Synthetic Precipitation Leaching Proc.	EPA 1312
TCLP	EPA 1311
Chlorinated Hydrocarbon Pesticides	
2,4'-DDD (Mitotane)	EPA 8081B
4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B
alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
Atrazine	EPA 8270D
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
Chlorobenzilate	EPA 8270D
delta-BHC	EPA 8081B

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Chlorinated Hydrocarbon Pesticides

Diallate	EPA 8270D
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B
Endrin	EPA 8081B
Endrin aldehyde	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Isodrin	EPA 8270D
Kepone	EPA 8081B
	EPA 8270D
Lindane	EPA 8081B
Methoxychlor	EPA 8081B
Mirex	EPA 8081B
Pentachloronitrobenzene	EPA 8270D
Simazine	EPA 8141B
Toxaphene	EPA 8081B

Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270D
1-Chloronaphthalene	EPA 8270D

Chlorinated Hydrocarbons

2-Chloronaphthalene	EPA 8270D
Hexachlorobenzene	EPA 8270D
Hexachlorobutadiene	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D
Hexachloroethane	EPA 8270D
Hexachloropropene	EPA 8270D
Pentachlorobenzene	EPA 8270D

Chlorophenoxy Acid Pesticides

2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
2,4-DB	EPA 8151A
Dalapon	EPA 8151A
Dicamba	EPA 8151A
Dichloroprop	EPA 8151A
Dinoseb	EPA 8151A
MCPA	EPA 8151A
MCPP	EPA 8151A
Pentachlorophenol	EPA 8151A

Dioxins and Furans

1,2,3,4,6,7,8,9-Octachlorodibenzofuran	EPA 8290A
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-diox	EPA 8290A
1,2,3,4,6,7,8-Heptachlorodibenzofuran	EPA 8290A
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxi	EPA 8290A
1,2,3,4,7,8,9-Heptachlorodibenzofuran	EPA 8290A

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All approved analytes are listed below:

Dioxins and Furans

1,2,3,4,7,8-Hexachlorodibenzofuran	EPA 8290A
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	EPA 8290A
1,2,3,6,7,8-Hexachlorodibenzofuran	EPA 8290A
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	EPA 8290A
1,2,3,7,8,9-Hexachlorodibenzofuran	EPA 8290A
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	EPA 8290A
1,2,3,7,8-Pentachlorodibenzofuran	EPA 8290A
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	EPA 8290A
2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290A
2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290A
2,3,7,8-Tetrachlorodibenzofuran	EPA 8290A
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 8290A

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 8270D
4-Bromophenylphenyl ether	EPA 8270D
4-Chlorophenylphenyl ether	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 8270D
Bis(2-chloroethyl)ether	EPA 8270D

Low Level Polynuclear Aromatic Hydrocarbons

Acenaphthene Low Level	EPA 8270D SIM
Acenaphthylene Low Level	EPA 8270D SIM
Anthracene Low Level	EPA 8270D SIM
Benzo(a)anthracene Low Level	EPA 8270D SIM
Benzo(a)pyrene Low Level	EPA 8270D SIM
Benzo(b)fluoranthene Low Level	EPA 8270D SIM

Low Level Polynuclear Aromatic Hydrocarbons

Benzo(g,h,i)perylene Low Level	EPA 8270D SIM
Benzo(k)fluoranthene Low Level	EPA 8270D SIM
Chrysene Low Level	EPA 8270D SIM
Dibenzo(a,h)anthracene Low Level	EPA 8270D SIM
Fluoranthene Low Level	EPA 8270D SIM
Fluorene Low Level	EPA 8270D SIM
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270D SIM
Naphthalene Low Level	EPA 8270D SIM
Phenanthrene Low Level	EPA 8270D SIM
Pyrene Low Level	EPA 8270D SIM

Metals I

Barium, Total	EPA 6010D
	EPA 6020B
Cadmium, Total	EPA 6010D
	EPA 6020B
Calcium, Total	EPA 6010D
	EPA 6020B
Chromium, Total	EPA 6010D
	EPA 6020B
Copper, Total	EPA 6010D
	EPA 6020B
Iron, Total	EPA 6010D
	EPA 6020B
Lead, Total	EPA 6010D
	EPA 6020B

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Metals I

Magnesium, Total	EPA 6010D
	EPA 6020B
Manganese, Total	EPA 6010D
	EPA 6020B
Nickel, Total	EPA 6010D
	EPA 6020B
Potassium, Total	EPA 6010D
	EPA 6020B
Silver, Total	EPA 6010D
	EPA 6020B
Sodium, Total	EPA 6010D
	EPA 6020B
Strontium, Total	EPA 6010D
	EPA 6020B

Metals II

Aluminum, Total	EPA 6010D
	EPA 6020B
Antimony, Total	EPA 6010D
	EPA 6020B
Arsenic, Total	EPA 6010D
	EPA 6020B
Beryllium, Total	EPA 6010D
	EPA 6020B
Chromium VI	EPA 7196A
	EPA 7199

Metals II

Lithium, Total	EPA 6010D
Mercury, Total	EPA 7471B
Selenium, Total	EPA 6010D
	EPA 6020B
Vanadium, Total	EPA 6010D
	EPA 6020B
Zinc, Total	EPA 6010D
	EPA 6020B

Metals III

Cobalt, Total	EPA 6010D
	EPA 6020B
Molybdenum, Total	EPA 6010D
	EPA 6020B
Silica, Dissolved	EPA 6010D
Thallium, Total	EPA 6010D
	EPA 6020B
Tin, Total	EPA 6010D
	EPA 6020B
Titanium, Total	EPA 6010D
	EPA 6020B

Minerals

Bromide	EPA 9056A
Fluoride, Total	EPA 9056A
Sulfate (as SO4)	EPA 9056A

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Miscellaneous	
Boron, Total	EPA 6010D
Cyanide, Total	EPA 9012B
Formaldehyde	EPA 8315A
Organic Carbon, Total	Lloyd Kahn Method
Perchlorate	EPA 6850
Phenols	EPA 9066
Specific Conductance	EPA 9050A
Nitroaromatics and Isophorone	
1,2-Dinitrobenzene	EPA 8270D
1,3,5-Trinitrobenzene	EPA 8270D
	EPA 8330B
1,3-Dinitrobenzene	EPA 8270D
	EPA 8330B
1,4-Dinitrobenzene	EPA 8270D
1,4-Naphthoquinone	EPA 8270D
2,4,6-Trinitrotoluene	EPA 8330B
2,4-Dinitrotoluene	EPA 8270D
	EPA 8330B
2,6-Dinitrotoluene	EPA 8270D
	EPA 8330B
2-Amino-4,6-dinitrotoluene	EPA 8330B
2-Nitrotoluene	EPA 8330B
3,5-Dinitroaniline	EPA 8330B
3-Nitrotoluene	EPA 8330B
4-Amino-2,6-dinitrotoluene	EPA 8330B

Nitroaromatics and Isophorone	
4-Dimethylaminoazobenzene	EPA 8270D
4-Nitroquinoline-1-oxide	EPA 8270D
4-Nitrotoluene	EPA 8330B
Hexahydro-1,3,5-trinitro-1,3,5-triazine	EPA 8330B
Isophorone	EPA 8270D
Methyl-2,4,6-trinitrophenylnitramine	EPA 8330B
Nitrobenzene	EPA 8270D
	EPA 8330B
Nitroglycerine	EPA 8330B
Octahydro-tetranitro-tetrazocine	EPA 8330B
Pentaerythritol tetranitrate	EPA 8330B
Pyridine	EPA 8270D
Nitrosoamines	
N-Nitrosodiethylamine	EPA 8270D
N-Nitrosodimethylamine	EPA 8270D
N-Nitrosodi-n-butylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 8270D
N-Nitrosodiphenylamine	EPA 8270D
N-nitrosomethylethylamine	EPA 8270D
N-nitrosomorpholine	EPA 8270D
N-nitrosopiperidine	EPA 8270D
N-Nitrosopyrrolidine	EPA 8270D
Nutrients	
Nitrite (as N)	EPA 9056A

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Organophosphate Pesticides	
Azinphos methyl	EPA 8141B
Bolstar	EPA 8141B
Carbophenothion	EPA 8141B
Chlorpyriphos	EPA 8141B
Coumaphos	EPA 8141B
Demeton-O	EPA 8141B
Demeton-S	EPA 8141B
Diazinon	EPA 8141B
Dichlorvos	EPA 8141B
Dimethoate	EPA 8270D
Disulfoton	EPA 8141B
	EPA 8270D
EPN	EPA 8141B
Ethion	EPA 8141B
Ethoprop	EPA 8141B
Famphur	EPA 8141B
	EPA 8270D
Fensulfothion	EPA 8141B
Fenthion	EPA 8141B
Malathion	EPA 8141B
Mevinphos	EPA 8141B
NALED	EPA 8141B
Parathion ethyl	EPA 8141B
	EPA 8270D
Parathion methyl	EPA 8141B
	EPA 8270D
Organophosphate Pesticides	
Phorate	EPA 8141B
	EPA 8270D
Ronnel	EPA 8141B
Sulfotepp	EPA 8270D
Thionazin	EPA 8270D
Tokuthion	EPA 8141B
Trichloronate	EPA 8141B
Petroleum Hydrocarbons	
Diesel Range Organics	EPA 8015D
	EPA 8015C
Gasoline Range Organics	EPA 8015D
	EPA 8015C
Oil and Grease Total Recoverable (HEM)	EPA 9071B (Solvent:Hexane)
Phthalate Esters	
Benzyl butyl phthalate	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 8270D
Diethyl phthalate	EPA 8270D
Dimethyl phthalate	EPA 8270D
Di-n-butyl phthalate	EPA 8270D
Di-n-octyl phthalate	EPA 8270D
Polychlorinated Biphenyls	
Aroclor 1016 (PCB-1016)	EPA 8082A
Aroclor 1221 (PCB-1221)	EPA 8082A
Aroclor 1232 (PCB-1232)	EPA 8082A

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Polychlorinated Biphenyls	
Aroclor 1242 (PCB-1242)	EPA 8082A
Aroclor 1248 (PCB-1248)	EPA 8082A
Aroclor 1254 (PCB-1254)	EPA 8082A
Aroclor 1260 (PCB-1260)	EPA 8082A
Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A
PCB 1	EPA 1668A
	EPA 1668C
PCB 10	EPA 1668A
	EPA 1668C
PCB 100	EPA 1668A
	EPA 1668C
PCB 101	EPA 1668A
	EPA 1668C
PCB 102	EPA 1668A
	EPA 1668C
PCB 103	EPA 1668A
	EPA 1668C
PCB 104	EPA 1668A
	EPA 1668C
PCB 105	EPA 1668A
	EPA 1668C
PCB 106	EPA 1668A
	EPA 1668C
PCB 107	EPA 1668A
	EPA 1668C

Polychlorinated Biphenyls	
PCB 108	EPA 1668A
	EPA 1668C
PCB 109	EPA 1668A
	EPA 1668C
PCB 11	EPA 1668A
	EPA 1668C
PCB 110	EPA 1668A
	EPA 1668C
PCB 111	EPA 1668A
	EPA 1668C
PCB 112	EPA 1668A
	EPA 1668C
PCB 113	EPA 1668A
	EPA 1668C
PCB 114	EPA 1668A
	EPA 1668C
PCB 115	EPA 1668A
	EPA 1668C
PCB 116	EPA 1668A
	EPA 1668C
PCB 117	EPA 1668A
	EPA 1668C
PCB 118	EPA 1668A
	EPA 1668C
PCB 119	EPA 1668A
	EPA 1668C

Serial No.: 60589

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2020
Issued April 01, 2019
Revised September 26, 2019

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. DUANE LUCKENBILL
EUROFINS LANCASTER LABORATORIES
ENVIRONMENTAL LLC
2425 NEW HOLLAND PIKE
LANCASTER, PA 17601-5994

NY Lab Id No: 10670

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Polychlorinated Biphenyls		Polychlorinated Biphenyls	
PCB 12	EPA 1668A	PCB 131	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 120	EPA 1668A	PCB 132	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 121	EPA 1668A	PCB 133	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 122	EPA 1668A	PCB 134	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 123	EPA 1668A	PCB 135	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 124	EPA 1668A	PCB 136	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 125	EPA 1668A	PCB 137	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 126	EPA 1668A	PCB 138	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 127	EPA 1668A	PCB 139	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 128	EPA 1668A	PCB 14	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 129	EPA 1668A	PCB 140	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 13	EPA 1668A	PCB 141	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 130	EPA 1668A	PCB 142	EPA 1668A
	EPA 1668C		EPA 1668C

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Polychlorinated Biphenyls	
PCB 143	EPA 1668A
	EPA 1668C
PCB 144	EPA 1668A
	EPA 1668C
PCB 145	EPA 1668A
	EPA 1668C
PCB 146	EPA 1668A
	EPA 1668C
PCB 147	EPA 1668A
	EPA 1668C
PCB 148	EPA 1668A
	EPA 1668C
PCB 149	EPA 1668A
	EPA 1668C
PCB 15	EPA 1668A
	EPA 1668C
PCB 150	EPA 1668A
	EPA 1668C
PCB 151	EPA 1668A
	EPA 1668C
PCB 152	EPA 1668A
	EPA 1668C
PCB 153	EPA 1668A
	EPA 1668C
PCB 154	EPA 1668A
	EPA 1668C

Polychlorinated Biphenyls	
PCB 155	EPA 1668A
	EPA 1668C
PCB 156	EPA 1668A
	EPA 1668C
PCB 157	EPA 1668A
	EPA 1668C
PCB 158	EPA 1668A
	EPA 1668C
PCB 159	EPA 1668A
	EPA 1668C
PCB 16	EPA 1668A
	EPA 1668C
PCB 160	EPA 1668A
	EPA 1668C
PCB 161	EPA 1668A
	EPA 1668C
PCB 162	EPA 1668A
	EPA 1668C
PCB 163	EPA 1668A
	EPA 1668C
PCB 164	EPA 1668A
	EPA 1668C
PCB 165	EPA 1668A
	EPA 1668C
PCB 166	EPA 1668A
	EPA 1668C

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Polychlorinated Biphenyls	
PCB 167	EPA 1668A
	EPA 1668C
PCB 168	EPA 1668A
	EPA 1668C
PCB 169	EPA 1668A
	EPA 1668C
PCB 17	EPA 1668A
	EPA 1668C
PCB 170	EPA 1668A
	EPA 1668C
PCB 171	EPA 1668A
	EPA 1668C
PCB 172	EPA 1668A
	EPA 1668C
PCB 173	EPA 1668A
	EPA 1668C
PCB 174	EPA 1668A
	EPA 1668C
PCB 175	EPA 1668A
	EPA 1668C
PCB 176	EPA 1668A
	EPA 1668C
PCB 177	EPA 1668A
	EPA 1668C
PCB 178	EPA 1668A
	EPA 1668C

Polychlorinated Biphenyls	
PCB 179	EPA 1668A
	EPA 1668C
PCB 18	EPA 1668A
	EPA 1668C
PCB 180	EPA 1668A
	EPA 1668C
PCB 181	EPA 1668A
	EPA 1668C
PCB 182	EPA 1668A
	EPA 1668C
PCB 183	EPA 1668A
	EPA 1668C
PCB 184	EPA 1668A
	EPA 1668C
PCB 185	EPA 1668A
	EPA 1668C
PCB 186	EPA 1668A
	EPA 1668C
PCB 187	EPA 1668A
	EPA 1668C
PCB 188	EPA 1668A
	EPA 1668C
PCB 189	EPA 1668A
	EPA 1668C
PCB 19	EPA 1668A
	EPA 1668C

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Polychlorinated Biphenyls	
PCB 190	EPA 1668A
	EPA 1668C
PCB 191	EPA 1668A
	EPA 1668C
PCB 192	EPA 1668A
	EPA 1668C
PCB 193	EPA 1668A
	EPA 1668C
PCB 194	EPA 1668A
	EPA 1668C
PCB 195	EPA 1668A
	EPA 1668C
PCB 196	EPA 1668A
	EPA 1668C
PCB 197	EPA 1668A
	EPA 1668C
PCB 198	EPA 1668A
	EPA 1668C
PCB 199	EPA 1668A
	EPA 1668C
PCB 2	EPA 1668A
	EPA 1668C
PCB 20	EPA 1668A
	EPA 1668C
PCB 200	EPA 1668A
	EPA 1668C

Polychlorinated Biphenyls	
PCB 201	EPA 1668A
	EPA 1668C
PCB 202	EPA 1668A
	EPA 1668C
PCB 203	EPA 1668A
	EPA 1668C
PCB 204	EPA 1668A
	EPA 1668C
PCB 205	EPA 1668A
	EPA 1668C
PCB 206	EPA 1668A
	EPA 1668C
PCB 207	EPA 1668A
	EPA 1668C
PCB 208	EPA 1668A
	EPA 1668C
PCB 209	EPA 1668A
	EPA 1668C
PCB 21	EPA 1668A
	EPA 1668C
PCB 22	EPA 1668A
	EPA 1668C
PCB 23	EPA 1668A
	EPA 1668C
PCB 24	EPA 1668A
	EPA 1668C

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Polychlorinated Biphenyls		Polychlorinated Biphenyls	
PCB 25	EPA 1668A	PCB 37	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 26	EPA 1668A	PCB 38	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 27	EPA 1668A	PCB 39	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 28	EPA 1668A	PCB 4	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 29	EPA 1668A	PCB 40	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 3	EPA 1668A	PCB 41	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 30	EPA 1668A	PCB 42	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 31	EPA 1668A	PCB 43	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 32	EPA 1668A	PCB 44	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 33	EPA 1668A	PCB 45	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 34	EPA 1668A	PCB 46	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 35	EPA 1668A	PCB 47	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 36	EPA 1668A	PCB 48	EPA 1668A
	EPA 1668C		EPA 1668C

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Polychlorinated Biphenyls	
PCB 49	EPA 1668A
	EPA 1668C
PCB 5	EPA 1668A
	EPA 1668C
PCB 50	EPA 1668A
	EPA 1668C
PCB 51	EPA 1668A
	EPA 1668C
PCB 52	EPA 1668A
	EPA 1668C
PCB 53	EPA 1668A
	EPA 1668C
PCB 54	EPA 1668A
	EPA 1668C
PCB 55	EPA 1668A
	EPA 1668C
PCB 56	EPA 1668A
	EPA 1668C
PCB 57	EPA 1668A
	EPA 1668C
PCB 58	EPA 1668A
	EPA 1668C
PCB 59	EPA 1668A
	EPA 1668C
PCB 6	EPA 1668A
	EPA 1668C

Polychlorinated Biphenyls	
PCB 60	EPA 1668A
	EPA 1668C
PCB 61	EPA 1668A
	EPA 1668C
PCB 62	EPA 1668A
	EPA 1668C
PCB 63	EPA 1668A
	EPA 1668C
PCB 64	EPA 1668A
	EPA 1668C
PCB 65	EPA 1668A
	EPA 1668C
PCB 66	EPA 1668A
	EPA 1668C
PCB 67	EPA 1668A
	EPA 1668C
PCB 68	EPA 1668A
	EPA 1668C
PCB 69	EPA 1668A
	EPA 1668C
PCB 7	EPA 1668A
	EPA 1668C
PCB 70	EPA 1668A
	EPA 1668C
PCB 71	EPA 1668A
	EPA 1668C

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Polychlorinated Biphenyls		Polychlorinated Biphenyls	
PCB 72	EPA 1668A	PCB 84	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 73	EPA 1668A	PCB 85	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 74	EPA 1668A	PCB 86	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 75	EPA 1668A	PCB 87	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 76	EPA 1668A	PCB 88	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 77	EPA 1668A	PCB 89	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 78	EPA 1668A	PCB 9	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 79	EPA 1668A	PCB 90	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 8	EPA 1668A	PCB 91	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 80	EPA 1668A	PCB 92	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 81	EPA 1668A	PCB 93	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 82	EPA 1668A	PCB 94	EPA 1668A
	EPA 1668C		EPA 1668C
PCB 83	EPA 1668A	PCB 95	EPA 1668A
	EPA 1668C		EPA 1668C

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Polychlorinated Biphenyls	
PCB 96	EPA 1668A
	EPA 1668C
PCB 97	EPA 1668A
	EPA 1668C
PCB 98	EPA 1668A
	EPA 1668C
PCB 99	EPA 1668A
	EPA 1668C
PCB Congeners, Total	EPA 1668C
Polynuclear Aromatic Hydrocarbons	
2-Acetylaminofluorene	EPA 8270D
3-Methylcholanthrene	EPA 8270D
7,12-Dimethylbenzyl (a) anthracene	EPA 8270D
Acenaphthene	EPA 8270D
Acenaphthylene	EPA 8270D
Anthracene	EPA 8270D
Benzo(a)anthracene	EPA 8270D
Benzo(a)pyrene	EPA 8270D
Benzo(b)fluoranthene	EPA 8270D
Benzo(g,h,i)perylene	EPA 8270D
Benzo(k)fluoranthene	EPA 8270D
Chrysene	EPA 8270D
Dibenzo(a,h)anthracene	EPA 8270D
Dibenzo(a,j)acridine	EPA 8270D
Fluoranthene	EPA 8270D
Polynuclear Aromatic Hydrocarbons	
Fluorene	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D
Naphthalene	EPA 8270D
Phenanthrene	EPA 8270D
Pyrene	EPA 8270D
Priority Pollutant Phenols	
2,3,4,6 Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D
2,4-Dichlorophenol	EPA 8270D
2,4-Dimethylphenol	EPA 8270D
2,4-Dinitrophenol	EPA 8270D
2,6-Dichlorophenol	EPA 8270D
2-Chlorophenol	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270D
2-Methylphenol	EPA 8270D
2-Nitrophenol	EPA 8270D
3-Methylphenol	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D
4-Methylphenol	EPA 8270D
4-Nitrophenol	EPA 8270D
Pentachlorophenol	EPA 8270D
Phenol	EPA 8270D
Semi-Volatile Organics	
1,1'-Biphenyl	EPA 8270D

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Semi-Volatile Organics

1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
2-Picoline	EPA 8270D
4-Amino biphenyl	EPA 8270D
Acetophenone	EPA 8270D
Aramite	EPA 8270D
Benzaldehyde	EPA 8270D
	EPA 8315A
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D
Ethyl methanesulfonate	EPA 8270D
Isosafrole	EPA 8270D
Methyl methanesulfonate	EPA 8270D
O,O,O-Triethyl phosphorothioate	EPA 8270D
Phenacetin	EPA 8270D
Safrole	EPA 8270D

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C

Volatile Aromatics

1,3-Dichlorobenzene	EPA 8260C
1,4-Dichlorobenzene	EPA 8260C
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
Ethyl benzene	EPA 8260C
Isopropylbenzene	EPA 8260C
m/p-Xylenes	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
o-Xylene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
Total Xylenes	EPA 8260C

Volatile Chlorinated Organics

Benzyl chloride	EPA 8260C

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C

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Volatile Halocarbons	
1,1,2,2-Tetrachloroethane	EPA 8260C
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C
1,1-Dichloroethane	EPA 8260C
1,1-Dichloroethene	EPA 8260C
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
1,2-Dichloropropane	EPA 8260C
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloro-1,3-butadiene (Chloroprene)	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C
3-Chloropropene (Allyl chloride)	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
Bromoform	EPA 8260C
Bromomethane	EPA 8260C
Carbon tetrachloride	EPA 8260C
Chloroethane	EPA 8260C
Chloroform	EPA 8260C
Chloromethane	EPA 8260C
cis-1,2-Dichloroethene	EPA 8260C
cis-1,3-Dichloropropene	EPA 8260C

Volatile Halocarbons	
Dibromochloromethane	EPA 8260C
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260C
Methyl iodide	EPA 8260C
Methylene chloride	EPA 8260C
Tetrachloroethene	EPA 8260C
trans-1,2-Dichloroethene	EPA 8260C
trans-1,3-Dichloropropene	EPA 8260C
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 8260C
Trichlorofluoromethane	EPA 8260C
Vinyl chloride	EPA 8260C
Volatile Organics	
1,4-Dioxane	EPA 8260C
	EPA 8260C SIM
	EPA 8270D
	EPA 8270D SIM
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
2-Nitropropane	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C
Acetonitrile	EPA 8260C
Carbon Disulfide	EPA 8260C

Serial No.: 60589

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2020
Issued April 01, 2019
Revised September 26, 2019

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. DUANE LUCKENBILL
EUROFINS LANCASTER LABORATORIES
ENVIRONMENTAL LLC
2425 NEW HOLLAND PIKE
LANCASTER, PA 17601-5994

NY Lab Id No: 10670

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Volatile Organics

Cyclohexane	EPA 8260C
Ethyl Acetate	EPA 8260C
Ethylene Glycol	EPA 8015C
Isobutyl alcohol	EPA 8260C
Isopropanol	EPA 8260C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
Methyl tert-butyl ether	EPA 8260C
n-Butanol	EPA 8260C
o-Toluidine	EPA 8270D
Propionitrile	EPA 8260C
tert-butyl alcohol	EPA 8260C
Vinyl acetate	EPA 8260C

Sample Preparation Methods

EPA 5035A-L
EPA 5035A-H
EPA 3010A
EPA 3005A
EPA 3050B
EPA 3550C
EPA 3540C
EPA 3020A
EPA 3546
EPA 5035
EPA 3060A

Serial No.: 60589

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APPENDIX B
FIELD STANDARD OPERATING PROCEDURES

EM TERRAIN CONDUCTIVITY STANDARD OPERATING PROCEDURES

1. Introduction 1
2. EM Geophysical Survey 1
3. Standard Operating Procedure for EM-31MK2 Survey 1
   Preparation 1
   Packing List 1
   Arrival 1
   Equipment Set-up and Survey Procedure 1
   Post Survey Procedure 2
4. Maintenance and Calibration 3

EM TERRAIN CONDUCTIVITY STANDARD OPERATING PROCEDURES

1. INTRODUCTION

RETTEW performs electromagnetic (EM) mapping in open fields and lightly wooded areas to depths of approximately 20 feet below grade utilizing a Geonics Limited (Geonics) EM-31MK2 terrain conductivity meter. This technique is used for a variety of surveys including landfill delineation, possible sinkhole location, and buried metal objects. It is a fast and reliable technique.

2. EM-31MK2 GEOPHYSICAL SURVEY

The EM-31MK2 measures the electrical conductivity of subsurface materials by using a transmitter coil to generate an electromagnetic field which drives an electrical current in the ground. A receiver coil at a fixed separation from the transmitter is tuned and oriented to be insensitive to the transmitted field, and therefore measures only a secondary electromagnetic field generated by the subsurface electrical current. The strength and orientation of this field can be used to accurately estimate the electrical conductivity (terrain conductivity) and/or relative metallic content (in-phase response) of the subsurface materials. Note that terrain conductivities are typically elevated over metallic targets and in dumping areas or buried lagoons due to the presence of exotic materials and/or conductive soils.

3. STANDARD OPERATING PROCEDURE FOR EM-31MK2 SURVEY

Preparation

Prior to arriving at a job site, RETTEW will review the proposal, job safety analysis (JSA) and tailgate safety sheets. Also, RETTEW will confirm the site contact's name and contact number.

Packing List

- EM-31 MK2 and spare "C" alkaline batteries
- GPS unit and communication cable
- Vinyl flagging or survey pin flags
- Survey tapes
- Marking paint
- Standard PPE
- Sleds, if using UTV for survey
- UTV
- DOT-approved helmets, if using UTV

Arrival

RETTEW will perform a tailgate meeting and JSA review of daily equipment and procedures. A site walk will be performed to evaluate areas of noise contamination (i.e., surface metal, pipes wells, fences powerlines etc.) and potential safety hazards. Next, the proposed grid spacing and orientation (see proposal, otherwise orientation should be north-south) will be assessed based on terrain, accessibility, and noise contamination. The grid boundaries will be marked using flags or paint, based on GPS or tape measures if necessary (small areas may not need to be gridded). Once the grid and/or boundaries are marked, unload UTV (as applicable) and set-up equipment.

Equipment Set-up and Survey Procedures

1. Battery Check
    a. Set MODE switch to OPER position and rotate RANGE switch to DAT position.
    b. If meter reads more than ± 4.4 then batteries do not need to be changed.

2. Initial Set-up

   a. Using identifying labels, attach transmitter coil tube.
   b. Set MODE switch to OPER and check the zero reading. Set the RANGE switch to least sensitive position (1,000 mS/m).
   c. The tolerance for this test is ± 1mS/s. To adjust reading use the DC ZERO CONTROL located under panel.
   d. Remove battery pack to gain access to the controls.
   e. Turn instrument off and attach receiver coil tube.
3. Equipment Functional Checks
   a. Set RANGE switch to 100 mS/m. (if reading on meter is off-scale, i.e.> 100 mS/m, set to 1000 mS/m.
   b. Set MODE switch to OPER position and adjust in phase meter reading to zero using the COARSE and FINE COMPENSATION controls, tolerance +0.1 ppt.
   c. Check the phase of the instrument, set MODE switch to PHASE position. Note meter reading and rotate the COARSE control one step clockwise. If the conductivity meter reading remained in the same tolerance (+ or- 0.2), the phase is already correct. Return COARSE control to its original position.
   d. If there is a difference in the readings with the COARSE control in its original position, adjust the PHASE potentiometer about ¼ turn clockwise. Repeat phase test. If the difference in reading has decreased, repeat procedure or if the difference has increased, the PHASE potentiometer should be rotated counter-clockwise.
   e. Always remember to set the COARSE control back to its original position. This can be confirmed by checking that the in-phase meter reads zero with the MODE switch set to OPER.
   f. Check the sensitivity of the instrument, set MODE switch to COMP position and rotate COARSE control clockwise one step. The conductivity reading should change between 22 to 26 mS/m.
4. Data Logger and GPS Set-Up
   a. Connect the data logger and GPS to the EM-31MK2.
   b. On the data logger, select the EM-31MK2 program on the logger screen.
   c. Set-up survey parameters, sample interval, and check GPS stream.
   d. Start the file, use default name (date, time, and alphabetical letter).
5. Once survey is set up and GPS is streaming, begin collecting data in a grid pattern.
   a. Walk or drive at a steady pace.
   b. Check the logger frequently making sure that lines are as straight as possible and separation is within survey tolerance.

<u>Post-Survey Procedures</u>

1. When survey is completed, power down and disassemble the EM-31MK2, remove batteries, and return all cables to the proper units/boxes.
2. Upload the data from the data logger to a thumb drive, flash card, or computer.
3. Plot raw data to check for data gaps, erroneous readings, anomalous features.
4. Use GPS system to record significant features, inaccessible areas, surface metal, pipes, and subsidence features if present.
5. Photograph any irregular features.
6. Remove flagging and survey markers.
7. Load equipment onto UTV (as applicable, **review UTV JSA before departing**).

4. MAINTENANCE AND CALIBRATION

After each survey, the equipment will be cleaned and stored in its designated location. Any issues during the survey are noted, checked by senior staff, and if not resolved in-house, the system is sent to Geonics for repairs. If an instrument is unavailable for use, mark the instrument and box with pink flagging.

RETTEW maintains multiple EM-31MK2 meters at the Lancaster office. To ensure consistency between the meters, RETTEW routinely (semi-annually) compares instrument readings between the meters in a designated location adjacent to our equipment storage facility. If a meter shows a significant deviation from the other meters, and cannot be calibrated to the same values as the other meters, it will be sent to Geonics for re-calibration and repair. This comparison is mandatory if using multiple meters on a single site.

GROUND PENETRATING RADAR STANDARD OPERATING PROCEDURE

1. Introduction 1
2. Ground Penetrating Radar Geophysical Survey 1
3. Standard Operating Procedure for GPR Survey 1
   Preparation 1
   Packing List 1
   Arrival 1
   Survey Procedures 1
   Post Survey Procedures 2
4. Maintenance and Calibration 2

GROUND PENETRATING RADAR STANDARD OPERATING PROCEDURE

1. INTRODUCTION

RETTEW uses Ground Penetrating Radar (GPR) to locate shallow targets in the subsurface. GPR is effective in smooth or flat terrain and provides real-time data to the user. This technique is widely used in the industry to locate buried tanks, pipes, and other shallow targets.

2. GPR GEOPHYSICAL SURVEY

GPR systems produce cross-sectional images of subsurface features and layers by continuously emitting pulses of radar frequency energy from a scanning antenna as it is towed along a survey profile. The radar pulses are reflected by interfaces between materials with differing dielectric properties. The reflections return to the antenna and are displayed on a video monitor as a continuous cross section in real time. Since the electrical properties of metallic drums, tanks, transformers, pipes, and wastes are distinctly different from soil and backfill materials, metallic targets produce typically dramatic and characteristic reflections. Materials such as fiberglass, plastic, concrete, and terra cotta and subsurface conditions such as voids, rock surfaces, changes in soil type, and concentrations of many types of nonmetallic wastes also produce recognizable, but less dramatic reflections.

3. STANDARD OPERATING PROCEDURE FOR GPR SURVEY

Preparation

Prior to arriving at a job site, RETTEW will review the proposal, job safety analysis (JSA) and tailgate safety sheets. Also, RETTEW will confirm the site contact's name and contact number.

Packing List

- GPR Unit and Batteries
- GPS Unit
- Vinyl flagging or survey pin flags
- Survey tapes
- Marking paint
- Standard PPE
- TW-6 metal detector (If looking for tanks or metal pipes)

Arrival

RETTEW will perform a tailgate meeting and JSA review of daily equipment and procedures. A site walk will be performed to evaluate areas of noise contamination (i.e., surface metal, pipes wells, fences powerlines etc.) and potential safety hazards (and traffic control, if working along the road or parking lot). Next, the proposed grid spacing and orientation (see proposal, otherwise orientation should be north-south) will be assessed based on terrain, accessibility, and noise contamination. The grid boundaries will be marked using flags or paint, if necessary (small areas may not need to be gridded).

Survey Procedures

- Isolate active work area with traffic cones, if necessary.
- Power up controller, select proper set-up to start, select units, and file location.
- Calibrate wheel, adjust set-up, gains (at least five points), and filters.
- Set range based on signal penetration.
- Test settings over known features to estimate depth of study.
- Calibrate depth/dielectric constant.

- Walk orthogonal grid using a spacing that will allow at least three profiles to intersect suspected target.
- Mark targets on the ground surface using semi-permanent paint or vinyl pin flags.
- Record selected profiles on ALL sites and well as grid profiles.
- To avoid scan dropouts, walk slowly and adjust scan rate as needed.

Post-Survey Procedures

- Once completed, upload files to computer or USB drive then power down the GPR unit and antenna and remove batteries.
- Take photos of marked targets and site obstructions.
- Apply extra paint to the marked areas.

4. MAINTENANCE AND CALIBRATION

After each survey, the equipment will be cleaned and stored in its designated location. Any issues during the survey are noted, checked by senior staff, and if not resolved in-house, the system is sent off to the manufacturer of the unit.

MAGNETOMETER STANDARD OPERATING PROCEDURES

1. Introduction 1
2. Magnetic Geophysical Survey 1
3. Standard Operating Procedure for MAG Survey 1
   Preparation 1
   Packing List 1
   Arrival 1
   Survey Procedure 1
   Post Survey Procedure 2
4. Maintenance and Calibration 2

MAGNETOMETER STANDARD OPERATING PROCEDURES

1. INTRODUCTION

RETTEW performs magnetometer (MAG) mapping in open fields and lightly wooded areas utilizing a Geometrics, Inc. (Geometrics) G-858 MagMapper meter. This technique is used for a variety of archaeologic and environmental surveys by locating buried metallic objects. It is a fast and reliable technique, but is highly susceptible to cultural interference (i.e., surface metal).

2. MAG GEOPHYSICAL SURVEY

RETTEW conducts magnetic surveys using a high-resolution cesium vapor magnetometer. The magnetometer measures and digitally records the intensity of the earth's magnetic field at a grid station. The intensity of the earth's magnetic field is generally constant or varies smoothly due to variations in bedrock composition at depth. However, the presence of magnetic objects may create localized/abrupt variations or anomalies in the ambient magnetic field.

3. STANDARD OPERATING PROCEDURE FOR MAG SURVEY

Preparation

Prior to arriving at a job site, RETTEW will review the proposal, job safety analysis (JSA) and tailgate safety sheets. Also, RETTEW will confirm the site contact's name and contact number.

Packing List

- G-858 Magnetometer (2x or base magnetometer)
- Battery Packs
- GPS System
- Vinyl flagging
- Survey tapes
- Marking paint
- Standard PPE with composite-toe shoes (non-ferrous/**NO STEEL-TOE**)

Arrival

RETTEW will perform a tailgate meeting and JSA review of daily equipment and procedures. A site walk will be performed to evaluate areas of noise contamination (i.e., surface metal, pipes wells, fences powerlines etc.) and potential safety hazards. During the site walk, a GPS will be used to mark areas of noise contamination. Next, the proposed grid spacing and orientation (see proposal, otherwise orientation should be north-south) will be assessed based on terrain, accessibility, and noise contamination. The grid boundaries will be marked using flags or paint, if necessary (small areas may not need to be gridded). The survey base station will be located in an area that is away from metal or moving objects. Set-up base station to record during the survey.

Survey Procedures

- Assemble the MagMapper according to operation manual for the survey
    - Make sure the cesium sensors are pointed at approximately 45 degrees.
    - Measure and record separation distance of sensors, GPS antenna, and operator.
    - Note the position of the sensors when connecting to the logger.
- Remove all metal from body before assembling and collecting the magnetic data.
- Connect GPS to the data logger (use null modem).
- Connect the cesium sensors to the data logger.
- Using the data logger, set-up the survey type and collection parameters.

- Perform cable test, latency test, and static test for unexploded ordnance (UXO) surveys (See UXO SOP).
- Once survey set-up and tests are complete, begin data collection.
- During collection, walk at a slow and steady pace to avoid excessive movement of the sensors, as this could create false anomalies. Watch for signal dropouts.
- Start and end lines with each direction to help with striping corrections.

Post-Survey Procedures

- Once the survey is completed, download the data from the survey magnetometer and the base magnetometer to a field computer and USB backup.
- Walk the site and remove flagging.
- Take pictures of the area and surface debris.

4. MAINTENANCE AND CALIBRATION

After each survey, the equipment will be cleaned and stored in its designated location. Any issues during the survey are noted, checked by senior staff, and if not resolved in-house, the system is sent to Geometrics for repairs. If an instrument is unavailable for use, mark the instrument and box with pink flagging.

RETTEW maintains three G-858 MagMapper magnetometers, each with two sensors, in-house at the Lancaster office. To ensure consistency between the meters, RETTEW routinely (semi-annually) compares instrument readings between the sensors in a designated location adjacent to our equipment storage facility. If a sensor shows a significant deviation from the other sensors or logger and cannot be fixed, it will be sent to Geometrics for re-calibration and repair. This comparison is mandatory if using multiple sensors and loggers on a single site.

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ENVIRONMENT
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STANDARD OPERATING PROCEDURE 001
FIELD LOG BOOK ENTRIES

Project name	**Loeffel Route 203 Property**
Project no.	**73458**
Recipient	**General Electric Company**
Document type	**Draft**
Version	**[0]**
Date	**November 11, 2019**
Prepared by	**Rob Hornung**
Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This Standard Operating Procedure (SOP) describes entries to be included in field log books or field forms. The field log book or field forms will be used to note information regarding collection of samples and any observations. All field log book entries will be signed and dated. Field log books will be waterproof and bound. The log book will be dedicated to the project and pages will not be removed. Corrections to the field log book and field forms will be made by drawing a single line through the incorrect data and initialing and dating the correction that was made to the side of the error. An initialed diagonal line will be used to indicate the end of an entry or the end of the day's activities in the field log book. Whenever possible, log book entries should be made in the field at the site, not at a later time at a different location. Supplemental entries to the log book may be made at a later date. The supplemental entry must be clearly identified as such and the entry must be signed and dated as described in this SOP.

2. Materials

- Field log book;
- Field forms; and,
- Indelible, blue or black ink pen.

3. Procedures

1. The name of the project, project number, and project location should be written in indelible ink on the outside of the field log book or on the field form.

2. Print legibly and be concise.

3. The following information will be recorded in the field log book or field form on a daily basis, as appropriate:

- Name of author, date, and time of site entry, and physical/environmental conditions during the field activity;
- Location of field activity;
- Date and time of entry;
- Name(s) of field team members on-site and site contacts;
- Name(s), titles of any site visitors, as well as the date and time entering and leaving the site;
- Weather information (e.g., temperature, cloud coverage, wind speed, and direction);
- Purpose of field activity;
- A detailed description of the fieldwork conducted;
- Sample media (e.g., soil, groundwater);
- Sample collection method;
- Number and volume of sample(s) taken;
- Description of sampling point(s);
- Volume of groundwater removed before sampling;

- Preservatives used;
- Analytical parameters;
- Date and time of collection;
- Sample identification number(s);
- Sample distribution (e.g., laboratory);
- Field observations;
- Calibration data for field meters;
- All field measurements made (e.g., photoionization detector [PID], pH, temperature, conductivity, water level, etc.);
- Health and safety monitoring results;
- Parent sample identifications for duplicate samples;
- References for all maps and photographs of the sampling site(s); and,
- Information pertaining to sample documentation such as dates and method of sample shipments, chain-of-custody record numbers, and air bill number(s).

4. Data Recording and Management

Ideally, at the end of each day, the day's documentation recorded in the field log book should be scanned for electronic archiving. At a minimum electronic archiving of the field log book will occur on a weekly basis. Electronic archiving allows copies of the field notes to be available in the event the field book is lost or damaged, and that field data can be easily disseminated to others without physically distributing the field log book. Field log books that are full should be archived with the project files.

5. Quality Assurance

Be aware that field log books may be used by others for purposes other than originally intended. Field log books should be considered as a legally defensible record, and information contained in field log books should be documented as such.

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STANDARD OPERATING PROCEDURE 002
SOIL SAMPLING PROCEDURE

Project name	**Loeffel Route 203 Property**
Project no.	**73458**
Recipient	**General Electric Company**
Document type	**Draft**
Version	**[0]**
Date	**November 11, 2019**
Prepared by	**Rob Hornung**
Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This Standard Operating Procedure (SOP) provides general guidance, material needs, and methodology for collecting surface and subsurface soil samples for chemical and/or physical properties analyses. This SOP does not address sample preservation, sample packaging, chain-of-custody, or laboratory analysis. Refer to additional SOPs in the Quality Assurance Project Plan (QAPP), as well as the Removal Sampling Work Plan (RSWP) and Health and Safety Plan (HASP), as appropriate.

2. Personnel Qualifications

Field sampling personnel involved with the collection of soil samples will have completed a training course of at least 40 hours meeting the requirements of 29 CFR 1910.120(e) for health and safety at hazardous waste operations. If the course was completed more than 12 months before the date of the site work, completion of an approved 8-hr refresher course will be required. Field activities that involve the collection of soil samples will be performed by an O'Brien & Gere Engineers, Inc. (OBG, a Ramboll company) geologist or hydrogeologist. Field personnel will be familiar with this SOP and possess the required skills, training, field observation documentation and experience necessary to successfully complete field activities.

3. Materials

The following materials and supplies, as appropriate, are necessary for soil sample collection:

- Field log book;
- Boring log as applicable;
- Field sampling personnel business cards;
- Chain-of-custody and security seals;
- Clean sample containers (include an extra set);
- Sample labels;
- Field parameter instruments (e.g., photoionization detector [PID]);
- Sample cooler(s);
- Plastic bags for ice and sample sets;
- Wet ice;
- Paper towels;
- Contractor bags;
- Nitrile gloves;
- Equipment decontamination materials, as necessary;
- Stainless steel or disposable scoop or trowel;
- Soil coring device;

- Vehicle or track-mounted direct-push technology (DPT) unit, lined dual-tube sampling system, lined Macro-core sampler®, and Shelby tube sampler, as applicable;
- Clean disposable aluminum or stainless-steel pans;
- Disposable pan liners;
- Resealable plastic zipper bags
- Work table(s);
- Stainless steel spoons; and,
- Indelible, blue or black ink pen.

4. Procedure

Soil samples may be collected at intervals from the ground surface to various depths as specified in the RSWP. In general, surface soil samples will be obtained using manual sampling methods if conditions are suitable for collection (i.e., not in paved areas, areas containing sub-base, etc.). Subsurface soil samples will be collected from soil cores obtained using direct-push methods, or other suitable methods if direct-push methods can-not be used to meet project objectives. Sample locations will be identified using stakes, flagging, or other appropriate means, and will be noted in the field log book.

1. Place plastic sheeting adjacent to the sampling location for use as a clean work area, if conditions allow. Otherwise, prevent sampling equipment from contacting the ground or other surface that could compromise sample integrity.
2. Clean dedicated sampling equipment should be used. Non-disposable sampling equipment that contacts the soil will be decontaminated between sample locations in accordance with SOP 005 (Field Equipment Decontamination).
3. Remove inconsequential surface debris (e.g., vegetation, rock) from the sampling location prior to collecting surface soil samples.
4. For subsurface soil sampling, perform an initial field screening of the soil core using a PID. The PID will be used to carefully scan the length of the soil core. Expose the interior of the soil core and insert the PID probe tip into this void space exercising caution not to insert the probe tip into the soil/water matrix. The geologist or hydrogeologist will note and record the depth and responses(s), if any, from the PID on the boring log.
5. Collect samples for volatile organic compound (VOC) analysis as discrete samples. The remaining soil from each of sampling intervals will be homogenized, placed into separate sample containers, and analyzed for the non-VOC parameters as required by the RSWP, if applicable.
6. For subsurface soil sampling, perform jar headspace analysis screening using a hand-held PID on the interval of soil core that exhibits the highest initial PID screening response per soil core run unless a sample is collected for laboratory analysis. If a sample is collected for laboratory analysis in a given core run, then the portion of that sample not collected for laboratory analysis will be used for headspace analysis screening. Collect a soil sample in a clean glass jar to perform headspace readings with a PID. Seal the glass jar with aluminum foil and a screw cap labeled with the appropriate sample identification information, including the depth of the sample, soil boring location, date, and time of sample collection. Each sample will remain sealed for a minimum of ten minutes to allow volatilization to occur. The headspace in each sample will then be screened with the PID by inserting the tip of the probe through the aluminum foil. The readings will then be recorded in the field screening log and boring log. Alternatively, headspace analysis screening can

be performed by placing the interval of soil core that exhibits the highest initial PID screening response per soil core run into a clean resealable plastic zipper bag in lieu of a glass jar.

7. Additional non-aqueous phase liquid (NAPL) screening techniques may be performed on select subsurface soil samples/soil cores in accordance with the NAPL field screening SOP 003 (NAPL Field Screening Procedure).
8. Soil samples will be collected and classified in accordance with the RSWP. Soil samples will be classified using the Modified Burmeister and Unified Classification Systems. In addition to logging the geologic descriptions, observations including soil texture, composition, color, consistency, moisture content, recovery (if applicable), and the observance of noticeable odors or stains will be recorded on the boring log (for subsurface soil sampling) or field log book or field forms (for surface soil sampling).
9. Place samples to be homogenized in a clean disposable aluminum pan or stainless-steel pan with pan liner(s) or clean resealable plastic zipper bag and remove any debris (e.g., rocks, sticks) greater than ½-inch-diameter. Homogenize the soil in the pan/bag and place directly into clean, laboratory-supplied sample containers.
10. Samples will be collected in unpreserved glass containers and cooled to ≤6 degrees Celsius (°C)[1] for submittal to the analytical laboratory except for samples analyzed for VOCs, which will be collected in accordance with United States Environmental Protection Agency (USEPA) Method 5035/5035A.
11. Relatively undisturbed soil samples will be collected using a Shelby Tube sampler or equivalent for dry bulk density and grain size distribution, as applicable.
12. Samples should be placed into a cooler containing wet ice immediately after collection.
13. Ship the samples to the laboratory under chain-of-custody following SOP 004 (Chain-of Custody, Handling, Packing, and Shipping).
14. Backfill soil borings/sample locations to grade in accordance with the RSWP.

5. Waste Management

Waste generated during this sample collection task will be investigation-derived materials (IDM) such as soil cuttings, personal protective equipment (PPE) and, if any, decontamination fluids. IDM will be managed in accordance with the RSWP.

6. Data Recording and Management

Recording of data pertaining to the sample collection is described in SOP 001 (Field Log Book Entries).

[1] Considering the temperature and conditions at the Site during sample collection, if samples are hand-delivered to the laboratory and are received by the laboratory within 8 to 12 hours of sample collection, cooler temperatures may exceed the preservation requirements. This exception applies only if: (1) samples are properly chemically preserved; (2) the sample cooler contains sufficient ice for the samples to reach the required temperatures within 24 hours of samples being placed in the cooler; and (3) the samples are not insulated from exposure to ice with bubble wrapping. Sample results determined to be impacted by a rapid delivery to the laboratory (within 8 to 12 hours of sample collection) will not be flagged during data validation.

7. Quality Assurance

Specific details related to quality assurance and quality control (QA/QC) samples are described in the QAPP. A brief overview of the collection of QA/QC samples is included here for reference.

7.1 Duplicate Samples

Duplicate samples are prepared by alternately filling the container for the "primary sample" for a particular parameter and then filling the container for the "duplicate sample" for the same parameter. Duplicate samples need to be included on the chain-of-custody.

7.2 Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates (MS/MSDs) are collected in the same manner as a duplicate sample. Check with the laboratory for the volume requirements for each parameter. MS/MSDs need to be included on the chain-of-custody form.

7.3 Equipment Blanks

Equipment blanks should be collected to verify that the decontamination procedures or materials used for sample collection are effective in minimizing potential for cross contamination. The equipment blank is prepared by pouring laboratory provided deionized (DI) water over the clean and dry sampling equipment, and collecting the water into appropriate sample containers. Equipment blanks should be collected at the frequency and analyzed for the parameters described in the QAPP, as appropriate.

RAMBOLL

FIELD SCREENING LOG

BORING NO.

PROJECT:					**SHEET** 1 OF
CLIENT:					**JOB NO.**
DRILLING CONTRACTOR:					**MEAS. PT. ELEV.**
PURPOSE:					**GROUND ELEV.**
DRILLING METHOD:		SAMPLE	CORE	CASING	**DATUM**
DRILL RIG TYPE:	TYPE				**DATE STARTED**
GROUND WATER DEPTH:	DIA.				**DATE FINISHED**
MEASURING POINT:	WEIGHT				**DRILLER**
DATE OF MEASUREMENT:	FALL				**INSPECTOR**

Depth Ft.	Sample Number	Record PID Response (ppm)	Visual Unaided Inspection - NAPL Observed (Y/N), if yes describe	UV Fluorescence Examination	Results of Soil Jar Shake Test	Remarks / Notes
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

RAMBOLL

FIELD SCREENING LOG

BORING NO.

PROJECT:

SHEET 2 OF

CLIENT:

JOB NO.

Depth Ft.	Sample Number	Record PID Response (ppm)	Visual Unaided Inspection - NAPL Observed (Y/N), if yes describe	UV Fluorescence Examination	Results of Soil Jar Shake Test	Remarks / Notes
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						

RAMBOLL

FIELD SCREENING LOG

BORING NO.

PROJECT:

SHEET 3 OF

CLIENT:

JOB NO.

Depth Ft.	Sample Number	Record PID Response (ppm)	Visual Unaided Inspection NAPL Observed (Y/N), if yes describe	UV Fluorescence Examination	Results of Soil Jar Shake Test	Remarks / Notes
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						

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STANDARD OPERATING PROCEDURE 003A
NAPL FIELD SCREENING PROCEDURE

Project name	**Loeffel Route 203 Property**
Project no.	**73458**
Recipient	**General Electric Company**
Document type	**Draft**
Version	**[0]**
Date	**November 11, 2019**
Prepared by	**Rob Hornung**
Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This standard operating procedure (SOP) provides the following guidance and list of materials for the performance of non-aqueous phase liquid (NAPL) field screening during soil sampling activities. Two field screening methods will be performed to visually detect NAPL, if present, in the soil cores collected. These include an examination of the ultra violet (UV) fluorescence of the soil samples and the use of a hydrophobic dye soil-water shake test.

2. Personnel Qualifications

Field sampling personnel involved with the screening of soil samples will have completed a training course of at least 40 hours meeting the requirements of 29 CFR 1910.120(e) for health and safety at hazardous waste operations. If the course was completed more than 12 months before the date of the site work, completion of an approved 8-hr refresher course will be required. Field activities that involve the screening of soil samples will be performed by an O'Brien & Gere Engineers, Inc. (OBG, a Ramboll company) geologist, hydrogeologist, or field scientist. Field personnel will be familiar with this SOP and possess the required skills, training, field observation documentation and experience necessary to successfully complete field activities.

3. Materials

The following materials and supplies shall be available, as required, during NAPL field screening activities:

- Field log book;
- NAPL field screening log;
- Field sampling personnel business cards;
- Indelible ink pens or pencils;
- Black permanent markers;
- Nitrile gloves;
- Polyethylene sheeting;
- Contractor bags;
- Work table(s);
- Canopy pop-up tent;
- Wooden stakes;
- Field parameter instruments (e.g., photoionization detector [PID]);
- UV fluorescent light;
- Blackout cover;
- Hydrophobic dye;
- Soil jars;
- Resealable plastic zipper bags;
- Aluminum foil;
- Distilled water; and,
- Personal Protective Equipment (PPE) as specified in the Health and Safety Plan (HASP).

4. Procedure

NAPL field screening will be performed in accordance with the following procedures:

1. Perform an initial field screening of the soil core using a PID. The PID will be used to carefully scan the length of the soil core. The geologist, hydrogeologist, or field scientist will note and record the depth and response(s), if any, from the PID on the field screening log (Attachment 003-1).

2. Perform unaided visual inspection of the soil core for the presence of NAPL.

3. If no visual presence of NAPL is observed but any section of the core exhibited significant PID responses (greater than 200 parts per million [ppm]), the geologist, hydrogeologist, or field scientist will take the soil core into a dark area (e.g., underneath the canopy pop-up tent, within a constructed UV blackout box, etc.) and perform an examination of the UV fluorescence of the soil core by scanning the core with a UV fluorescent light. The core will be left in the sampler during the examination so that the sample interval of detected NAPL, if any, can be determined. A specially-designed blackout cover can be constructed for the soil core to further reduce ambient light exposure, if needed. The cover should be constructed and care taken so as to minimize disturbance of the soil core.

4. Following the UV fluorescence screening, a soil jar shake test using a hydrophobic dye (Oil Red O), will be performed on any sections of core exhibiting significant PID responses, greater than 200 ppm or positive indication of NAPL during UV fluorescence screening. Note that UV and jar shake tests do not need to be performed if visual inspection confirms NAPL presence. The soil-water shake test will be performed by placing approximately 30 grams of soil in a glass jar (the geologist, hydrogeologist, or field scientist should leave some of the sample from the tested interval in the core sampler for subsequent lab testing if needed (i.e., do not use up the entire section of the core showing elevated PID for the jar shake test), adding 20 milliliters (ml) of water (being sure to leave a generous air-filled head space) and shaking the sample for approximately one minute. Approximately two milligrams (an amount that would rest on the edge of a toothpick) of a hydrophobic dye (Oil Red O) will then be added to the soil/water mixture. The sample will be shaken for one minute. The presence of NAPL can then be determined based on the color change in the soil jar. If NAPL is present, it will turn red or reddish-pink in color and adhere to the glass in the headspace portion of the jar (NAPL is wetting with respect to air on glass). If necessary, the glass jar should be held up to a light source to better see if NAPL is wetting the glass surface. If large quantities of NAPL are present, it may also be identifiable within the soil pack in the glass jar. Residual waste containing the hydrophobic dye will be containerized separately. The procedures for handling the containerized waste are discussed in Section VI below.

5. After collecting the sample, record the depth of the sample, soil boring location, date, and time of sample collection on the sample container(s) and in the field screening log.

6. If not already performed pursuant to SOP 002 (Soil Sampling Procedure), perform jar headspace analysis screening using a hand-held PID on the interval of soil core that exhibits the highest initial PID screening response per soil core run unless a sample is collected for laboratory analysis. If a sample is collected for laboratory analysis in a given core run, then only a portion of that sample will be used for headspace analysis screening. Collect a soil sample in a clean glass jar to perform headspace readings with a PID. Seal the glass jar with aluminum foil and a screw cap labeled with the appropriate sample identification information, including the depth of the sample, soil boring location, date, and time of sample collection. Each sample will remain sealed for a minimum of ten minutes to allow volatilization to occur. The headspace in each sample will then be screened with the PID by

inserting the tip of the probe through the aluminum foil. The readings will then be recorded in the field screening log. Alternatively, headspace analysis screening can be performed by placing the interval of soil core that exhibits the highest initial PID screening response per soil core run into a clean resealable plastic zipper bag in lieu of a glass jar.

If additional samples are to be collected from the same boring, repeat steps 1 to 6. If refusal has been encountered, move to step 7.

7. Backfill the boring in accordance with the Removal Sampling Work Plan (RSWP) and mark the sample location with a wooden stake indicating the boring identification. Also, sketch the boring location on the site map, if not already identified.

8. Remove waste materials and field screening supplies from the boring location and transfer waste materials in secured sealable 5-gallon buckets or sealed contractor bags into labeled 55-gallon drums at a central location on-site.

5. Decontamination Procedures

Decontamination of all non-disposable equipment used during completion of the field screening program will be performed in accordance with SOP 005 (Field Equipment Decontamination).

6. Handling of Investigation-Derived Materials

Investigation-derived materials (IDM) resulting from performance of NAPL field screening activities will require appropriate management. This IDM includes the following:

- Drill cuttings and potential NAPL impacted soils;
- Residual soil/water mixture containing the hydrophobic dye;
- Groundwater which may have settled out of drill cuttings; and,
- PPE and associated debris resulting from the execution of field activities.

The management of these materials will be performed in accordance with the procedures detailed in the RSWP. Residual soil/water mixture containing the hydrophobic dye will be containerized separately and will be characterized as necessary for profile approval prior to being transported off-site for disposal at a permitted facility. A drum inventory shall be maintained and updated as necessary throughout the duration of the field screening program.

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STANDARD OPERATING PROCEDURE 004
CHAIN-OF-CUSTODY, HANDLING, PACKING AND SHIPPING

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Prepared by	**Rob Hornung**
Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This Standard Operating Procedure (SOP) describes the chain-of-custody, handling, packing, and shipping procedures for the management of samples.

2. Materials

The following materials and supplies, as appropriate, are necessary for chain-of custody, handling, packing, and shipping:

- Field log book;
- Polyethylene bags (resealable-type);
- Clear packing tape, strapping tape;
- Chain-of-custody forms;
- DOT shipping forms, as applicable;
- Custody seals;
- Insulated coolers of adequate size for samples and wet ice;
- Cushioning material (i.e. bubble wrap);
- Temperature blank (typically provided by the laboratory);
- Sample return shipping papers and addresses; and,
- Indelible, blue or black ink pen.

3. Procedures

3.1 Chain-of-Custody

1. Start chain-of-custody records in the field when sample collection is completed, if possible. One completed chain-of-custody record must be kept with each sample cooler at all times.

2. Complete chain-of-custody and sample collection forms in waterproof, non-erasable ink.

3. Complete chain-of-custody forms neatly using printed text. If a simple mistake is made, the error will be lined out with a single line, initialed, and dated.

4. Sequentially number each separate sample entry.

5. Avoid the use of "ditto" or quotation marks to indicate repetitive information in columnar entries.

6. A continuous vertical arrow will be used between the first entry and the next different entry if numerous repetitive entries must be made in the same column.

7. Consecutively number each form using the "Page ___ of ___" format when more than one chain-of-custody form is used for a single shipment.

8. Place additional instructions directly onto the chain-of-custody form, if necessary.

9. Define acronyms used on a chain-of-custody form.

10. The chain-of-custody form will contain the following information:

- Project identification and number;
- Sample description/location;
- Required analyses;
- Date of sample collection;
- Time of sample collection;
- Type and matrix of sample;
- Number of sample containers;
- Analysis requested/special analytical comments;
- Sampler signature/date/time;
- Date/signature/time of the laboratory representative;
- Shipping carrier used to ship sample coolers; and,
- Air bill number if shipped by a commercial carrier.

11. The field sampling team will transport or ship the cooler via an overnight delivery service or hand deliver to the laboratory. Prior to shipment of sample coolers, the field sampling team will contact the laboratory to notify the laboratory of the shipment.

12. The chain-of-custody (COC) document will be completed by the field sampler and provided for each sample cooler. When transferring the possession of samples, individuals relinquishing and receiving will sign, date, and note the time on the COC. Custody of samples must be continuous between parties, and time gaps must not be present. Each shipment of samples to the laboratory must have its own COC record with the contents of the shipment, method of shipment, name of courier, and other pertinent information written on the record.

3.2 Handling

1. The field sampler is personally responsible for the care and custody of the sample until transferred. The field log book or field forms will be used to note information regarding collection of samples and any observations.

2. The following information will be recorded in the field logbook or field forms by the field sampling team:

- Project number and site name;

- Sample identification code and other sample identification information;
- Sampling method;
- Date and time;
- Sample media;
- Name of sampler(s);
- Location of field duplicates and sample identifications; and,
- Locations that field quality control (QC) samples were collected including blind duplicates and matrix spike/matrix spike duplicates.

3. The sample label will be completed with the following information in indelible ink:

   - Sample identification code and other sample identification information;
   - Analysis required;
   - Date and time sampled;
   - Initials of sampling personnel; and,
   - Preservative added, if applicable.

3.3 Packing

1. For aqueous and solid samples, ice that has been placed in heavy-duty polyethylene bags and properly sealed will be placed on top of or between the samples. Samples will be packed securely to eliminate breakage during shipment.

2. Sampling containers will be packed with packing materials. When possible, sample container preparation and packing for shipment will be completed in a well-organized and clean area. Sample containers will be prepared for shipment by wiping containers clean of debris/water using paper towels.

3. The chain-of-custody record will be placed into a ziploc plastic bag; the bag will be placed inside the cooler; and the top of the cooler will be closed and securely taped (preferably with fiber tape) shut. One custody seal will be affixed to the latch and lid of the cooler. Custody seals will consist of adhesive-backed tape that easily rips if it is disturbed. The field sampler will initial and date the seal. The seal must be broken to open the cooler and will indicate tampering if the seal is broken before receipt at the laboratory.

4. A label containing the name and address of the shipper will be placed on the outside of the container.

3.4 Shipping

1. All samples should be delivered by an express carrier within 24 hours of sample collection. Alternatively, samples may be delivered directly to the laboratory or laboratory service center, or a laboratory courier may be used for sample pickup.

2. Sampling personnel will take precautions to ship or deliver samples to the laboratory so that the holding times will not be exceeded.

3. Samples must be maintained at ≤6 °C[1] until shipment and through receipt at the laboratory.

When the samples are received by the laboratory, laboratory personnel will complete the chain-of-custody by recording the date and time of receipt of samples, measuring and recording the internal temperature of the shipping container, and checking the sample identification numbers on the containers to ensure they correspond with the chain-of-custody forms.

4. Data Recording and Management

The original chain-of-custody record accompanies the shipment, and the copies are kept with the field log book, field forms, and distributed to the Project Manager and project team. The laboratory will immediately contact the Project Manager if issues pertaining to sample condition or documentation are detected (i.e., broken security seal; broken; open, or otherwise compromised sample containers; chain-of-custody information in disagreement with sample labels; etc.).

5. Quality Assurance

Chain-of-custody forms will be legibly completed in accordance with the Quality Assurance Project Plan (QAPP). A copy of the completed chain-of-custody form will be sent to the Project Manager or designee for review.

5.1 Duplicate Samples

Duplicate samples are prepared by alternately filling the container for the "primary sample" for a particular parameter and then filling the container for the "duplicate sample" for that same parameter. Duplicate samples need to be included on the chain-of-custody.

[1] Considering the temperature and conditions at the Site during sample collection, if samples are hand-delivered to the laboratory and are received by the laboratory within 8 to 12 hours of sample collection, cooler temperatures may exceed the preservation requirements, This exception applies only if: (1) samples are properly chemically preserved; (2) the sample cooler contains sufficient ice for the samples to reach the required temperatures within 24 hours of samples being placed in the cooler; and (3) the samples are not insulated from exposure to ice with bubble wrapping. Sample results determined to be impacted by a rapid delivery to the laboratory (within 8 to 12 hours of sample collection) will not be flagged during data validation.

5.2 Trip Blanks

Trip blanks are prepared in the laboratory and are shipped from the laboratory with the applicable sample collection vials for each project. The trip blank vials should be inspected for air bubbles upon receipt from the laboratory. The trip blanks are not opened in the field. A trip blank should be present in each shipping cooler containing samples to be analyzed for volatile compounds. Trip blanks need to be included on the chain-of-custody form.

5.3 Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates (MS/MSDs) are collected in the same manner as a duplicate sample. MS/MSDs need to be included on the chain-of-custody form.

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STANDARD OPERATING PROCEDURE 005
FIELD EQUIPMENT DECONTAMINATION

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Recipient	**General Electric Company**
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Prepared by	**Rob Hornung**
Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This Standard Operating Procedure (SOP) describes the steps to be used to decontaminate equipment. Equipment decontamination is performed such that sampling or monitoring equipment is free from analytes of interest and/or constituents that would interfere with laboratory analysis for analytes of interest. Equipment that may require decontamination includes non-disposable sampling equipment, monitoring equipment, and water testing instruments. Non-disposable equipment will be cleaned before collecting each sample, between sampling events, and prior to leaving the site. Dedicated and/or disposable (not to be re-used) sampling equipment will not require decontamination.

2. Materials

The following materials will be available during equipment decontamination:

- Distilled water;
- Non-phosphate detergent (e.g., Seventh Generation Free and Clear Solution);
- Potable water;
- Brushes;
- Contractor bags;
- Spray bottles;
- Paper towels;
- Plastic sheeting; and,
- 5-gallon buckets with snap on lids or equivalent for performing decontamination.

3. Procedures

Equipment decontamination areas will be set up within or adjacent to the specific work areas or in a dedicated temporary decontamination station. Decontamination will be conducted as follows:

1. Prepare a wash bucket by filling a clean 5-gallon bucket with potable water and adding a small amount of non-phosphate detergent. Prepare a rinse bucket by filling a 5-gallon bucket with potable water.

2. Wash and scrub the equipment using brushes in the wash bucket.

3. Remove as much soap residue as possible prior to placing the equipment into the rinse bucket. Rinse in the rinse bucket to remove the remaining soap residue.

4. Remove the equipment from the rinse bucket and rinse equipment with distilled water.

5. Wrap the decontaminated equipment in aluminum foil or place inside clean contractor bags prior to next use.

3.1 Decontaminating Submersible Pumps

Submersible pumps may be used during groundwater sampling activities. The pumps will be cleaned and flushed before and between uses. This cleaning process will consist of an external detergent solution wash and potable water rinse, a flush of detergent solution through the pump, followed by a flush of potable water and distilled water through the pump. Flushing will be accomplished by using an appropriate container filled with detergent solution and other containers filled with potable water and distilled water. The pump will run long enough to effectively flush the pump housing and hose (unless new, disposable hose is used). Caution should be exercised to avoid contact with the pump casing and water in the container while the pump is running (do not use metal drums or garbage cans) to avoid electric shock. Disconnect the pump from the power source before handling. After decontamination, the pump should be wrapped in aluminum foil and the pump and hose should be placed on or in clean polyethylene sheeting or a clean contractor bag, as necessary, to avoid contact with the ground surface.

4. Handling of Decontamination Water

The management of decontamination water will be performed in accordance with the Removal Sampling Work Plan (RSWP).

5. Data Recording and Management

Equipment cleaning and decontamination will be noted in the field log book. Information will include the type of equipment cleaned, the decontamination location, and any deviations from this SOP.

6. Quality Assurance

6.1 Equipment Blanks

Equipment blanks will be collected to verify that the decontamination procedures of non-dedicated equipment are effective in minimizing potential for cross contamination. The equipment blank is prepared by pouring analyte-free water provided by the laboratory over the clean and dry equipment, and collecting the rinsate into appropriate sample containers. Equipment blanks will be collected at the frequency and analyzed for the parameters described in the Quality Assurance Project Plan (QAPP).

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STANDARD OPERATING PROCEDURE 006
WATER LEVEL MEASUREMENT

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Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This Standard Operating Procedure (SOP) describes procedures associated with measuring and recording groundwater levels, non-aqueous phase liquid (NAPL) levels and thicknesses, if present, and total well depths. Groundwater levels, NAPL thicknesses, and total well depths may be measured using an electronic water level probe or electronic interface probe. Groundwater levels, NAPL levels and thicknesses, and total well depths will be measured from an established, surveyed, reference point, typically marked on the top of the well casing. Groundwater levels and NAPL levels will be converted to elevations by subtracting the depth to the groundwater or NAPL surface within the well from the reference point elevation.

2. Materials

The following materials will be available during water level, NAPL level, and total depth measurements:

- Electronic water level probe with sufficient cable length to reach the water level in the well or total well depth, if applicable;
- Electronic interface probe with sufficient cable length to reach the NAPL level in the well and total well depth (if collecting NAPL level measurements);
- Well keys;
- Nitrile gloves;
- Field parameter instruments [e.g., photoionization detector (PID)];
- Decontamination supplies (spray bottles containing non-phosphate detergent with distilled water and distilled water, paper towels);
- Contractor bags;
- Indelible blue or black ink pen; and,
- Field log book and field forms.

3. Procedures

1. Record the monitoring well identification/number in the field log book or on the field form along with date and time using indelible ink.

2. Don a new pair of nitrile gloves.

3. Stand upwind of the monitoring well and unlock and open the monitoring well. Measure the air in the breathing zone above the open monitoring well with the PID to confirm that no potential airborne volatile organic compound (VOC) contaminant concentrations are above appropriate working conditions per the Health and Safety Plan (HASP). Record the concentrations, if any, measured in the field log book or on the field form.

4. For wells with screen intervals below the water table, the well must be vented to the atmosphere or the water level should be allowed to stabilize prior to recording the ground water level. With no venting to the atmosphere, a vacuum or pressure can develop within the well with the rise and fall of the ground water elevation. This vacuum or pressure will prevent the ground water level from

stabilizing to atmospheric pressure until the well is uncapped. When the well cap is removed the water level will begin to equilibrate, but in low permeable formations that equilibration can require an extended period of time. Unless one knows that a well will equilibrate in seconds, field personnel shall measure the water level multiple times over an extended period of time (up to a few minutes) to confirm that the water level has stabilized prior to recording the water level on the field log book or field form.

5. Locate the reference point on the well casing. If a reference point is not present, create one by marking the casing at its highest point using a permanent marker. Document in the field log book that a new reference mark has been established.

6. If using an electronic water level probe, slowly lower the water level indicator probe until it emits a tone and/or light indicating that the water surface has been encountered. Record the water level from the reference mark to the nearest 0.01 feet.

7. If collecting a total well depth measurement, continue to lower the level indicator probe to the bottom of the well. Record the total well depth from the reference mark to the nearest 0.01 feet.

   Note: If there is a protective tip on the sonde between the electrical sensor and tip of the probe, the length of this protective tip must be added into the total measured length when measuring well depth.

8. If collecting a NAPL depth/thickness measurement, slowly lower the electronic interface probe until it emits a tone and/or light indicating whether light non-aqueous phase liquid (LNAPL) is present. Continue to lower the interface probe until it indicates the top of water. To collect dense non-aqueous phase liquid (DNAPL) measurements, lower the electronic interface probe to the bottom of the well noting the depth of DNAPL, if any, based on the signal emitted by the interface probe. Record the NAPL level and thickness from the reference mark to the nearest 0.01 feet.

9. When finished with the water level, NAPL measurement, or total depth measurement, decontaminate the water level or electronic interface probe measuring device per the SOP 005 (Field Equipment Decontamination).

10. Secure the well head by locking the lock.

4. Handling of Investigation-Derived Material

Decontamination water, if generated, and used personal protective equipment (PPE) will be managed in accordance with the Removal Sampling Work Plan (IWP).

5. Data Recording and Management

Data recording and management will be conducted per the SOP 001 (Field Log Book Entries).

6. Quality Assurance

Water level, oil/water interface, and total depth measurements will be confirmed by raising and lowering the measuring device) to obtain multiple readings to check that consistent readings are obtained.

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STANDARD OPERATING PROCEDURE 007
MONITORING WELL DEVELOPMENT

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Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This Standard Operating Procedure (SOP) provides the following guidance and list of materials for the performance of monitoring well development. Well development will be completed to:

- Remove fine-grained materials from the sand pack, well screen, and formation that may have settled during drilling and well installation;
- Reduce the turbidity of groundwater samples; and,
- Improve the hydraulic connection between the well, filter pack, and the surrounding formation.

Monitoring well development should be completed no less than 24 hours after the completion of monitoring well installation. A submersible pump or inertial pump with surge blocks will be used to surge within the screened interval of the well with the goal being to achieve visibly sediment-free groundwater discharge and/or stabilization of the water quality parameters (i.e., pH, temperature, specific conductivity, and turbidity). If water quality parameters do not stabilize or groundwater continues to be observed with sediment, development will be considered complete when a volume of groundwater equivalent to 10 well volumes has been removed. For slowly recharging monitoring wells, development will be considered complete when a minimum of three well volumes are removed regardless of turbidity values or water quality parameter stabilization.

1.1 Associated Procedures

Refer to additional SOPs provided in the Quality Assurance Project Plan (QAPP), as needed and appropriate. These may include, but are not limited to:

- SOP 001 – Field Log Book Entries;
- SOP 005 – Field Equipment Decontamination; and,
- SOP 006 – Water Level Measurement.

This SOP does not address the management of investigation-derived materials (IDM). Refer to the appropriate work plan for considerations pertaining to the management of IDM.

2. Personnel Qualifications

Field activities that involve monitoring well development will be completed by an O'Brien & Gere Engineers, Inc. (OBG, a Ramboll company) geologist, hydrogeologist, or field scientist. The geologist, hydrogeologist, or field scientist will have completed a training course of at least 40 hours meeting the requirements of 29 CFR 1910.120(e) for health and safety at hazardous waste operations. If the course was completed more than 12 months before the date of site work, completion of an approved 8-hr refresher course will be required. Field personnel will be familiar with the relevant SOPs and possess the required skills, training, and experience necessary to complete field activities.

3. Procedures

As required, the following materials shall be available during the monitoring well development activities:

- Well construction records;
- Field parameter instruments [e.g., photoionization detector (PID)];
- Development pump (e.g., submersible pump, waterra hydrolift inertial pump, buffalo pump, etc.)
- Dedicated low-density polyethylene (LDPE) or high-density polyethylene (HDPE) tubing;
- Foot valves;
- Surge blocks;
- Electronic water level indicator;
- Flow rate measurement supplies (i.e., graduated 5-gallon buckets and stop watch);
- Power source (e.g., portable generator or nearby electrical outlet with GFI protection);
- Purge water container (e.g., bucket, drum, or polyethylene tank);
- Water quality meter that measures the following parameters:
    - Temperature measured in degrees Celsius (°C);
    - pH measured in standard units (SU);
    - Specific conductivity, measured in microsiemens, millisiemens or Siemens per centimeter (µS/cm, mS/cm, or S/cm);
- Meter for measuring turbidity in nephelometric units (NTU);
- Flow through cell or measurement cup;
- Three-way valve to act as a bypass;
- Check valve to prevent back flow should the pump stop;
- Plastic sheeting;
- Contractor bags;
- Paper towels;
- Personal protective equipment (PPE) as required by the Health and Safety Plan (HASP);
- Decontamination supplies per SOP 005 (Field Equipment Decontamination); and,
- Field log book and field forms.

4. Monitoring Well Development Procedures

This section discusses the procedures to be followed before, during, and after monitoring well development, and the necessary steps to document the monitoring well development activity.

4.1 Pre-Well Development Procedures

1. Identify the locations of the monitoring wells to be developed.

2. Perform calibration checks on field monitoring instruments as recommended by manufacturer and document per SOP 001 (Field Log Book Entries).

3. Don appropriate PPE as required by the HASP.

4. Begin monitoring the breathing zone of field personnel for volatile organic compounds (VOCs) in accordance with procedures outlined in the HASP.

5. Record the following information on the monitoring well development log:

    a. pump type / identification number; and,

    b. depth to water and bottom of the monitoring well as described in SOP 006 (Water Level Measurement).

6. Calculate the length of the water column:

$$LWC = DTB - DTW$$

$Where$:
$LWC = Length\ of\ water\ column\ (feet)$
$DTB = Depth\ to\ bottom\ of\ the\ monitoring\ well\ (feet\ below\ datum)$
$DTW = Depth\ to\ water\ (feet\ below\ datum)$

7. Calculate the volume of water in the monitoring well by multiplying the LWC by the gallons per foot appropriate for the diameter of the well as shown below:

Diameter (inches)	**Volume Conversion** (gallons/foot)
1	0.041
2	0.163
3	0.367
4	0.653
5	1.020
6	1.469
8	2.611
10	4.080

8. Record the length of water column and well volume on the monitoring well development log.

4.2 Monitoring Well Development Procedure

1. Attach the LDPE tubing to the development pump if using a submersible pump or buffalo pump. Attach a foot valve and surge blocks to the HDPE tubing if using a waterra hydrolift inertial pump. Install the pump in the well by slowly lowering the pump, tubing, and the pump electrical lead cable, if present, or the tubing, foot valve, and surge blocks, depending on the type of pump being used, into the well to the specified development depth. Generally, the pump should first be installed so that it sits at the upper portion of the screen interval.

2. If using a submersible pump, attach the check valve, three-way valve, and assemble and attach the flow-through cell/in-line water quality meter between the pump and the purge water container.

3. Attach tubing from the outlet of the flow-through cell to the purge water container ensuring that the end of the tubing discharges above the water surface in the container to prevent the potential for purge water backflow into the well when the pump is turned off.

4. Attach the pump electrical lead to the pump control box. If using a waterra hydrolift inertial pump, attach electrical lead into the controller.

5. Start the generator.

6. Plug the pump control box or electrical lead from the controller into the power source.

7. If using a submersible pump, set the three-way valve to direct the discharge through the flow-through cell and into the purge water container.

8. Begin purging at a flow rate of approximately 500 milliliters per minute (ml/min).

9. After the flow-through cell, or measurement cup if not using the submersible pump for development has completely filled, record the initial water quality parameters (temperature, pH, specific conductivity,) on the development log.

10. Record the initial characteristics of the discharge water (i.e. color, odor, and sheen/free product) on the development log.

11. If using a submersible pump, adjust the three-way valve to bypass the flow-through cell to direct discharge into the purge water container. If not using the submersible pump, fill the turbidity vial directly from the discharge of the HDPE tubing. Measure the turbidity and approximate flow rate and record the values on the development log.

12. Increase the flow rate to the maximum capacity of the pump.

13. The screen interval of the well will be surged in 2 to 3-foot sections by using the submersible pump as a surge block or the surge blocks on the HDPE tubing attached to the foot valve.

14. One well volume will be purged from each 2 to 3-foot surging interval.

15. Starting at the top of the screen interval of the well, surge a 2 to 3-foot section of the well by raising and lowering the pump tubing or HDPE tubing, surge blocks, and foot valves repeatedly to agitate the water column being careful not to impact the bottom of the well with the pump or foot valve. Secure the pump tubing near the base of the interval and continue to remove water from the well.

16. Continue purging the interval until the turbidity visibly decreases, if possible. Repeat the surging and purging process in this interval until one well volume has been purged or the discharge turbidity remains below 50 NTU while surging.

17. Lower the pump or tubing to the 2 to 3-foot section immediately below the previous, and surge this section of the well by raising and lowering the pump or tubing repeatedly to agitate the water column.

18. Repeat steps 15 through 17 until each 2 to 3-foot section of the screened interval of the well has been surged and purged as described above. Once each 2 to 3-foot section has been surged and purged, set the pump and tubing at the midpoint of the well screen.

19. Measure and record the depth to water, flow rate, and water quality parameters every well volume removed.

20. Continue purging until 10 well volumes have been purged or the water quality parameters and/or turbidity have remained stable (as listed below) for three consecutive recording intervals:

    a. Temperature (±10%);
    b. pH (±0.10 SU);
    c. Specific conductivity (±10%); and,
    d. Turbidity (50 NTU or less).

21. For slowly recharging monitoring wells, development will be considered complete when a minimum of three well volumes are removed regardless of turbidity values or water quality parameter stabilization.

22. Record the final characteristics of the discharge water (i.e. color, odor, and sheen/free product) and total volume purged on the development log.

23. Stop the pump, turn off the generator or disconnect the power source.

4.3 Post Development Procedures

1. As the pump assembly or tubing is removed from the well, separate and coil the discharge tubing taking care to minimize contact with the ground.

2. Set aside the pump, flow-through cell, and other non-disposable/non-dedicated down-well equipment for decontamination per SOP 005 (Field Equipment Decontamination).

3. Measure the final total depth of the well and record the final total depth in the field log book or field form.

4. Record the completion time of monitoring well development in the field log book.

5. Manage the IDM in a manner consistent with the work plan.

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STANDARD OPERATING PROCEDURE 008
LOW FLOW PROCEDURE

Project name	**Loeffel Route 203 Property**
Project no.	**73458**
Recipient	**General Electric Company**
Document type	**Draft**
Version	**[0]**
Date	**November 12, 2019**
Prepared by	**Rob Hornung**
Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This Standard Operating Procedure (SOP) describes the steps to be used to collect groundwater samples from monitoring wells using the low-flow sampling technique. The low-flow sampling technique is used to collect samples that are representative of groundwater conditions in the geologic formation. There are three primary benefits of sampling using the low-flow technique. First, it minimizes disturbances of sediment at the bottom of the well, thus producing a sample with low turbidity. Second, it minimizes the aeration of groundwater during sample collection. Third, it significantly reduces the volume of purged groundwater.

2. Materials

As required, the following materials shall be available during the collection of groundwater samples with the low-flow sampling technique:

- Well construction records;
- Field parameter instruments [e.g., photoionization detector (PID)];
- Sampling pump (e.g., submersible pump, bladder pump, etc.)
- Dedicated or new low-density polyethylene (LDPE) tubing;
- Electronic water level indicator;
- Flow rate measurement supplies (i.e., graduated cylinder and stop watch);
- Power source (e.g., portable generator or nearby electrical outlet with GFI protection or source of compressed gas if using a bladder pump [compressed gas cylinder or oil free compressor]);
- Purge water container (e.g., 5-gallon buckets);
- Water quality meter that measures the following parameters:
    - Temperature measured in degrees Celsius (°C);
    - pH measured in standard units (SU);
    - Specific conductivity, measured in microsiemens, millisiemens or Siemens per centimeter (µS/cm, mS/cm, or S/cm);
    - Oxidation-reduction potential (ORP), measured in millivolts (mV);
    - Dissolved oxygen (DO), measured in milligrams per liter (mg/l);
- Meter for measuring turbidity in nephelometric units (NTU);
- Flow through cell;
- Three-way valve to act as a bypass for collection of turbidity readings;
- Check valve to prevent back flow should the pump stop;
- Plastic sheeting;
- Contractor bags;
- Paper towels;
- Sample containers;
- Sample coolers;
- Wet ice;
- Ziploc sealable bags;
- Single-use disposable filter that fits the LDPE tubing, as applicable;
- Personal protective equipment (PPE) as required by the Health and Safety Plan (HASP);

- Decontamination supplies per SOP 005 (Field Equipment Decontamination); and,
- Field log book and field forms.

3. Procedures

3.1 Pre-Sampling Activities

1. Determine the order of sampling.

2. Perform calibration checks on field monitoring instruments as recommended by manufacturer and document per SOP 001 (Field Log Book Entries).

3. Lay out a sheet of polyethylene sheeting or contractor bag around the well to be sampled.

4. Don appropriate PPE as described in the HASP.

5. If required by the site HASP, monitor for volatile organic compounds (VOCs) in accordance with procedures outlined in the HASP.

6. Measure and record the depth to water and the total depth of the well as described in SOP 006 (Water Level Measurement).

3.2 Groundwater Sample Collection

1. Install the pump in the well. Attach new or LDPE tubing to the pump. Slowly lower the pump, tubing, and the pump electrical lead cable or air lines, depending on the type of pump being used, into the well to the specified sample depth. Generally, the pump should be installed so that it sits at the mid-point of the screened interval.

2. Measure and record the depth to water in the well as described in SOP 006 (Water Level Measurement). Leave the water level probe suspended in the well for use during purging.

3. Attach the three-way valve, check valve, and flow through cell and/or in-line water quality meter between the pump and the purge water container.

4. Attach tubing from the outlet of the flow through cell and/or meter to the purge water container ensuring that the end of the tubing discharges above the water surface in the container to prevent the potential for purge water backflow into the well when the pump is turned off.

5. Attach the pump electrical lead or air lines to the pump control box.

6. If using a generator, place the generator downwind of the sampling location to the extent feasible, then start the generator.

7. Plug the pump control box into the power source or connect air lines to source of compressed gas, depending on the type of pump being used.

8. During low-flow sampling, the pump should produce a flow rate of no less than 100 milliliters per minute (ml/min) and no greater than 500 ml/min. Measure and record the depth to water every 3 to 5 minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 feet or less). Adjust the flow rate as necessary so that pumping does not induce drawdown.

9. During purging of the well, measure and record the field parameters (temperature, pH, specific conductivity, ORP, DO and turbidity) at the same frequency as the depth to water measurements. Purging and field parameter monitoring should continue until the field parameters have stabilized for at least three consecutive measurements. Stabilization is defined as:

    a. pH within ± 0.1 SU;

    b. Specific conductivity within ± 3%;

    c. ORP within ± 10 mV;

    d. DO ± 10%; and,

    e. Turbidity ± 10% above 10 NTU or three consecutive readings below 10 NTU.

Evaluate field parameters to ensure consistency in parameter relationships (e.g., if ORP is negative, DO should be very low or 0 mg/l).

10. Once stabilization has occurred, disconnect the in-line water quality meter while continuing to purge the well, taking care to not allow water to spill on the ground surface.

11. The pump should not be turned off prior to sampling. If, at any point, the pump shuts down or flow is lost, stabilization must be re-achieved before sampling, even if it has already been achieved.

12. Field personnel conducting the sampling should don a new pair of nitrile gloves immediately before sampling the groundwater.

13. Label the sample containers as outlined in the Quality Assurance Project Plan (QAPP).

14. Sampling should be conducted using flow rates between 100 and 250 ml/min. Samples for VOC analysis should be collected first. If field-filtered samples are to be collected, collect all unfiltered

samples first, then attach a single-use filter to the LDPE tubing. Sample through the filter for any field-filtered samples.

15. After the samples have been collected, turn off the pump control box and then turn off the pump power supply (i.e., the electrical or compressed gas sources). Disconnect the pump control box from the power supply, and then disconnect the pump electrical lead or air lines from the control box.

16. Remove the pump, LDPE tubing, and electrical or air lines from the well, while winding the lead cable back around the reel to minimize tangling. The LDPE tubing should not be allowed to touch the ground and should be coiled as it is pulled out of the well. If the tubing is to be dedicated, it should be placed back in the well after the pump has been removed or the coil should be placed in a clean and labeled contractor bag for future use. If the LDPE tubing will be discarded, it should be cut into manageable pieces and discarded in accordance with the Removal Sampling Work Plan (RSWP).

17. Close and lock the well. Clean up all equipment and discard polyethylene sheeting or contractor bags in accordance with the waste management procedures discussed in the RSWP.

18. Decontaminate the pump prior to its next use by following the procedure outlined in SOP 005 (Field Equipment Decontamination). It is recommended that the pump be disassembled during decontamination.

4. Quality Assurance

Specific details related to field quality assurance and quality control (QA/QC) samples are described in the QAPP. A brief overview of the collection of QA/QC samples is included here for reference.

4.1 Duplicate Samples

Duplicate samples are prepared by alternately filling the container for the "primary sample" for a particular parameter and then filling the container for the "duplicate sample" for that same parameter. Duplicate samples need to be included on the chain-of-custody.

4.2 Trip Blanks

Trip blanks are prepared in the laboratory and are shipped from the laboratory with the applicable sample collection vials for each project. The trip blank vials should be inspected for air bubbles upon receipt from the laboratory. The trip blanks are not opened in the field. A trip blank should be present in each shipping cooler containing samples to be analyzed for VOCs. Trip blanks need to be included on the chain-of-custody form.

4.3 Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates (MS/MSDs) are collected in the same manner as a duplicate sample. MS/MSDs need to be included on the chain-of-custody form.

4.4 Equipment Blanks

Equipment blanks are prepared by slowly pouring laboratory-quality deionized (DI) water over decontaminated, non-dedicated sampling equipment (i.e., submersible pump, etc.) and sampling the resulting run-off by catching it in the appropriate sampling container. An equipment blank should be collected for the same analyses as the samples. Equipment blanks need to be included on the chain-of-custody form.

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STANDARD OPERATING PROCEDURE 009
PHOTOIONIZATION DETECTOR (PID)

Project name	**Loeffel Route 203 Property**
Project no.	**73458**
Recipient	**General Electric Company**
Document type	**Draft**
Version	**[0]**
Date	**November 12, 2019**
Prepared by	**Rob Hornung**
Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This Standard Operating Procedure (SOP) describes the use of a photoionization detector (PID) to measure total organic vapors in work breathing zones. A PID is a portable, hand-held monitoring instrument that measures total organic compounds by photoionization of organic vapors. Monitoring for the potential presence of organic vapors in work breathing zones is required by the Health and Safety Plan (HASP).

2. Materials

- Health and safety plan;
- Personnel protective equipment (PPE) as specified in the HASP for the activity to be conducted;
- Operating manual for the model of PID in use;
- PID with appropriate lamp rating for the volatile organic compounds known or anticipated to be present in the work area. The instrument will not detect/measure volatile organic compounds that have ionization potentials above the rating of the lamp;
- Calibration gas;
- Field log book or field log forms; and,
- Indelible, blue or black ink pen.

3. Procedures

1. Charge the PID before use each day.

2. Connect the measurement probe to the instrument (if necessary depending on the model of PID), turn on the instrument, and make necessary operational checks in accordance with the manufacturer's instructions provided in the operating manual.

3. Calibrate the instrument using appropriate calibration gas and calibration steps in accordance with the manufacturer's instructions provided in the operating manual.

4. Return instrument to its monitoring mode.

5. Point the tip of the probe into the breathing zone to be monitored and observe the readings measured in parts per million (ppm).

6. Record the highest reading observed in the field log book or field log form and compare the reading to action levels identified in the HASP. Make appropriate upgrades to PPE, if necessary, as specified in the HASP.

4. Quality Assurance

At the beginning of each day of use, make sure the PID battery is fully charged, is in proper working order, and calibrated in accordance with manufacturer's specifications. If problems are observed when using or calibrating the PID, refer to the manufacturer's instructions to trouble-shoot the problem, and/or replace the PID if necessary.

Be aware that high humidity can interfere with the operation of the PID and can cause the PID to stop working or give erroneous readings. If the PID is believed to be responding abnormally and moisture is the suspected cause, use the calibration gas as a check (not calibration) on the instrument response. If the PID reading is lower or higher than the concentration of the calibration gas then dry out the probe and ionization chamber in accordance with the manufacturer's instructions before using the PID.

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STANDARD OPERATING PROCEDURE 010
UNDERGROUND STORAGE TANK SOFT DIG AND SAMPLING

Project name	**Loeffel Route 203 Property**
Project no.	**73458**
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Prepared by	**Rob Hornung**
Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This Standard Operating Procedure (SOP) describes the procedures to be used by O'Brien & Gere Engineers, Inc. (OBG, a Ramboll company) field personnel performing oversight and sampling activities associated with the Underground Storage Tank (UST) soft dig and sampling as presented in the Removal Sampling Work Plan (RSWP). All work requirements associated with soft digging (including the use of a truck-mounted vacuum excavator) to expose the top of the UST will be performed by an approved sub-contractor under oversight by OBG personnel.

2. Materials

The following materials, as required, will be available during collection of the UST samples:

- Sample bottles (kept closed in the laboratory-supplied containers or an appropriately sealed container under custody until the samples are collected);
- Sampler coolers;
- Chain-of-custody labels, tags, seals;
- Field book and indelible ink pens or markers;
- Digital camera to document sample collection and location;
- Weighted bailer or equivalent;
- Peristaltic pump with appropriate low-density polyethylene (LDPE) and silicon tubing;
- Plastic sheeting;
- Contractor bags;
- Paper towels;
- Twine;
- Measurement cup;
- Plastic bags for ice and/or sample sets;
- Nitrile gloves;
- Wet ice;
- Containers with snap on lids for investigation-derived materials (IDM);
- Field parameter instruments [i.e., photoionization detector [PID], etc.];
- Electronic interface probe;
- Gauge stick; and
- Additional Personal Protective Equipment (PPE) as required by the Health and Safety Plan (HASP)

3. Procedure

As discussed in the RSWP, based on the results of the surface geophysical survey, the top of the UST will be exposed to locate a possible location for collecting a sample of the contents through a port, pipe, or bung. The top of the UST is estimated to be approximately 2 to 3 feet below grade. Exposing the top of the tank may reveal one or more connections to the tank such as a riser fill pipe and/or vent pipe. If present, the riser pipe or vent pipe joint at the top of the UST will be loosened to gain access to the tank to determine if any liquid is present. If liquid is present in the tank, an estimate of the approximate

volume of material will be made prior to attempting to collect a sample of the contents. The integrity of the tank will not be compromised to estimate the volume of the tank contents or attempt to collect a sample. If the UST contains liquids and/or solids, additional disposal characterization sampling will be performed in accordance with the RSWP in order to determine the best way of managing the contents. Once the sampling activities have been completed, the shallow excavation will be backfilled to the height of the surrounding grade. UST gauging and sample collection procedures will be completed as follows:

1. Place plastic sheeting adjacent to the sampling location for use as a clean work area if conditions allow. Otherwise, prevent sampling equipment or sample contents from contacting the ground or other surfaces that could compromise sample integrity or cross-contaminant clean areas.

2. Clean dedicated sampling equipment (i.e., weighted bailer or equivalent, peristaltic pump with appropriate LDPE and silicon tubing, etc.) should be used. Non-disposable sampling equipment will be avoided for sample collection.

3. Don appropriate PPE as described in the HASP.

4. Remove the exposed bung or seal on the UST, as necessary, to obtain access for assessing the tank to determine if material is present for gauging the contents of the tank and sampling.

5. Monitor the breathing zone in the area adjacent to the exposed bung or seal on the UST with field parameter instrumentation. Don additional PPE based on the readings provided by field instrumentation as required in the HASP.

6. Obtain measurements of the size of the tank and attempt to measure the depth to liquid and/or product utilizing an interface probe per the procedures outlined in SOP 006 (Water Level Measurement). Alternatively, a gauge stick can be used in lieu of an interface probe.

7. If an appropriate volume of material is in the UST for sample and parameter collection, slowly lower a weighted bailer or equivalent attached to twine into the tank and fill the bailer with the contents of the UST. Slowly pull the bailer with the UST contents through the open bung, port, or pipe out of the tank. Alternatively, if a bailer will not fit through the open pipe, port, or bung, a peristaltic pump with appropriate tubing may be used to obtain material from the UST.

8. Slowly lower the weighted bailer or peristaltic pump tubing back down the open pipe, port, or bung and continue to collect material from the UST for sample collection.

9. Begin filling sample bottles with the UST contents. Sample bottles shall be filled in the following order:
    - VOCs by USEPA SW-846 Method 8260C;
    - SVOCs by USEPA SW-846 Method 8270D;
    - PCBs by USEPA SW-846 Method 8082A;
    - Pesticides by USEPA SW-846 Method 8081B;
    - Total and dissolved metals by USEPA SW-846 Method 6010D;
    - Mercury by USEPA SW-846 Method 7470A; and,
    - Total cyanide by USEPA SW-846 Method 9012B.

10. Complete any remaining information on the sample labels using indelible ink pens or markers as outlined in the QAPP.

11. Place the sample containers on wet bagged ice in sample coolers immediately following sample collection. Samples will be cooled to ≤6 degrees °C[1] for submittal to the analytical laboratory.

12. Complete appropriate sample collection forms and record the information in the field notes.

13. Record the sample collection on the chain-of-custody and ship the samples to the laboratory under chain-of-custody following SOP 004 (Chain-of-Custody, Handling, Packing, Shipping).

14. Backfill the soil surrounding the UST that was exposed for sample collection to the existing grade.

4. Waste Management

Waste generated during this sample collection will be IDM such as buckets containing residual contents from the UST and, if any, decontamination fluids. Additional IDM from the sample collection will consist of spent PPE such as nitrile gloves and Tyvek® coveralls. All IDM generated during sample collection will be managed in accordance with the procedures outlined in the RSWP.

5. Quality Assurance

Specific details related to field quality assurance and quality control (QA/QC) samples are described in the QAPP. A brief overview of the collection of QA/QC samples is included here for reference.

5.1 Duplicate Samples

Duplicate samples are prepared by alternately filling the container for the "primary sample" for a particular parameter and then filling the container for the "duplicate sample" for that same parameter. Duplicate samples need to be included on the chain-of-custody. No duplicate samples are anticipated to be collected during UST sampling.

5.2 Trip Blanks

Trip blanks are prepared in the laboratory and are shipped from the laboratory with the applicable sample collection vials for each project. The trip blank vials should be inspected for air bubbles upon receipt from the laboratory. The trip blanks are not opened in the field. A trip blank should be present in each shipping cooler containing samples to be analyzed for VOCs. Trip blanks need to be included on the chain-of-custody form.

[1] Considering the temperature and conditions at the Site during sample collection, if samples are hand-delivered to the laboratory and are received by the laboratory within 8 to 12 hours of sample collection, cooler temperatures may exceed the preservation requirements. This exception applies only if: (1) samples are properly chemically preserved; (2) the sample cooler contains sufficient ice for the samples to reach the required temperatures within 24 hours of samples being placed in the cooler; and (3) the samples are not insulated from exposure to ice with bubble wrapping. Sample results determined to be impacted by a rapid delivery to the laboratory (within 8 to 12 hours of sample collection) will not be flagged during data validation.

5.3 Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates (MS/MSDs) are collected in the same manner as a duplicate sample. MS/MSDs need to be included on the chain-of-custody form. Given the nature of the potential contents of the UST, it is not anticipated that an MS/MSD sample will be collected during UST sampling.

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STANDARD OPERATING PROCEDURE 011
SEDIMENT SAMPLING AND SOFT SEDIMENT PROBING

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Prepared by	**Rob Hornung**
Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This Standard Operating Procedure (SOP) describes the procedures to be used by O'Brien & Gere Engineers, Inc. (OBG, a Ramboll company) field personnel performing sediment sampling and soft sediment probing as presented in the Removal Sampling Work Plan (RSWP). This SOP is designed to provide information for collection of sediment thickness and sediment samples from the pond located on the Loeffel Route 203 Property. Grab samples are anticipated to be collected from the pond using the materials and procedures described below.

1.1 Responsibilities and Qualifications

Only qualified personnel shall be allowed to perform this procedure. Qualifications will be based on previous experience and appropriate health and safety training. These considerations are discussed in more detail in the project Health and Safety Plan (HASP).

2. Materials

The following materials, as required, will be available during sediment probing for calculating the thickness of sediment and sediment sample collection:

- Sample bottles (kept closed in the laboratory-supplied containers or an appropriately sealed container under custody until the samples are collected);
- Field parameter instruments (e.g., Photoionization detector [PID]);
- Sample coolers;
- Chain-of-custody labels, tags, seals;
- Field book and indelible ink pens or markers;
- Digital camera to document sample collection and location;
- Hacksaw and linoleum or carpet knives with spare blades;
- Electric shears or hand shears;
- Long pole for sediment probing;
- Plastic sheeting;
- Contractor bags;
- Paper towels;
- Aluminum foil;
- Pan liner(s);
- Resealable plastic zip bags;
- Work table(s);
- Stainless-steel spoons;
- Stainless-steel spatulas or plastic trowels;
- Stainless-steel, plastic, or aluminum pans for homogenizing samples;
- Paddle and electric mixer for homogenization (as required based on sediment matrix);
- Waders;
- Small boat (e.g., jon boat or inflatable boat)

- Appropriate equipment for sediment sample collection (e.g., core or grab sampler, ponar or eckman dredge, bucket auger, shovel, or equivalent sampling device based on characteristics of the sediment as observed in the field);
- Plastic bags for ice and/or sample sets;
- Nitrile gloves;
- Work gloves;
- Wet ice;
- Global positioning system (GPS) device,
- Containers with snap on lids for investigation-derived materials (IDM); and,
- Additional personal protective equipment (PPE) as required by the HASP.

3. Procedure

Sediment is defined as sub-aqueous material collected below the ordinary high-water mark. Prior to collecting sediment samples, sediment probing will be completed at the proposed sediment sampling locations to determine a suitable location for sample collection. Sediment samples will be collected using a core or grab sampler (e.g., core tube, grab sampler, ponar or eckman dredge, etc.). Supervision of the sediment sampling activities will be provided by a qualified geologist or hydrogeologist who will be in attendance during the sediment sampling activities to inspect sediment samples, prepare field notes based on sediment observations, properly label, package, and handle sediment samples, and complete daily records. Sediment samples collected for laboratory analysis will be obtained and handled in accordance with the Quality Assurance Project Plan (QAPP). Field quality analysis/quality control (QA/QC) samples associated with the sediment sampling will be collected in accordance with the QAPP. Sediment sampling activities will be documented in the field notes and will include, but not necessarily be limited to, descriptions of the drainage area (e.g., pond width, substrate type, water depth, type and species of vegetation along the edge of the pond or in the pond, and bank height, if any, around the pond). Wooden stakes, or equivalent, GPS device, and flagging may be used to identify and mark the sampling locations for subsequent surveying.

The following sections summarize each of the potential sampling methodologies based on the substrate in the pond and the nature of the sediment matrix.

3.1 Core Tube Sampling Method

Sediment may be sampled using the core tube sampling method. Core sampling typically consists of dedicated polycarbonate or lexan core tubing, 36 inches or less in length, inserted into a core sampling device. The core sampling device is then driven into the substrate with a manual slide hammer, or equivalent. A valve within the core sampling device creates a vacuum upon retrieval, thereby retaining the material inside the tube. A cap is placed over the bottom of the core tube just prior to lifting it out of the water.

Upon removal of the core sampling device from the substrate, the core tube is removed from the core sampling device. A cap is placed on the top of the core tube, and duct tape is used to secure both caps in place. The core is measured and descriptions of the sediment are recorded in the field notes. Core samples are stored vertically until processed.

3.2 Grab Sampling with Ponar/Eckman Dredge Method

If the core sampling device is ineffective due to the physical constraints of the area to be sampled (e.g., depth, width, presence of debris or consistency of the substrate), then a Ponar or Eckman dredge may be used to collect sediment grab samples. A Ponar or Eckman dredge is lowered to the substrate via a rope or cable and a trigger is used to close the dredge's spring-loaded clamshell arms to grab a sample of surficial material. After raising the dredge to the surface, the sampler's arms are opened, and the sampled material is deposited into a stainless-steel, disposable plastic, or disposable aluminum pan for processing as discussed below. If laboratory samples are to be collected for VOC analysis, a representative portion of the retrieved soil sample will be placed in an appropriate pre-cleaned container provided by the laboratory. The sample containers will be filled to minimize any headspace.

3.3 Bucket Auger or Shovel Method

If the substrate is consolidated and too hard for the core tube sampling method, or if the sampling location includes a significant amount of gravel, surficial sediment grab samples could be collected with a stainless-steel bucket auger or shovel. A pre-cleaned bucket auger or shovel will be advanced manually into the substrate to loosen and lift the surficial sediment. The core tube sampling method, as discussed in Section 3.1 above, will then be utilized to collect sediment to be sampled from below the surficial sediment.

3.4 Sample Processing

Following collection of the sediment samples, the sediment will be processed and sampled for the appropriate chemical and physical analyses per the RSWP. Sample processing and collection procedures are discussed below:

1. Prior to performing sample collection, place plastic sheeting adjacent to the sampling location, if possible, for use as a clean work area. If utilizing a boat to collect sediment samples in the pond, field personnel will follow the procedures outlined in the HASP during collection activities. Samples should be brought back on solid ground for sample processing.

2. Clean dedicated sampling equipment should be used when possible. Non-disposable sampling equipment that contacts the sediment will be decontaminated between sample locations in accordance with SOP 005 (Field Equipment Decontamination).

3. Following completion of sediment sample collection, the planned discrete interval shall be extruded out of the core tube, dredge, shovel, or auger into a stainless-steel, disposable plastic, or disposable aluminum pan.

4. The PID will be used to carefully scan the length of the sediment. The sediment shall be screened at three-inch to six-inch intervals. PID measurements and the depth of any response(s) will be recorded in the field notes.

5. If laboratory samples are to be collected for Volatile Organic Compound (VOC) analysis, VOC sediment sample collection will be performed via United States Environmental Protection Agency

(USEPA) SW-846 Method 5035 in accordance with the equipment and methodology dictated by the analytical laboratory, for example, Encore or Terra-Core samplers. If using a dredge, shovel, or auger for sample collection, VOC sediment samples will be collected by placing into an appropriate laboratory container and minimizing the head space in the sample container for analysis. Sediment collected for VOC analysis will not be homogenized, mixed, or stirred.

6. Following collection of VOC samples, further description of the sediment will be noted in the field notes, including descriptions of the sample texture, composition, color, consistency, moisture content, odors (if present), staining (if present), and recovery.

7. The remaining sediment will be homogenized using a stainless-steel spatula, disposable plastic scoop, or hand mixer and paddle in the stainless-steel, disposable plastic, disposable aluminum pan, or resealable plastic zipper bag.

8. Following homogenization, sediment will be transferred to the appropriate laboratory containers for analysis. Sediment sample collection will occur in the following order, as required based on the field program:

    1. SVOCs by USEPA SW-846 Method 8270D;
    2. PCBs by USEPA SW-846 Method 8082A;
    3. Pesticides by USEPA SW-846 Method 8081B;
    4. Metals by USEPA SW-846 Method 6010D;
    5. Mercury by USEPA SW-846 Method 7471B;
    6. Total cyanide by USEPA SW-846 Method 9012B;
    7. Total organic carbon by Lloyd Kahn; and,
    8. Grain size by American Society and Testing Materials (ASTM) D422.
    9. Additional physical properties samples will be collected by advancing a Shelby tube or equivalent for a relatively undisturbed sample to measure dry bulk density by ASTM e-868-82.

9. Once the sediment is placed into containers, the sample containers will be appropriately labeled and placed in a sample cooler on bagged wet ice and allowed to chill to ≤6 degrees Celsius (°C)[1] for submittal to the analytical laboratory.

10. Samples will be shipped to the laboratory under chain of custody following SOP 004 (Chain-of Custody, Handling, Packing, and Shipping).

4. Waste Management

Waste generated during the sediment sample collection will be managed in accordance with the RSWP. IDM may consist of excess sediment from sampling activities, water that settles out during sample

1 Considering the temperature and conditions at the Site during sample collection, if samples are hand-delivered to the laboratory and are received by the laboratory within 8 to 12 hours of sample collection, cooler temperatures may exceed the preservation requirements. This exception applies only if: (1) samples are properly chemically preserved; (2) the sample cooler contains sufficient ice for the samples to reach the required temperatures within 24 hours of samples being placed in the cooler; and (3) the samples are not insulated from exposure to ice with bubble wrapping. Sample results determined to be impacted by a rapid delivery to the laboratory (within 8 to 12 hours of sample collection) will not be flagged during data validation.

collection, and decontamination fluid. Additional IDM from the sample collection will consist of spent PPE such as nitrile gloves and work gloves. All IDM generated during sample collection will be managed in accordance with the procedures outlined in the RSWP.

5. Quality Assurance

Specific details related to field QA/QC samples are described in the QAPP. A brief overview of the collection of QA/QC samples is included here for reference.

5.1 Duplicate Samples

Duplicate samples are prepared by alternately filling the container for the "primary sample" for a particular parameter and then filling the container for the "duplicate sample" for that same parameter. Duplicate samples need to be included on the chain-of-custody.

5.2 Trip Blanks

Trip blanks are prepared in the laboratory and are shipped from the laboratory with the applicable sample collection vials for each project. The trip blank vials should be inspected for air bubbles upon receipt from the laboratory. The trip blanks are not opened in the field. A trip blank should be present in each shipping cooler containing samples to be analyzed for VOCs. Trip blanks need to be included on the chain-of-custody form.

5.3 Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates (MS/MSDs) are collected in the same manner as a duplicate sample. MS/MSDs need to be included on the chain-of-custody form.

5.4 Equipment Blanks

Equipment blanks are prepared by slowly pouring laboratory-quality deionized (DI) water over decontaminated, non-dedicated sampling equipment (i.e., hand auger, shovel, etc.) and sampling the resulting run-off by catching it in the appropriate sampling container. An equipment blank should be collected for the same analyses as the samples. Equipment blanks need to be included on the chain-of-custody form.

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STANDARD OPERATING PROCEDURE 012
SUPPLY WELL SAMPLING

Project name	**Loeffel Route 203 Property**
Project no.	**73458**
Recipient	**General Electric Company**
Document type	**Draft**
Version	**[0]**
Date	**November 14, 2019**
Prepared by	**Rob Hornung**
Checked by	**Jesse J. Vollick**
Approved by	**Douglas M. Crawford**

CONTENTS

1. Scope and Application

This Standard Operating Procedure (SOP) provides general guidance, material needs, and methodology for collecting supply well samples. This SOP does not address sample preservation, chain-of-custody, sample handling, packing, shipping, or laboratory analysis. Refer to additional SOPs, as well as the Removal Sampling Work Plan (RSWP), Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HASP), as appropriate.

2. Personnel Qualifications

Field sampling personnel involved with the collection of supply well samples will have completed a training course of at least 40 hours meeting the requirements of 29 CFR 1910.120(e) for health and safety at hazardous waste operations. If the course was completed more than 12 months before the date of the site work, completion of an approved 8-hr refresher course will be required. Field activities that involve the collection of supply well samples will be performed by an O'Brien & Gere Engineers, Inc. (OBG, a Ramboll company) geologist, hydrogeologist, or field scientist. Field personnel will be familiar with this SOP and possess the required skills, training, field observation documentation and experience necessary to successfully complete field activities.

3. Materials

The following materials and supplies, as appropriate, are necessary for collection of supply well samples;

- Field log book;
- Field forms;
- Field sampling personnel business cards;
- Indelible, blue or black ink pen;
- Chain-of-custody and security seals;
- Clean sample containers (with an extra set) including any preservatives, as required per the QAPP;
- Sample labels;
- Sample cooler;
- Wet ice;
- Plastic bags for ice and sample sets;
- Paper towels;
- Nitrile gloves; and,
- Contractor bags.

4. Procedures

Prior planning and preparation tasks in advance of supply well sampling may include owner contact to arrange access and understand the sampling conditions.

Document the well configuration (i.e., depth, casings, construction date), pumping system (pump type, pump capacity, storage tank capacity), piping system (i.e., pipe type - copper, lead-joint construction),

and presence of any treatment devices (softeners, filters, UV treatment, carbon treatment). A sketch or photographs may be useful for this documentation. If well information is not available from resident/owner, drilling logs may be available from the drilling sub-contractor who installed the well, the New York State Department of Environmental Conservation (NYSDEC), New York State Department of Health (NYSDOH), or other appropriate agencies.

Document well proximity to site buildings/septic system using a field sketch and sampling notes, as necessary. The following procedures will be followed for collecting supply well samples:

1. Whenever possible, the cold water tap closest to the well will be used. The tap should be upstream of any treatment system or storage/pressure tank. Often outdoor taps are not connected to the treatment or storage components. This should be verified with the owner prior to sample collection. Leaking taps that allow water to flow out from around the stem of the valve handle and down the outside of the lip are to be avoided as sampling locations. Aerator, strainer, and hose attachments on the tap must be removed before sampling.

2. Turn on the sampling location tap and run the water until the well pump cycles on and the water temperature is cool to cold.

3. Begin filling sample bottles with cool to cold supply well water. Sample bottles shall be filled in the following order:
    a. VOCs by USEPA SW-846 Method 8260C;
    b. SVOCs by USEPA SW-846 Method 8270D;
    c. 1,4-dioxane by USEPA SW-846 Method 8270D Selective Ion Monitoring (SIM);
    d. PCBs by USEPA SW-846 Method 8082A;
    e. Pesticides by USEPA SW-846 Method 8081B;
    f. Total and dissolved metals by USEPA SW-846 Method 6010D (note that dissolved metals may need to be post filtered at the laboratory prior to performing analysis);
    g. Mercury by USEPA SW-846 Method 7470A; and,
    h. Total cyanide by USEPA SW-846 Method 9012B.

4. After filling the sample containers, turn off the supply well water and wipe any excess water or moisture off the outside of the sample containers with clean paper towels. Re-secure any aerators, strainers, and hose attachments on the tap to the original condition prior to sample collection.

5. Complete sample labels per the QAPP and affix labels to the sample containers.

6. Ship the samples to the laboratory per project requirements following SOP 005 (Chain-of-Custody, Handling, Packing and Shipping).

7. Place any personal protective equipment (PPE) used for collecting the supply well samples in contractor bags and dispose of per the RSWP and Waste Management section below.

5. Waste Management

Waste generated during this sample collection task will be investigation-derived materials (IDM) such PPE. IDM will be managed in accordance with the RSWP.

6. Quality Assurance

Specific details related to field quality assurance and quality control (QA/QC) samples are described in the QAPP. A brief overview of the collection of QA/QC samples is included here for reference.

6.1 Duplicate Samples

Duplicate samples are prepared by alternately filling the container for the "primary sample" for a particular parameter and then filling the container for the "duplicate sample" for that same parameter. Duplicate samples need to be included on the chain-of-custody.

6.2 Trip Blanks

Trip blanks are prepared in the laboratory and are shipped from the laboratory with the applicable sample collection containers for each project. The trip blank vials should be inspected for air bubbles upon receipt from the laboratory. The trip blanks are not opened in the field. A trip blank should be present in each shipping cooler containing samples to be analyzed for VOCs. Trip blanks need to be included on the chain-of-custody form.

6.3 Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates (MS/MSDs) are collected in the same manner as a duplicate sample. MS/MSDs need to be included on the chain-of-custody form.

APPENDIX C
DATA VALIDATION APPROACH

Data Validation and Usability

Soil, sediment, and groundwater samples will be collected and submitted for laboratory analysis during the investigation. Full Contract Laboratory Program (CLP)-like data packages will be provided for definitive data generated by Eurofins Lancaster Laboratories Environmental, LLC (ELLE).

Data validation will be performed for the soil, sediment and groundwater sample results for Target Compound List (TCL)/Target Analyte List (TAL) constituents (including polychlorinated biphenyls [PCBs]) and cyanide, and for the groundwater sample results for 1,4-dioxane. Sufficient Quality Assurance (QA)/Quality Control (QC) samples will be collected for the definitive analyses performed by ELLE. The following will be applied for the data validation process.

Scope of Validation

Full data validation (Stage 4 - Manual) will be performed on 10% of the following samples and partial validation will be performed on the remaining shallow soil boring, deep soil boring, sediment and groundwater samples. The current USEPA Region II validation guidance will be applied as described in the following section.

Upon request by the data validator, the laboratory will provide additional or supplemental information within three working days of the request.

Validation Procedures

Data validation is a process of determining the suitability of a measurement system for providing useful analytical data. Data validation is essentially a three-step process in which the analytical data's quality assurance/quality control information is first compared to a series of QA/QC criteria. Based on the results of this comparison, the analytical data are then assigned qualifiers, which provide an indication of the data's usability. Finally, an overall evaluation of the data's usability is performed.

Full validation consists of a review of data summary forms and supportive raw analytical data provided in the data packages. Partial review consisted of a review of the data summary forms as presented in the data packages as described below. Supportive raw analytical data are not reviewed in the partial data validation effort.

The analytical data generated for this investigation will be evaluated by Ramboll using the analytical methods utilized by the laboratories (as presented in this UFP-QAPP), the QA/QC requirements listed in Tables 1 to 8, where applicable for each method, and professional judgment.

Data affected by excursions from the QA/QC criteria will be qualified using the following USEPA Region II data validation guidance documents or the most current documents and professional judgment:

- USEPA. 2006a. *USEPA Region II Validating Pesticide Compounds Organochlorine Pesticides by Gas Chromatography SW-846 Method 8081B. HW-44 Revision 1.* Reviewed 2009. Albany, New York.
- USEPA. 2006b. *USEPA Region II Validating PCB Compounds, PCBs by Gas Chromatography SW-846 Method 8082A, HW-45 Revision 1.* Reviewed 2009. Albany, New York.

- USEPA. 2008a. Reviewed 2009. *USEPA Region II Validating Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry SW-846 Method 8260B, SOP HW-24* Revision 2. *Reviewed 2009.* Albany, New York.
- USEPA. 2008b. *USEPA Region II Validating Semi-volatile Organic Compounds by Gas Chromatography/Mass Spectrometry SW-846 Method 8270D, SOP HW-22* Revision 4. Reviewed 2009. Albany, New York.
- USEPA. 2012a. *Hazardous Waste Support Section, SOP HW-02a Rev.15,ICP-AES Data Validation, (ISM01.2 - Evaluation of Metals Data for the CLP Method).*
- USEPA. 2012b. *Hazardous Waste Support Section, SOP HW-02b Rev.15,ICP-MS Data Validation, (ISM01.2 - Evaluation of Metals Data for the CLP Method).*
- USEPA. 2012c. *USEPA Region II Mercury and Cyanide Data Validation, SOP HW-2c Revision 15. Albany, New York.*

These validation guidelines will be modified to reflect the QA/QC criteria established in this UFP-QAPP and the analytical methods utilized by the laboratories.

Data validators will be responsible for reviewing the QC parameters as listed below. For full validation, data validators will recalculate approximately ten percent of the sample results using raw data and review approximately ten percent of the raw data to verify that target analyte identification was performed correctly and transcription errors are not present.

Data quality will be evaluated using current laboratory control limits as provided in the data packages and data will be qualified based on excursions. Data validators will check corrective action reports and results of reanalysis if available. Corrective actions implemented by the laboratory will be evaluated during the validation process.

In accordance with the USEPA guidance, and utilizing professional judgment, the following qualifiers will be used in the data validation:

"R" Indicates that the QL or sample result is determined to be unusable due to a major deficiency in the data generation process. The data should not be used for any qualitative or quantitative purposes.

"U" Indicates that the analyte was analyzed for, but a concentration was not detected. The sample QL is reported. This qualifier is also used in the validation process to signify that the detection limit of an analyte was revised due to blank contamination.

"J" Indicates that the concentration should be considered approximate. This qualifier is used when the data validation process identifies a deficiency in the data generation process. This qualifier is also applied by the laboratory when the analyte concentration is greater than the MDL but less than the QL. In the latter case, the identification of the analyte is not in question, but the quantitation of the analyte concentration may be uncertain.

"J+" The result is an approximate quantity, but the result may be biased high.

"J-" The result is an approximate quantity, but the result may be biased low.

"UJ" Indicates that the analyte was analyzed for, but a concentration was not detected. The sample QL is reported and should be considered approximate. This qualifier is used when the data validation process identifies a deficiency in the data generation process.

"JN " Indicates that there is presumptive evidence that the analyte is present, but it has not been confirmed due to confirmation excursions.

The following guidelines will be used regarding the assignment of qualifiers and the evaluation of data:

- The data quality evaluation results in only one type of qualifier ("U", "J", "UJ," or "R") for each analyte; in a case when several qualifiers are applicable to the same analyte, the cumulative effect of the various QA/QC excursions is employed in assigning the final data qualifiers. For example, if a sample result is affected by low surrogate recoveries, for which the "UJ" qualifier is applied, but low MS/MSD recoveries result in the rejection of the sample result (application of the "R" qualifier), the final data qualifier is the "R" qualifier.

The following parameters are included in the full and partial data validation for organic and inorganic analyses, where applicable for each analysis method, unless otherwise noted:

1. UFP-QAPP compliance
2. Chain-of-custody records
3. Sample collection and sample preservation
4. Holding times
5. GC/MS tuning criteria (full validation only)
6. Instrument performance (full validation only)
7. Calibration (full validation only)
8. Blank analysis
9. Surrogate recovery
10. MS/MSD analysis
11. Laboratory duplicate analysis
12. Field duplicate analysis
13. LCS analysis
14. ICP interference check sample analysis
15. ICP serial dilution analysis
16. Internal standards performance
17. Target analyte identification, quantitation, and QLs (full validation only)
18. Deliverables and documentation completeness

Unless requested, tentatively identified compounds (TICs) for VOC analyses will not be evaluated as part of the validation process.

Data Usability Evaluation

Based on the QA/QC information review and the qualifiers assigned to the analytical data, an overall evaluation of the data's usability will be performed. Data usability is defined as the percentage of data that remains unqualified or is qualified as approximate or non-detected due to blank contamination, divided by the data reported by the laboratory times 100. The percent usability excludes the data qualified as rejected due to major QA/QC excursions. The non-usable data are defined as the percentage of the data qualified as rejected divided by the data reported by the laboratory times 100. The data usability will be provided for each the complete data set for this project.

The data usability evaluation considers the data parameters of precision, sensitivity, accuracy, representativeness, comparability, and completeness, which are described as follows:

- Precision is evaluated through the review of field duplicate samples, laboratory duplicates, and MS/MSD samples.
- Sensitivity is evaluated through the review of QLs.
- Accuracy is evaluated through the review of MS/MSD recoveries, internal standards, surrogate recoveries, LCS recoveries, calibration, instruction performance check, ICP interference check analysis, and ICP serial dilutions.
- Representativeness is evaluated through the review of holding times, sample preservation and preparation, blank analysis and target compound identification and quantification.
- Comparability is evaluated through the review of the analytical methods and reporting procedures for consistency.
- Completeness is defined as the overall percentage of sample results that are determined to be usable.

Data Validation Report

The Data Validation Report will contain separate QA sections in which data quality information collected during the investigation is summarized. The Data Validation Report will include the following:

- Guidelines used to evaluate the data.
- Data qualifiers applied to sample results.
- Summary of samples collected and analyses performed.
- Narrative that identifies major and minor analysis excursions detected for each parameter evaluated for each analysis.
- Additional issues and information that may be beneficial to the data user are discussed.
- Data summary forms.
- Data usability.

The Data Validation Report will be prepared under the direction of the Ramboll Quality Assurance Officer.

APPENDIX B
HASP

Intended for
General Electric Company

Document type
Health and Safety Plan

Date
November 2019

Loeffel Route 203 Property
Nassau, New York

Index No. CERCLA-02-2019-2014

HEALTH AND SAFETY PLAN
LOEFFEL ROUTE 203 PROPERTY

RAMBOLL Bright ideas. Sustainable change.

HEALTH AND SAFETY PLAN
LOEFFEL ROUTE 203 PROPERTY

Project name	**Loeffel Route 203 Property**
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1. INTRODUCTION

This Health and Safety Plan (HASP) has been developed by O'Brien & Gere Engineers, Inc. (OBG, a Ramboll company) on behalf of the General Electric Company (GE or Respondent) to provide both general procedures and Site-specific requirements to be followed by OBG personnel while performing investigation activities at/near the Loeffel Route 203 Property. The property is located at 5225-5239 Route 203 in the Town of Nassau, Rensselaer County, New York (see **Figure 1-1**). Activities will also be performed on two adjacent properties (to the east and south) which, with the Loeffel Route 203 Property, comprise the "Site". This HASP was prepared in accordance with the Occupational Safety and Health Administration's (OSHA's) requirements, and will be implemented with the Investigation Work Plan (IWP) in accordance with the Administrative Settlement Agreement and Order on Consent for a Removal Action (Index No. CERCLA-02-2019-2014) (Settlement Agreement) between the United States Environmental Protection Agency (USEPA) and Respondent.

Owners of the Loeffel Route 203 Property have included Mr. Richard Loeffel and Ms. Florence Loeffel (June 1955 to December 1975), and son, Mr. Dewey Loeffel (December 1975 to June 1978). Ms. Carol Loeffel has owned the property since June 1978 to the present. The property was reportedly permitted by New York State Department of Environmental Conservation (NYSDEC) as a waste oil transfer facility in the 1970s and early 1980s and was reportedly used by Messrs. Richard and/or Dewey Loeffel to store trucks associated with their various companies including Loeffel's Waste Oil and Removal Service Company, Inc. and Marcar Oil, Inc. (the "Loeffel Companies"). In July 2018, NYSDEC provided information about the Site to USEPA, which then performed site investigation work from October 2018 through May 2019 (Weston Solutions, Inc. [Weston], 2019a and 2019b). The Site is listed on USEPA's Superfund Enterprise Management System (NYN000203244) but is not on or proposed for the federal National Priorities List (NPL).

This HASP describes the responsibilities, training requirements, protective equipment, and standard operating procedures to be used by OBG personnel to address potential health and safety hazards while performing work at/near the Site. This HASP specifies procedures and equipment to be used by OBG personnel during work activities, including emergency response procedures, to minimize exposures to hazardous constituents and physical hazards.

1.1 Implementation

The requirements and guidelines presented in this HASP are based on a review of available information and an evaluation of potential Site hazards. This HASP has been prepared in accordance with the OSHA requirements in 29 CFR Part 1910.120 and the Standard Operating Safety Guidelines section of the USEPA's Office of Solid Waste and Emergency Response (OSWER) guidance entitled *Integrated Health and Safety Policy for Field Activities* (USEPA, 1988). OBG personnel and its subcontractors are required to read this HASP before beginning work at the Site. This HASP will be available for use by OBG employees and its subcontractors while work activities are taking place. OBG employees will comply with this HASP while conducting work at the Site.

OBG's subcontractors shall comply with all applicable laws and requirements, including but not limited to OSHA, and with all safety rules and procedures provided by OBG. Each subcontractor

shall be solely responsible for the health and safety of its employees and agents during performance of work at the Site. OBG will provide the subcontractor with pertinent available information regarding Site conditions. The subcontractor shall provide, implement and maintain a HASP appropriate to the Site conditions and the scope and purpose of the subcontractor's services. The subcontractor's HASP will be as encompassing and stringent as this HASP. Subcontractors may adopt this HASP as their own, provided all of the elements of this HASP cover the scope of the subcontractor services in their entirety. If the subcontractor chooses to adopt this HASP, the subcontractor's management must sign and date the Subcontractor Acknowledgement and Sign-Off Form provided in Appendix A. Any work to be conducted by the subcontractor that is not covered by this HASP requires that the subcontractor provide work-specific Activity Hazard Analyses (AHAs) prior to the start of such work to the OBG Project Manager and Site Safety and Health Coordinator (SSHC) for review.

Although this HASP may be made available to interested persons for informational purposes, OBG does not assume responsibility for the interpretations or activities of any persons or entities other than employees of OBG.

Whenever conducting Site activities, OBG will have a designated SSHC. The SSHC is responsible to the OBG Project Manager for monitoring activities, monitoring compliance with the provisions of this HASP, and for modifying this HASP, with approval of the Project Manager, to the extent necessary if Site conditions change. Other personnel from OBG will notify the SSHC of health and safety matters, if they arise.

1.2 Background Information

1.2.1 Site Description

The Site is located approximately one mile south of the Village of Nassau in Rensselaer County, New York. The Site is situated in a glaciated valley with hummocky terrain characterized by low-lying areas (including wetlands, ponds and lakes) between elongated hills. The Loeffel Route 203 Property is located within a rural area with a mix of residential properties and farms (see **Figure 1-1**). To the north, the property is bounded by farmland. To the east, the property is bounded by Route 203 and then farmland. To the south, the property is bounded by Sweets Crossing Road and then residences. The National Grid Property bounds the property to the west, and separates the property from the small residential development (17 properties) farther west.

The Loeffel Route 203 Property occupies approximately 8.4 acres on the west side of Route 203 and north side of Sweets Crossing Road (see **Figure 1-2**). The northeastern portion of the property is residential use and contains a single-family house. Three one-story commercial structures are located in the southern portion of the property. The residential and commercial structures are serviced by two onsite private supply wells (one for the residence and the other for the commercial structures) and onsite septic systems.

Per the Investigation Work Plan (IWP) (OBG, 2019a), the investigation will focus on the following areas:

- Loeffel Route 203 Property – Defined as property located at 5225-5239 Route 203, Town of Nassau, Rensselaer County, New York as shown on **Figure 1-2**. Current and historical uses

included residential and commercial use. The residence is located in the northeastern portion of the property and is not the subject of this investigation. Commercial buildings are located in the south-central portion of the property. Specific investigation areas on this property include the following:

- Aboveground Storage Tank (AST)/Lagoon Area – Shown on **Figure 1-2** and defined as the area encompassing a soil berm in the south-central portion of the property where four 30,000-gallon ASTs were historically located (Weston, 2019a). A lagoon was reportedly historically located in the area of the ASTs.

- Underground Storage Tank (UST) – As shown on **Figure 1-2**, a 30,000-gallon UST is reportedly located in the south-central portion of the property proximal to the southeast corner of the easternmost commercial garage (Weston, 2019a). There is currently no visible expression of the UST at the surface (e.g., appurtenant piping and fill port), but the tank was identified by surface geophysical work performed by USEPA in October 2018.

- Drum Area – Nine deteriorated 55-gallon drums are located in the central portion of the property as shown on **Figure 1-2**.

- Upland Area – Defined as the topographically higher portion of the property located north of the southern driveway (to the commercial buildings) and the pond. This area is wooded, and is not believed to have been used for any historical operations, but is included in the IWP for verification.

- Eastern Drainageway – Defined as the onsite drainage swale associated with the ephemeral stream running from northeast to southwest through the southeastern corner of the property, crossing under Route 203 (single, large culvert) from the east and crossing under Sweets Crossing Road to the south (two parallel culverts). The ephemeral stream continues to the south-southwest through the adjacent residential property (see **Figure 1-2**).

- Pond Area (Pond) – As shown on **Figure 1-2**, an approximately 1-acre pond is located on the western portion of the property.

- National Grid Property – Owned by National Grid and defined as that portion of the former railroad grade that trends north-south to the immediate east of the Pond. The former railroad grade separates the Loeffel Route 203 Property from the residential area to the west, as shown on **Figure 1-2**.

- Residential Property – Defined as the property located at 5213 Route 203, located across Sweets Crossing Road from the Loeffel Route 203 Property, as shown on **Figure 1-2**. The ephemeral stream runs through this property to the south-southwest from the twin culvert under Sweets Crossing Road.

1.2.2 Site History

As discussed above, owners of the Loeffel Route 203 Property have included Mr. Richard Loeffel and his wife Ms. Florence Loeffel, his son Mr. Dewey Loeffel, and others. Ms. Carol Loeffel is the

current owner. The property was reportedly permitted by NYSDEC as a waste oil transfer facility in the 1970s and early 1980s, and was also reportedly used by Messrs. Richard and/or Dewey Loeffel to store trucks associated with the Loeffel Companies. Loeffel Refining Products, Inc. (USEPA ID No. NYD980642912) is additionally identified as a company formerly located at the property (OBG, 2019a).

Several site inspections were performed at the Loeffel Route 203 Property by the Rensselaer County Department of Health (RCDOH), as documented in memorandums dated December 7, 1973 and February 25, 1975. The memos indicate the presence of four 30,000-gallon ASTs[1] and one 30,000-gallon UST at the property, and also note that oil appeared to have entered the onsite swamp (Weston, 2019b).[2] Additional inspections were performed by NYSDEC on March 25, 1987 and April 8, 1988. and by USEPA on July 15, 1986. A notice of violation (NOV) was issued to Loeffel Refining Products, Inc. on March 25, 1987 (OBG, 2019a).

NYSDEC collected samples of amphibian tissue and an aquatic insect on November 27, 1979 from the pond for laboratory analysis.[3] Polychlorinated biphenyls (PCBs) were reportedly detected in the samples (Weston, 2019b). Soil and pond water samples collected at the Loeffel Route 203 Property by a neighbor on July 27, 1987 for laboratory analysis did not reportedly contain PCBs, lead, oil and grease, benzene, toluene, ethylbenzene, and xylenes (BTEX) and total petroleum hydrocarbons (Weston, 2019a).

1.3 Project Organization

All personnel involved in activities at the Site implicitly have a part in implementing the HASP. Among them, the OBG Project Officer, the Project Manager, the Corporate Associate for Safety and Health, and the SSHC have specifically designated responsibilities. Contact information for these personnel is presented in **Table 1-1**. Key project personnel and their responsibilities with regard to the implementation of work at the Site are discussed below.

1.3.1 Respondent's Project Coordinator

Mr. Lewis S. Streeter is the Respondent's Project Coordinator. The Respondent's Project Coordinator is responsible for administration of the actions by Respondents required by the Settlement Agreement.

1.3.2 Project Officer

Mr. Douglas M. Crawford, P.E., is the Project Officer. The Project Officer is responsible for the overall administration and technical execution of the project. The Project Officer is further responsible for the acquisition and delegation of resources necessary for project completion and HASP implementation.

1.3.3 Project Manager

Mr. Jesse J. Vollick, P.G., is the Project Manager. The Project Manager reports to the Project Officer and is directly responsible for the technical progress and financial control of the project.

[1] Mr. Dewey Loeffel stated in an April 3, 2019 declaration that in the late 1960s three ASTs were relocated to the property from a disposal facility located along Mead Road in Nassau, New York, now known as the Dewey Loeffel Landfill Superfund Site.

[2] Based on Mr. Dewey Loeffel's April 3, 2019 declaration, the onsite swamp was dredged in the 1960s or 1970s to create the existing pond, and that the dredged material was placed onto the banks of the pond.

[3] NYSDEC collected aquatic insect, freshwater crustacean, and amphibian tissue samples from the Valatie Kill at Sweets Crossing Road on November 20, 1979, June 8, 1980, and June 9, 1993 for laboratory analysis of PCBs.

Mr. Vollick will be responsible for the implementation of this HASP. Procedural changes and modifications to this HASP must be approved by Mr. Vollick.

Specifically, the Project Manager is responsible for the following actions:

- Verify appropriate employee training has been completed prior to the participation in field activities;
- Verify training records and certificates are on file in the OBG office;
- Verify that field staff review this HASP and are familiar with it prior to participating in the field activities. Modify and direct OBG field staff to alter work practices that are deemed unsafe or not sufficiently protective of human health;
- Conduct and document health and safety audits; and
- Investigate accidents, injuries, and near-misses.

1.3.4 Corporate Associate for Safety and Health

Jeffrey Parsons, C.I.H. is the Corporate Associate for Safety and Health. Mr. Parsons is the corporate resource should health and safety questions or issues arise during the implementation of this HASP.

1.3.5 Site Safety and Health Coordinator

The field team leader, or designee, will be the SSHC during field activities. The SSHC is required to have completed OBG Site Safety Leader training for "SSL1" certification. The SSHC will have the following responsibilities:

- Provide a complete copy of the HASP at the Site before the start of activities;
- Familiarize workers with the HASP and enforce health and safety rules;
- Conduct daily safety pre-work safety meetings and document meetings on a daily Pre-Task Planner. An example of a daily Pre-Task Planner is included in Appendix B;
- Maintain safety awareness among onsite OBG employees and OBG subcontractors and communicate health and safety matters to them;
- Conducting and documenting safety inspections on a weekly basis and conducting daily safety walkthroughs;
- Review field activities for performance in a manner consistent with this HASP;
- Verify that OBG field staff/subcontractors use the specified personal protective equipment (PPE);
- Initiate immediate response actions in the event of an emergency or unsafe condition and coordinate those actions with emergency responders, as necessary;
- Promptly notify the Project Manager of an accident, injury, or near-miss. The Project Manager, or designee, will subsequently notify the Project Coordinator of all accidents, injuries and/or near-misses;
- Investigate accidents, injuries, and near-misses in conjunction with the Project Manager; and
- Recommend improved health and safety measures to the Project Manager.

1.3.6 Subcontractor Safety Competent Person

All OBG subcontractors will be required to designate a Safety Competent Person (SCP). The SCP may be the lead driller or the superintendent/foreman unless the project is sufficiently large to require a full-time SCP. A SCP must be onsite at all times when the subcontractor has employees performing work for OBG and will have the same responsibilities as the OBG SSHC within the

subcontractor’s scope of work. This individual must possess a sound working knowledge of pertinent OSHA regulations and other applicable safety requirements related to the scope of work. The SCP will ensure timely correction of safety deficiencies identified by OBG. Subcontractors may request assistance from the OBG SSHC.

2. HAZARD ANALYSIS

This HASP addresses both general Site hazards and specific health and safety concerns associated with the scope of work to be performed at and near the Site, which includes the following tasks:

- General chemical, environmental and physical hazards;
- General Site visits;
- Field equipment calibration;
- Field equipment decontamination;
- Utility mark-out/Surface geophysical survey;
- Direct push drilling;
- Monitoring well installation;
- Water level monitoring;
- Wetland delineation;
- Surface and subsurface soil sampling;
- Groundwater sampling and well development;
- Bathymetry survey;
- Soft sediment probing;
- Sediment sampling;
- Staff gauge installation and monitoring;
- Characterization of UST contents;
- Surveying.

Detailed descriptions of these tasks are presented in the IWP. Activities will be conducted in accordance with the procedures described in the IWP, this HASP, the Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP), and any other work plans prepared pursuant to the Settlement Agreement. Both the potential health and safety hazards and the hazard and contaminant control procedures for each task are discussed below or provided in the task-specific AHAs included as Appendix C. Subcontractor AHAs will be developed to supplement these AHAs as applicable.

Additional AHAs may need to be prepared to supplement and support this HASP to accommodate changes to the scope of work or changing Site conditions. Specific information related to the equipment, tools, work methods, and hazards that are not already in this HASP will be provided in the AHA. AHAs will be presented and reviewed with the field team prior to the initiation of field activities. A pre-work AHA template is presented in Appendix D for use if there are changes in the scope of work or changing Site conditions.

2.1 General Hazards

The general chemical, environmental and physical hazards associated with the Site are discussed below.

2.1.1 General Chemical Hazards

There is a potential for exposure to Site-related constituents in groundwater, soil and/or sediment. Although not the dominant volatile organic compound (VOC) at the Site, the primary chemical of concern is benzene due to its low Permissible Exposure Limit (PEL). Metals, including

lead, mercury, arsenic and chromium were also present at the Site and have notably low PELs. Aroclor 1260 would also be considered a primary chemical of concern due to the extent and magnitude of Site impacts based on preliminary investigations.

Skin contact with impacted groundwater soil and/or sediment should be minimized using disposable gloves and good work practices. When practicable, personnel should position themselves upwind when working near areas/monitoring wells with known elevated levels of VOCs. The potential hazard of ingestion can be managed by avoiding hand contact with the face during field activities. Eating, drinking, and smoking are prohibited in the exclusion zone and buffer zones. Personnel are required to wash hands thoroughly before eating, drinking, or smoking. Proper use of PPE and sampling equipment, as outlined in this HASP and other associated plans, are intended to reduce potential exposure to Site groundwater, soil and/or sediment contaminants.

The primary potential constituents of concern (PCOCs) for the Site include Aroclor 1260, BTEX compounds, chlorobenzenes, phenol, and select metals. Appendix E presents a list of PCOCs historically detected in soil and sediment, their exposure information, maximum detected concentration in soil and sediment and Safety Data Sheets (SDSs) (formerly Material Safety Data Sheets [MSDSs]) that may be:

- Encountered in groundwater, soil and/or sediment;
- Used for the calibration or decontamination of equipment;
- Used as analytical sample preservatives; or
- Used as fuels while performing work activities at the Site.

2.1.2 General Environmental Hazards

OBG will not conduct field operations during severe weather. The SSHC will decide when severe weather conditions exist or are forecast and shall take appropriate actions to protect personnel and maintain the Site in a safe and secure state. The Project Manager may also direct the SSHC to stop operations based on weather conditions.

Aggressive fauna, such as ticks, black flies, mosquitoes, bees, wasps, spiders and snakes, as well as poisonous plants (e.g., poison ivy, poison oak, giant hogweed[4]) may be present at the Site. OBG employees should make a reasonable effort to avoid tall grasses, and should don protective clothing (e.g., light-colored long sleeved shirts/jackets and pants tucked into socks) to reduce the exposure to insect bites/stings and poisonous plants. If work in overgrown areas[5] cannot be avoided, light-weight spun-poly coveralls (e.g., Tyvek®) shall be worn during work occurring in these areas because of the prevalence of tick-borne diseases in New York. Diethyltoluamide (DEET) (>20%) insect repellent may be applied on the skin at the ankles/calves, wrists/forearms and neck (caution must be used to avoid spray on nose, mouth, and eyes). The use of permethrin repellant on clothes is also suggested. Employees should check themselves and other field personnel upon leaving the area and prior to going indoors or getting in a vehicle. Identifying images of aggressive fauna and flora are presented in Appendix F. Should insect

[4] In the event Hogweed is found at the Site, the NYSDEC will be notified via e-mail at ghogweed@dec.ny.gov or by calling the Hogweed Hotline at 1-845-256-3111.

[5] Overgrown areas include tall grassy or woodland areas where tall grass, shrubs, leaf-litter, and other overgrowth is present. Areas which have been cleared of tall grass, shrubs, leaf-litter and overgrowth are not considered an overgrown area and include cleared paths, graded areas, and mowed grassy areas.

bites/stings or contact with poisonous plants occur, the employee must report it to the SSHC and the Project Manager. Employees requiring immediate access to special first aid supplies or medications (e.g., prescription medication for severe allergic reaction to bee stings), will be responsible for obtaining and having on-hand these items during field activities and are also required to notify the SSHC of these allergies.

The timing and location of this project may be such that heat/cold stress could pose a threat to the health and safety of Site personnel. Work/rest regimens will be employed as deemed necessary by the SSHC so that OBG personnel do not suffer adverse effects from heat/cold stress. Special clothing and an appropriate diet and fluid intake may be recommended to onsite personnel to further reduce these temperature-related hazards. Site workers should stop work and notify the SSHC when they observe symptoms of heat/cold stress in themselves or co-workers.

2.1.3 General Physical Hazards

Field personnel should be alert to potential hazards arising from unstable or uneven terrain, steep slopes and icy or muddy surfaces (i.e., slips, trips and falls) and should take measures to avoid them. OBG employees are required to wear safety shoes with good tread when working at the Site.

Field personnel should also be alert to potential musculoskeletal injuries caused by lifting, bending, or operating field equipment. Safe lifting techniques (e.g., bending at the knees, two-person carry) should be utilized. Proper work attire (e.g., long sleeves and long pants) and gloves should be worn to minimize the potential for cuts and lacerations. Potentially dangerous physical activities such as clearing and grubbing and use of chain saws, etc., are not anticipated to be performed; however, if these activities are determined to be necessary, an AHA will be developed and the activities will be performed in accordance with OBG's Health, Safety and Environment Manual (OBG, 2019b).

The use of a "buddy system" is recommended during all field activities conducted at the Site. The buddy system is intended to provide immediate assistance to an individual in the event of an emergency. An individual must remain in direct line of sight with another group member, otherwise a means of communication must be immediately available (e.g., cellular telephone, two-way radio).

The "buddy" is another worker in the appropriate PPE who can perform the following activities:

- Provide partner with assistance;
- Observe partner for signs of chemical or heat exposure;
- Periodically check the integrity of partner's PPE; and
- Notify others if emergency help is needed.

A functional cellular telephone, first aid kit and vehicle will be kept close to the field activities area.

2.1.4 Working in Shallow Water or on Water

Work activities may be performed during the IWP that require personnel to work in shallow water bodies or on deep water bodies (e.g. sediment sampling, sediment probing). These activities will

be performed in accordance with the procedures included in OBG's Health, Safety and Environment Manual (OBG, 2019b). The following sections provide additional safety requirements and instructions for field personnel that are working in shallow water or deep water that requires the use of small watercraft.

2.1.4.1 Work in Shallow Water

This subsection provides guidance related to surveys, studies, and similar work which requires walking or wading into small streams, wetlands, and other shallow bodies of water with a significant drowning hazard. There is no regulatory definition of "shallow water," but for purposes of this procedure, shallow water is defined as being up to waist deep. Safety requirements are listed below:

- Personal Floatation Devices (PFDs), such as life jackets or buoyant work vests, shall be approved by the US Coast Guard.
    - The PFD must be the right size for the wearer, the right type for the work being performed, and must be in serviceable condition according to the manufacturer's requirements and recommendations
    - PFDs shall be inspected for defects before use by the user
    - Defective PFDs shall not be used and must be discarded.
- Be aware of severe downstream hazards near work in shallow water and implement additional safety precautions when applicable;
- Use waders to minimize exposure to water, reduce potential for hypothermia, and minimize contact with contaminated sediment (where contamination is an issue);
- Understand the hazards posed by using waders. Water currents and falling can cause the waders to fill creating a very serious condition. Fatigue can occur more rapidly from walking through the water;
- Implement a buddy system when performing work in shallow water when a significant drowning hazard is identified. Alternately, a shore-based observer may be used as a "buddy";
- Tether persons to a safety line while walking in water currents. This safety line will be tended by shore-based observers and/or securely anchored;
- A rescue skiff exemption applies to this type of work.[6] However, if shallow water is open and navigable by small watercraft and a significant drowning hazard is identified, then a rescue skiff (canoe, small row boat, etc.) should be provided because it can be used to transport injured or incapacitated workers to shore for quicker treatment by emergency medical services. However, a motor and fire extinguisher are not required for shallow water rescue; and

[6]If the water is not navigable or is so shallow that rescuers could simply run in (and the skiff would foul on the bottom anyway), a skiff would not be required. A skiff is specifically required by OSHA for construction work except marine construction operations subject to construction standard 29CFR1926.106 which does not require a rescue skiff. A rescue skiff is also not required by the U.S. Coast Guard nor other OSHA regulations including marine construction operations (29CFR1926.605), long shoring work (29CFR1918), marine terminals operations (29CFR1917, and shipbuilding (29CFR1915). Therefore, a rescue skiff is not required when working over, near, or on water while performing nonconstruction work. Non-construction work includes most field engineering, studies, and investigations.

- Provide a life ring only if a rescue skiff is applicable otherwise it's not required. Ring buoys, with at least 90 feet of line, shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet.

2.1.4.2 Work on Surface Water Using Small Watercraft

The procedures specified in this subsection are designed to protect field personnel when conducting work activities involving small watercraft on surface waters. Governmental laws and regulations regarding onshore waters are generally under the jurisdiction of the Unites States Coast Guard (USCG) and state agencies. However, OSHA may exercise regulatory authority on small watercraft operating on inland waters, State territorial seas and waters that are not U.S. navigable waters (as determined by the USCG). The following procedures will be observed when OBG conducts work activities in open water conditions in small watercraft:

- OBG employees who transport a vessel (including small watercraft) by driving a truck and trailer combination must comply with OBG's Vehicle Safety Program;
- Monitor weather conditions. No on-water work from a small watercraft may proceed if there is a "Small Craft Advisory" issued by the National Oceanic and Atmospheric Administration National Weather Service for the body of water upon which work will be performed;
- Be aware of severe downstream hazards near on-water work and implement additional safety precautions;
- All work activities conducted on surface waters will be conducted in accordance with the requirements of the USCG and appropriate state agency;
- A PFD that is USCG approved must be worn at all times when on surface waters. One adult size PFD (wearable style) for every person on the water craft;
- Have on board a "throwable" flotation device (life ring) with 90' of attached line;
- Distribute weight evenly across the beam of the watercraft;
- Only allow one person to stand at a time in a small watercraft vessel;
- Do not exceed manufacture's capacity plate load limits;
- Attach a lanyard or safety line which can be tied to the sampling personnel when water surface conditions are rough. This will enable easier retrieval of the person should he/she fall over the side of the water craft;
- Check running condition of the outboard motor prior to launching (i.e. ample supply of fuel/oil mix, fuel line in good condition, integrity of the propeller, extra sheer pins);
- Equipment to have on board include: oars, anchor w/line (100' minimum line on inland waters), mooring lines of adequate length;
- Waterproof emergency box containing: American National Standards Institute (ANSI) Class B First-Aid kit, Flares, Air Horn;
- Wear work gloves when using equipment that could injure hands;
- Wear hard hat if overhead hazards exist (e.g. A-Frame, use of long coring devices);

- Secure overboard equipment to vessel; and
- Use proper lifting techniques when retrieving heavy equipment.

2.2 General Site Visits

Periodic general Site visits will be performed prior to (e.g., Site reconnaissance, sample location mark-out) or during field investigation activities. When performing general Site visits, there is minimal potential for contact with chemical hazards. However, personnel will have the potential to encounter a variety of environmental and physical hazards. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the General Site Hazards AHA included in Appendix C.

2.3 Field Equipment Calibration

While using certain field equipment periodic calibrations will be required. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the Field Equipment Calibration AHA included in Appendix C.

2.4 Field Equipment Decontamination

Equipment decontamination activities will be completed regularly throughout the Site investigation. Generally, equipment decontamination will be performed to remove groundwater, soil, and sediment that are potentially contaminated by PCOCs using water, steam, and chemical detergents. Potential decontamination methods include steam cleaning and pressure washing. Decontamination procedures are described in the UFP-QAPP. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the Field Equipment Decontamination AHA included in Appendix C.

2.5 Utility Mark-Out/Surface Geophysical Survey

Surface geophysical survey methods including ground penetrating radar (GPR), magnetic (MAG) and electromagnetic (EM) methods will be used to locate subsurface utilities, structures, and other features. A qualified utility locating/geophysical survey firm will be contracted and supervised by OBG. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the General Site Hazards AHA included in Appendix C.

2.6 Direct-Push Drilling

Direct-push drilling techniques are anticipated during the completion of the investigation activities. Direct-push drilling will consist of the collection, screening, logging, and sampling of soils using a dual tube sampling system lined with an acetate sleeve. Continuous soil cores will also be collected using an acetate-lined Macro-core® sampler advanced within a vehicle or track-mounted direct push drilling unit (see Section 2.7). The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the Drilling/Monitoring Well Installation AHA included in Appendix C.

2.7 Rotary Drilling

Although not anticipated, boreholes may be advanced during the Site investigation using hollow-stem augering or other method (e.g., rotosonic). Hollow-stem augering methods may be used to advance borings in overburden to facilitate the installation of monitoring wells. The potential

health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the Drilling/Monitoring Well Installation AHA included in Appendix C.

2.8 Monitoring Well Installation

As part of Site investigation activities, overburden monitoring wells will be installed using direct push or rotary drilling techniques. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the Drilling/Monitoring Well Installation AHA included in Appendix C.

2.9 Water Level Monitoring

Periodic water level monitoring will be conducted in association with monitoring well installation, groundwater elevation monitoring, groundwater sampling, and surface water staff gauge monitoring activities. Water level monitoring will involve the use of a water level indicator. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the Groundwater Monitoring and Sampling Activities AHA included in Appendix C.

2.10 Wetland Delineation

As part of Site investigation activities, a wetland delineation will be conducted. As part of the field activities, prospective wetland areas will be observed and documented for evidence of wetland hydrologic indicators and plant communities. Soil samples may also be collected using a hand auger within prospective wetland areas for the purpose of evaluating the hydric soil indicators. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the General Site Hazards AHA included in Appendix C.

2.11 Surface and Subsurface Soil Sampling

Surface and subsurface soil sampling will be performed during the implementation of the Site investigation during direct push drilling activities. Shallow soil samples may also be collected manually using a hand auger or similar hand-operated sampling equipment where sample locations are not accessible by direct push drilling equipment. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the Soil and Sediment Sampling Activities AHA included in Appendix C.

2.12 Groundwater Sampling and Well Development

Groundwater sampling will be performed during the implementation of the Site investigation. Additionally, following the installation of any new wells at the Site, well development procedures will take place. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the Groundwater Monitoring and Sampling Activities AHA included in Appendix C.

2.13 Bathymetry Survey

A bathymetric survey of the approximately 1-acre pond on the western portion of the Loeffel Route 203 Property will be performed during the implementation of the Site investigation. Survey methods including an echo-sounder, global positioning system (GPS) navigation software and GPS real-time kinematic (RTK) survey instruments will be used to establish the subaqueous topography of the pond. It may be necessary to use a small boat or remotely-operated, unmanned watercraft during this activity. A New York-state licensed surveyor will be contracted

and supervised by OBG. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the General Site Hazards and Surveying AHAs included in Appendix C.

2.14 Soft Sediment Probing

Soft sediment probing will be performed during the implementation of the Site investigation for the purpose of documenting the depth and thickness of sediment in the approximate 1-acre pond on the western portion of the Loeffel Route 203 Property. Bathymetric survey results will also be verified by sediment probing activities. If the water depth exceeds 3 feet in any portion of the pond and the sediments are thicker than 3 feet, it may be necessary to use a small boat during this activity. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the Soil and Sediment Sampling Activities AHA included in Appendix C.

2.15 Pond Sediment Sampling

Sediment sampling will be performed during the implementation of the Site investigation using a combination of techniques using Lexan or aluminum tubes (or equivalent) advanced manually or with hand-held equipment. If the water depth exceeds 3 feet in any portion of the pond and the sediments are thicker than 3 feet, it may be necessary to use a small boat to obtain soft sediment samples. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the General Site Hazards and Soil and Sediment Sampling Activities AHAs included in Appendix C.

2.16 Staff Gauge Installation and Monitoring

A staff gauge will be installed on the eastern side of the pond to monitor the surface water elevation. The staff gauge, constructed of either a fiberglass, porcelain enameled iron or steel plating, with be affixed to a stable structure (e.g., galvanized steel post manually driven into the pond sediments). Periodic measurements of the staff gauge will be recorded during groundwater monitoring (Section 2.9). The potential health and safety hazards and contaminant control procedures for this task are discussed in the Surface Water Staff Gauge Installation AHA included in Appendix C.

2.17 Characterization of UST Contents

Surface geophysical methods (Section 2.5) will be used to locate the approximate extent of the UST on the Loeffel Route 203 Property. The contents of the UST will be sampled for the purpose of material characterization, if present and the interior of the UST is accessible. Soft digging techniques, such as use of a truck-mounted vacuum extraction system, will be used to excavate shallow soil and locate a port on top of the UST. Characterization samples of the UST contents will be collected using a peristaltic pump or other manual method. If a UST port is not located, characterization samples will not be collected. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the Characterization of UST Contents AHA included in Appendix C.

2.18 Surveying

Surveying of soil sampling locations at the Site, and the newly installed monitoring wells and two supply wells at the Loeffel Route 203 Property, will be performed. When performing surveying activities, personnel will have the potential to encounter a variety of chemical, environmental,

and physical hazards. The potential health and safety hazards and the hazard and contaminant control procedures for this task are discussed in the Surveying AHA included in Appendix C.

2.19 Management of Investigation-Derived Materials

Investigation-derived material (IDM) resulting from the various Site investigation activities will require appropriate management. The IDM includes the following:

- Soil and drill cuttings;
- Sediment;
- Groundwater resulting from the development of the overburden monitoring wells;
- Purge water from well sampling;
- Decontamination fluids;
- Solids (if any) which settle out of groundwater and/or decontamination fluids; and
- Personnel protective equipment (PPE) and associated debris resulting from the execution of the various field activities *(*e.g., polyethylene sheeting, sample tubing, disposable equipment, etc.).

The management of these materials is discussed in the IWP. The potential health and safety hazards and the hazard and contaminant control procedures for the management of IDM are provided in the IDM Management AHA included in Appendix C.

2.20 Hot Work

Any task that creates an open flame, arc, or spark is classified as hot work. Typical hot work tasks include welding, cutting and grinding, during drilling, groundwater sampling, water level monitoring, and well installation activities the use of tools with open flames may be required. Specifically, hot work activities may include the use of propane torches to thaw frozen locks and well covers and to heat water for equipment decontamination during the winter months. Although not anticipated, oxygen-acetylene torches may be used to cut steel casings during well installation. Hot work activities will be performed in accordance with the procedures included in OBG's Health, Safety and Environment Manual (OBG, 2019b). The potential health and safety hazards and the corresponding hazard and contaminant control procedures for hot work activities are discussed below.

2.20.1 Potential Health Hazards and Contaminants

- Potential Hazard #1: Unintended ignition of combustible materials in the hot work area;
- Potential Hazard #2: Combustible atmosphere;
- Potential Hazard #3: Burn hazards associated with hot work (i.e., torch cutting and welding of well casings);
- Potential Hazard #4: Ultraviolet light exposure from welding;
- Potential Hazard #5: Musculoskeletal injuries while handling compressed gas cylinders;

- Potential Hazard #6: Exposure to carbon monoxide and other hazardous gases generated from welding and open flame tools;

- Potential Hazard #7: Combustible gas cylinders, lines, and tools can be hazardous when poorly maintained and incorrectly assembled, used and stored.

2.20.2 Hazard and Contaminant Control

To review the potential hazards while performing hot work activities, a hot work permit will be completed by the SSHC prior to initiating hot work. The hazard controls corresponding to the potential health hazards and contaminants identified in Section 2.20.1 are identified below.

Hazard Control #1: Prior to initiating hot work, unnecessary dry or combustible materials (e.g., leaves, paper, fuel canisters) within 35 feet of hot work should be cleared from the hot work area or protected by fire resistant tarps. A 20-lbs ABC fire extinguisher will be placed within 25 feet of the hot work area unless otherwise indicated on the hot work permit. A fire watch person will be identified by name on the hot work permit and remain in the hot work area a minimum of 1 hour following the completion of hot work activities.

Hazard Control #2: Prior to the initiating hot work, air monitoring will be performed to confirm flammable vapors are not present in the hot work area if a potential source is located nearby.

Hazard Control #3: In addition to level D PPE (i.e., hard hat, work clothes, safety shoes, eye protection, and high visibility vests) additional PPE (e.g., flame retardant clothing, leather gloves, and appropriate eye protection) described in Section 4.1.3 will be donned prior to initiating hot work activities. Loose clothing will be secured while performing hot work, and covered with a flame retardant cover layer. Safety shoe tops will be covered with pant legs to prevent hot materials from falling inside the safety shoe of the person performing the hot work activity.

Hazard Control #4: Fire watch personnel and other personnel in the vicinity of hot work activities should be notified before hot work is initiated. Precautions (e.g., physical barriers blocking ultraviolet [UV] rays or eye protection with lenses conforming to 29CFR 1915.153[a][4]) will be deployed to protect workers from UV rays.

Hazard Control #5: To minimize musculoskeletal injuries, proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist).

Hazard Control #6: Hot work activities (i.e., torch cutting and welding of well casings) will be performed in an adequately ventilated area.

Hazard Control #7: Compressed combustible gas cylinders will be clearly labeled, inspected daily, and stored and secured in an upright position. The compressed combustible gas cylinder valve stem will be covered when not in use.

3. PERSONNEL TRAINING

3.1 Site Workers

OBG employees performing field activities onsite must have completed a training course of at least 40 hours meeting the requirements of 29 CFR 1910.120(e) for health and safety at hazardous waste operations. If the course was completed more than 12 months before the date of Site work, completion of an approved 8-hour refresher course on health and safety at hazardous waste operations is required.

3.2 Emergency Response Personnel

OBG employees who respond as "Good Samaritans" to emergency situations involving health and safety hazards must be trained in how to respond to such emergencies in accordance with the provisions of 29 CFR 1910.120(l). Skills such as cardiopulmonary resuscitation (CPR), mouth-to-mouth rescue breathing, avoidance of blood-borne pathogens, and basic first aid may be necessary.

3.3 Site-Specific Training

Project orientation training will be provided to each OBG employee and reviewed before assignment. OBG personnel and subcontractors will be briefed daily by the SSHC as to the potential hazards that may be encountered during that day. Topics will include:

- Availability, location and contents of this HASP;
- General Site hazards and specific hazards of the task(s) being performed that day;
- Work practices and use of engineering controls to minimize risks from hazards;
- Specific hazards related to the weather and subsequent environmental conditions;
- Selection, use, testing, and care of the body, eye, hand, foot and respiratory protective equipment being worn and the limitations of each;
- Decontamination procedures for OBG personnel, their PPE, and other equipment used onsite;
- Emergency response procedures and requirements;
- Emergency notification procedures and evacuation routes to be followed; and
- Procedures for obtaining emergency assistance and medical attention.

3.4 Training Certification

A record of employee training completion will be maintained by the SSHC for each OBG employee and subcontractor involved in onsite field activities. This record will include the dates of the completion of worker training, refresher training, and Site-specific training for OBG employees and environmental subcontractor personnel. The training documentation form is included as Appendix G.

3.5 Visitors

Site visitors include individuals not assigned to the project, or those who have not received the required training certifications (e.g., Hazardous Waste Operations and Emergency Response [HAZWOPER]). A visitor must be escorted by personnel with the appropriate training and certifications and adhere to the health and safety requirement outlined in this HASP. Additionally, Site visitors will be logged in the SSHC's field book, including full name, times on and offsite, and employer; and will complete the Site Visitor Signature form included as Appendix H. Visitors will be restricted from entering exclusion and buffer zones established around work areas.

4. PERSONNEL PROTECTION

The basic level of PPE to be used during activities at the Site is OSHA Level D. PPE may be upgraded at the discretion of the Project Manager and based on the SSHC's recommendations. A downgrade of PPE must be approved by the SSHC and the Project Manager.

If the SSHC determines that field measurements or observations indicate that a potential exposure is greater than the protection afforded by the equipment or procedures specified in this or other sections of this HASP, the work will be stopped, and OBG employees and subcontractor personnel will be removed from the area of concern until the exposure has been reduced or the level of protection has been increased.

4.1 Protective Equipment Description

The level of PPE is categorized as Level A, B, C, or D, based upon the degree of protection required. The use of Level A and Level B PPE is not anticipated during Site activities. The following is a brief summary of the two levels of PPE that may be used at the Site.

4.1.1 Level D

Level D is a work uniform affording minimal protection, used for nuisance contamination only. The following constitutes Level D equipment:

- Coveralls or other appropriate work clothing;
- Safety shoes, with steel or composite toe and shank meeting ASTM International (ASTM) F2412/2413 standard, and good treads;
- Hand protection when necessary. Disposable gloves (powder-free nitrile) are required when handling soil and groundwater and leather work gloves are required when handling drums, during clearing and grubbing activities and any other time when handling sharp objects;
- Hard hats will be worn for all Site activities;
- Safety glasses, chemical splash goggles or face shield, as necessary. Safety glasses are required during all drilling activities, clearing and grubbing activities, during groundwater sampling and when flying object hazards are present (must meet ANSI Z87 standards);
- Hearing protection, ear plugs and/or ear muffs, as necessary when working next to drill rig and other loud machinery; and
- High visibility reflective safety vests, required for all Site work.

This is the minimum level of protection required to be worn by OBG personnel as required by the HASP.

4.1.2 Level C

Level C is used when concentration(s) and type(s) of airborne substance(s) are known and the criteria triggering the required use of air purifying respirators are met. The following constitute Level C PPE:

- National Institute for Occupational Safety and Health (NIOSH) approved, full-face air-purifying respirator with organic vapor/acid cartridges and P100 particulate filters;
- Chemical-resistant clothing (polyethylene coated overalls, chemical-splash suit, disposable chemical-resistant overalls);

- Coveralls (optional);
- Gloves, outer, nitrile, chemical-resistant (optional);
- Gloves, inner, nitrile, chemical-resistant;
- Safety shoes, with steel or composite toe and shank meeting ASTM F2412/2413 standard, and good treads;
- Chemical resistant boot covers (optional);
- High visibility reflective safety vests, required for all Site work;
- Hearing protection, ear plugs and/or ear muffs, as necessary when working next to drill rig and other loud machinery; and
- Hard hats will be worn for all Site activities.

4.1.3 Hot Work Personal Protective Equipment

Additional PPE is required to protect workers performing hot work activities (e.g., welding, cutting, brazing). The following PPE will be donned prior to the initiation of hot work activities:

- Welding goggles or helmet with lenses conforming to 29CFR 1915.153(a)(4);
- Leather or flame retardant clothing free of combustible compounds (e.g., grease, oil, or solvents);
- High-top, fully-laced safety shoes, with steel or composite toe and shank meeting ASTM F2412/2413 standard, and good treads; and
- Long-cuffed leather gloves free of combustible compounds (e.g., grease, oil, or solvents).

4.1.4 Respirator Usage

Based on work zone air monitoring, half face and/or full face respirator usage may be required for intrusive field activities and during the management of IDM. Respirator usage is not anticipated for non-intrusive field activities; however, OBG supports the use of disposable filtering facemasks for voluntary use by field personnel for nuisance dust protection in areas where airborne exposures are below occupational exposure limits (OELs).

OBG field personnel have been trained and medically approved to use respiratory protection. Respirators issued are approved for protection against dust and organic vapors by the NIOSH and are issued for the exclusive use of one worker and will be cleaned and disinfected after each use by the worker. Respirator users must check the fit of the respirator before each day's use to see that it seals properly. The respirator must seal against the face so that the wearer receives air only through the air purifying cartridges attached to the respirator. No facial hair that interferes with the effectiveness of a respirator will be permitted on personnel required to wear respiratory protection. Cartridges and filters for air-purifying respirators in use will be changed daily at a minimum. The user will inspect the integrity of air-purifying respirators daily.

4.1.5 PPE Maintenance

To effectively protect employees from hazards, PPE must be appropriately maintained and inspected. Guidelines for maintenance, cleaning, inspection, and storage of Level D PPE components are provided below.

Hearing Protection

- Keep formable plugs and ear muff cushions clean and free from material that can irritate the ear canal. Formable plugs and ear muff cushions may be washed in a mild detergent and war water. Squeeze excess water from the plugs and air dry; and
- Discard plugs if they harden, or do not return to their original size and shape, or are dirty. Discard ear muff cushions whenever they become stiff, cracked, or do not seal.

Hard Hat

- Never alter or modify the shell or suspension system;
- Do not place or carry any object between the suspension and the shell, or between the suspension and your head;
- Wear the hard hat square on the head; not tipped forward, backward, or to either side; and
- Do not wear hard hat with the brim facing backwards unless designed to do so and the task at hand requires it (e.g., certain welding hoods).

Safety Glasses

- Other than cleaning with mild detergents or water and a nonabrasive cloth, there is little maintenance associated with eyewear; and
- Replace eyewear and face shields if lenses are cracked or excessively scratched or the frame is damaged.

Safety Shoes

- Safety shoes should be discarded if soles and/or treads are excessively worn or stitched seams begin to separate.

5. MEDICAL MONITORING

5.1 Medical Surveillance Program

OBG has implemented a medical monitoring program in accordance with 29 CFR 1910.120. OBG's program is designed to monitor and reduce health risks to employees potentially exposed to hazardous materials and to provide baseline medical data for each employee involved in work activities. It is also designed to evaluate the employee's ability to wear PPE such as chemical-resistant clothing and respirators.

Medical examinations are administered on a post-hire and annual basis and as warranted by symptoms of exposure or specialized activities. The post-hire examination provides baseline data. The examining physician is required to make a report to OBG of any medical condition that would increase the employee's risk when wearing a respirator or other PPE. OBG maintains medical records as required by 29 CFR 1910.120 and by 29 CFR 1910.1020, as applicable, for personnel working on the Site.

OBG employees performing onsite field activities or as listed in this document have or will receive medical tests as regulated by 29 CFR 1910.120. Where medical requirements of 29 CFR 1910.120 overlap those of 29 CFR 1910.134 or 29 CFR 1910.1025, the more stringent standard will be applied.

5.2 Respirator Certification

Employees who wear or may wear respiratory protection have been provided respirators as required by 29 CFR 1910.134. This standard requires that an individual's ability to wear respiratory protection be medically certified before performing designated duties.

5.3 Medicine and Alcohol

Medicine and alcohol can mask the effects of exposure to certain compounds. Consumption of prescribed drugs must be at the direction of a physician and must not affect the ability of the employee to safely execute job tasks. Employees taking medication that could potentially affect their ability to safely execute a job task must notify the SSHC. Alcohol consumption is prohibited while performing work at the Site and during working hours.

6. ENVIRONMENTAL MONITORING

Based on environmental data collected from the Site, there is minimal potential for exposure to airborne concentrations of Site-related constituents of concern during Site reconnaissance, routine monitoring, well inspection and maintenance, and surveying activities.

However, there is a potential for airborne contaminant concentrations to exceed the OSHA PEL or American Conference of Governmental Industrial Hygienists (ACGIH) values during intrusive subsurface activities. A PID with an 11.7-eV lamp will be utilized during those activities to monitor the breathing zone in the immediate work area. Environmental monitoring may be complicated by the types of chemicals that are encountered. For example, benzene is a Site-related constituent of concern and is a concern when monitoring with a PID due to a low PEL. The SSHC will evaluate whether the personal protective measures employed during these specific field activities are appropriate and will modify the protective measures accordingly. Field personnel will record readings in a notebook at the Site. The SSHC will be responsible to maintain monitoring instruments throughout these specific field activities.

6.1 Photoionization Detector

As required, the air in the workers breathing zone will be monitored with a PID equipped with a 10.6-electron volt (eV) lamp or 11.7-eV lamp to evaluate the presence and level of VOCs. As previously discussed, benzene is a Site constituent of concern. Should the 10.6-eV or 11.7-eV lamp PID readings in the work zone exceed 1 part per million (ppm), a benzene-specific PID will also be used to monitor the breathing zone of workers within the work zone. Air monitoring will be performed during the specific activities identified in this HASP. Air monitoring will initially be conducted and recorded at approximately 15-minute intervals. If individual air monitoring is necessary, it will be performed in the breathing zone, and if workers are wearing respiratory protective equipment, outside the face piece.

Before the start of work which may result in potential exposure to VOCs, the PID will be used to evaluate the level of VOCs upwind of the work area. When VOC levels exceed the action levels discussed in Section 6.3, the PID will be used to measure the VOC level downwind of the work area. PID monitoring will be initiated before starting intrusive field activities and, if the action levels are exceeded, monitoring will be conducted continuously in the breathing zone of the worker. If the PID readings are less than 1 ppm benzene and less than 5 ppm total VOCs above background, then monitoring will be completed at a frequency of approximately every 15 minutes.

The monitoring strategies may change if work tasks or operations change. Monitoring instruments will be checked for appropriate response to a predetermined concentration of isobutylene in accordance with the manufacturer’s instructions.

The PID will be used in accordance with procedures described in the UFP-QAPP.

6.2 Quality Control - Field Monitoring

The SSHC, or someone under the direct supervision of the SSHC, will record the results of the air monitoring for health and safety purposes in the appropriate field book. These books and sheets will be used to document the monitoring results so that an individual data set can be traced to its

point of origin, the sampler, and the sampling equipment used. Air monitoring will be performed according to the manufacturer's instructions.

6.3 Action Levels

Action levels are used to determine when activities should stop, to determine when Site evacuation is necessary, to select emergency response levels, and to change PPE levels. The action levels are listed in **Table 6-1**.

6.3.1 Organic Vapors

During the activities specified in this HASP, a PID will be used to monitor the presence of organic vapors in the work and breathing zones. Actions such as keeping the monitoring upwind of motors and fuel areas will be implemented to reduce potential interferences. Benzene and total VOC action levels and corresponding monitoring requirements and levels of PPE are listed in **Table 6-1**.

Field activities will temporarily stop when the reading on the PID continuously exceeds 1 ppm benzene or 5 ppm total VOCs above background in the work zone.

When the VOC levels range from 1 to 10 ppm benzene or 5 to 50 ppm total VOCs above background in the work zone, additional sampling in the worker's breathing zones will be initiated. If the level in the worker's breathing zone is less than 1 ppm benzene and 5 ppm total VOCs above background, work may resume with continuous alternate breathing zone and work zone monitoring. Continuous air monitoring may cease when the work zone level is less than 1 ppm benzene and less than 5 ppm total VOCs above background.

When the VOC levels in the work zone continuously ranges from 5 to 10 ppm benzene or 50 to 100 ppm total VOCs above background as indicated by the PID, PPE will be upgraded to Level C, which includes air purifying respirators (half or full face respirators PF-10) and chemical resistant clothing (Section 4). Once the respirators are donned, work may resume with continuous air monitoring alternating between the breathing zone and the work zone. During work activities, monitoring will be conducted downwind of the work zone at 15-minute intervals. Respirators may be removed when the breathing zone level is less than 1 to 10 ppm benzene or 5 to 50 ppm total VOCs above background. Continuous air monitoring may cease when the work zone is less than 1 ppm benzene or 5 ppm total VOCs above background.

If the measured VOC level is greater than or equal to 10 ppm benzene or 100 ppm total VOCs above background, work will be stopped and the workers will leave that work area until organic vapor concentrations are reduced. Actions, such as increasing ventilation, will be implemented to promote dispersion of the vapors. Workers wearing respirators may return when the level is less than 10 ppm benzene or less than 100 ppm total VOCs above background. The action levels for air purifying respirators then apply.

6.3.2 Particulates

If airborne particulate matter associated with Site activities is observed, a water spray will be applied as a control measure.

7. SITE CONTROL

7.1 Site Security

Security of the work area will be monitored and controlled by the SSHC or designee. The duties of the SSHC or designee will include escorting Site visitors, overseeing project equipment and materials, and overseeing work activities. The procedures specified below will be followed to control access to each work area to prevent persons who may be unaware of Site conditions from exposure to hazards. Work area control procedures may be modified as required by activity and Site conditions.

7.2 Site Access Procedures

OBG personnel, subcontractors, and visitors will be logged into the SSHC field log daily. Logged information will include, full name, times onsite and offsite, and employer.

7.3 Site Control

Two categories of work zones will be established at each sampling location, drilling location, or work area: an exclusion zone and a buffer zone.

Control procedures to limit access and exposure to work hazards, short of formal zones, will be established when Level D PPE is utilized, as specified in this HASP.

7.3.1 Exclusion Zone

The exclusion zone is where the work activities are conducted. The SSHC will identify this zone. As indicated previously, visitors will be restricted from entering exclusion zones.

When Level C or higher PPE, or heavy equipment is required, this zone will be designated with portable stakes, roping, cones or signage installed before beginning the field work. If possible, the exclusion zone will be at least 30 feet in diameter and centered on the work activities. The zone may be enlarged to contain the necessary ancillary equipment and personnel for the work to be performed.

7.3.2 Buffer Zone

The buffer zone contains personnel and equipment decontamination stations. It will only be large enough to contain equipment and personnel necessary to keep potentially contaminated media and materials in the immediate work area. As indicated previously, visitors will be restricted from entering buffer zones.

This area will be designated with flags, portable stakes, cones or signage when an exclusion zone is utilized or Level C or higher PPE is required.

7.3.3 Support Zone

The support zone is located outside of the buffer zone. The support zone contains support facilities, extra equipment, transport vehicles, and additional personnel and equipment necessary to manage and perform work activities. Visitors will be allowed access to the support zone.

7.4 Site Communications

Two sets of communication systems will be established prior to initiating Site activities: internal communications among personnel at the Site; and external communication between on and offsite personnel. Internal communication protocol is designed to alert team members to emergencies, pass along safety information, convey changes in the work to be accomplished, and maintain Site control. An external communication system between on and offsite personnel is necessary to coordinate emergency response, report to management, and maintain contact with essential offsite personnel. Emergency telephone numbers are presented in **Table 9-1** of this HASP.

Onsite internal communications will be conducted through verbal communications. Nonverbal communications will be used when background noise impedes verbal communications. Nonverbal communications will utilize standard hand and horn signals, as illustrated below:

7.4.1 Communication Procedures

1. Personnel in the work areas should remain in constant verbal communication or within sight of the designated personnel.
2. A 10 second blast with a vehicle horn will indicate the initiation of a Site evacuation. All Site personnel shall evacuate the Site and proceed to the designated place(s) of safe refuge.
3. In an emergency, Site personnel will signal distress either verbally or with three blasts from a vehicle horn.
4. In the event of an emergency, the Project Manager and Project Coordinator will be notified immediately.
5. External communications during Site activities will be accomplished by use of a cellular phone.

7.4.2 Nonverbal Communication

The following standard hand signals will be used in case of failure of verbal communications:

1. Hands on top of head — *Need assistance*
2. Thumbs up — *OK, I am alright, I understand*
3. Thumbs down — *No, negative*

7.4.3 Lines of Communication

In general, health and safety concerns will be first addressed by the SSHC. The SSHC will then pass on pertinent information to the Project Manager. The Respondent's Project Coordinator will also be notified as necessary.

7.5 Confined Space Entry

Entry of permit-required confined spaces is not anticipated during this project. If permit-required confined space entry does become necessary, this HASP will be modified accordingly.

8. DECONTAMINATION

Equipment and personnel decontamination will be performed onsite at a location designated by the Project Manager or SSHC. The SSHC will be responsible for supervising the proper use and decontamination of equipment and PPE.

8.1 Personnel Decontamination Procedures

Decontamination procedures are required only if the work being performed results in contaminated protective equipment. OBG personnel leaving an exclusion zone will decontaminate their protective equipment within the buffer zone before entering the support zone. Decontamination involves removal of contaminated disposable protective garments and/or scrubbing with a non-phosphate detergent and potable water solution followed by a rinse with potable water. Decontamination will take place on a decontamination pad. Dirt or other foreign materials that are visible will be removed from surfaces. Scrubbing with a brush may be required to remove materials that adhere to the surfaces. Waste waters from personnel decontamination will be handled with the waste waters from equipment decontamination. The decontamination procedures will be modified based on the potential level of contamination. The SSHC will be responsible for determining the appropriate level of decontamination.

Disposable protective equipment generated during the field activities will be containerized in a lined waste receptacle and subsequently disposed under direction of the Project Coordinator. Personnel will wash hands thoroughly prior to eating or drinking in the support zone.

8.2 Emergency Decontamination Procedures

The extent of emergency decontamination depends on the severity of the injury or illness and the nature of the contamination. If the situation is such that the contaminated clothing cannot be removed, the person should be given required first aid treatment, and then wrapped in a blanket prior to transport to medical care. If heat stress is a factor in the victim's illness/injury, outer clothing will be removed from the victim immediately.

8.3 Monitoring and Heavy Equipment Decontamination Procedures

Non-disposable or non-dedicated monitoring equipment will be cleaned of visible contamination and debris before initial use onsite, between uses, and after final use. Non-disposable or non-dedicated monitoring equipment that contacts the soil or groundwater will be decontaminated after each use by scrubbing with a non-phosphate detergent and potable water solution followed by rinses with potable water and distilled water, as required.

Decontamination procedures for heavy equipment used for the drilling and installation of monitoring wells will be performed at a location designated by the Project Manager or SSHC. Decontamination involves potable water or steam cleaning on a decontamination pad that will contain rinse water and overspray. Heavy equipment will be thoroughly cleaned and inspected by the SSHC prior to leaving the Site.

Decontaminated or clean equipment not in use will be stored in a designated storage area in the support zone.

8.4 Decontamination Supplies

When Level C or higher PPE is utilized, the following supplies will be available for the decontamination of personnel and equipment:

- Plastic drop cloths;
- Appropriate containers to collect non-reusable PPE and other disposables;
- Plastic wash tubs;
- Long-handled brushes;
- Appropriate containers to collect wash and rinse waters;
- Hand spray units for decontamination;
- Non-phosphate detergent;
- Potable water;
- Distilled water;
- Paper towels; and
- Washable tables that eliminate bending during decontamination activities (optional).

8.5 Collection and Disposition of Potentially Contaminated Materials

PPE and other investigation-derived wastes are to be collected, drummed, and disposed of in accordance with the procedures described in the IWP.

8.6 General Refuse

General refuse such as food and beverage containers, paper, cardboard, and plastic products that do not contain hazardous substances from the Site or the Site work will be bagged or otherwise contained and will be properly disposed.

9. EMERGENCY RESPONSE

9.1 Notification of Site Emergencies

In an emergency, Site personnel will signal distress either verbally or with three blasts from a vehicle horn. A 10-second blast with a vehicle horn will indicate the initiation of evacuation procedures from the work area. All Site personnel shall evacuate the work area and proceed to the designated place(s) of safe refuge as will be discussed in Section 9.4.

Table 9-1 contains emergency telephone numbers. This table will be kept at the work area and updated as needed by the SSHC. Emergency personnel will be notified immediately of emergencies by dialing 911 from a cellular telephone.

Albany Memorial Hospital is located on 600 Northern Boulevard, Albany, New York. **Figure 9-1** shows the route to Albany Memorial Hospital from the Site. Albany Memorial Hospital is approximately 20 to 25 minutes away from the Site.

A copy of this HASP will be maintained at the Site by the SSHC. Should someone be transported to a hospital or doctor, a copy of this HASP should accompany him/her.

9.2 Responsibilities

The SSHC is responsible for responding to or coordinating the response of emergency personnel to emergencies and will notify the Project Manager and Respondent's Project Coordinator immediately of emergencies. In the event of an emergency, the SSHC will direct notification and response, and will arrange follow-up actions. Upon notification of an exposure incident, the SSHC will dial the appropriate telephone number listed in **Table 9-1** and request hospital, fire, and/or police emergency personnel be dispatched to the location of the emergency.

Response personnel will, as necessary, recommend medical diagnosis, treatment, and provide transportation to the hospital. Before work may resume following an emergency, used emergency equipment must be recharged, refilled, or replaced and government agencies must be notified as required.

9.3 Accidents, Injuries, and Near-Misses

In the event of an accident or injury, workers will immediately implement emergency isolation measures to assist those who have been injured and to protect others from hazards. Upon notification of any accident or injury, the SSHC will immediately contact the Project Manager, and the Project Manager will notify the Project Coordinator. If necessary, immediate medical care will be provided by personnel trained in first aid procedures.

Near-miss incidents must also be reported immediately to the Project Manager. Near-miss incidents are cases in which no injury or property damage occurred. However, an injury or property damage could have occurred under similar conditions.

The Project Manager, assisted by the SSHC, must investigate the accident, injury, or near-miss as soon as possible. The Project Manager will assess accident, injury, or near-miss, the cause, and the means to prevent similar incidents. The resulting report must be signed and dated by the Project Manager and the SSHC.

9.3.1 Personal Injury Response Plan

Treatment for minor injuries will be provided onsite using available first aid supplies and personnel trained in first aid

WorkCare Incident Intervention – WorkCare is a service available to OBG employees for non-emergency injuries as outlined below. Subcontractors are not able to utilize OBG's subscription to this service but are encouraged to set up a WorkCare account for their own employees.

- All OBG employees will call WorkCare for minor injuries that include any strains, cuts for which an employee is not confident that a band aid is sufficient, tick/insect bites for which the employee is concerned about infection or Lyme disease, and any other work-related injury for which the employee would like to talk to a WorkCare medical professional regarding proper treatment or follow-up;
- WorkCare posters must be posted at each job Site with a field office or trailer; and
- Minor (not life threatening) injuries that require medical attention will be treated at the "Non-Emergency Med Treatment" clinic identified below unless an alternate clinic is recommended by WorkCare. If no clinic is available or identified, then default to the "Emergency Medical Treatment" facility.

The preferred occupational clinic for non-emergency medical treatment during normal business hours is East Greenbush Urgent Care, located at 2 Empire Drive in Rensselaer, New York (**Figure 9-2**). Emergency rooms may be used to treat minor injuries that require further medical treatment after normal business hours. East Greenbush Urgent Care is approximately 15 to 20 minutes away from the Site.

Emergency or life-threatening injuries**,** including puncture wounds to the head, chest, and abdomen, serious head and spinal cord injuries, and loss of consciousness must be treated at the hospital emergency room (**Figure 9-1**).

9.4 Safe Refuge

As indicated in Section 9.1 a 10-second blast of a horn (e.g., air horn, vehicle horn, etc.) will sound in the event of an emergency evacuation. During an emergency evacuation while working within the Site, personnel will assemble on the northeast portion of the property near the Route 203 entrance to the onsite residence. While working at offsite locations the SSHC will communicate a safe refuge location to the field crew during the daily pre-work safety meeting.

If the investigation location changes during the work day, a new primary and secondary safe refuge location will be communicated to the field crew by the SSHC during a pre-work safety meeting prior to commencing work activities at the new location.

In case of an emergency, personnel in the work area should evacuate for their own safety and to prevent hampering rescue efforts. Following an evacuation, the SSHC will account for Site personnel using the daily sign-in sheet. If evacuation from the primary refuge location is necessary, the project vehicles will be used to transport personnel to the secondary place of refuge.

9.5 Fire Protection & Prevention

Hot Work Permits, subcontractor safety plans, and AHAs may supplement basic fire safety requirements outlined below by establishing specific requirements throughout the course of the project as needed to ensure that personnel and property are adequately protected from potential fires. Emergency response associated with fires is covered in the Emergency Response section of this HASP.

Basic fire protection requirements include:

- Construction heaters or other forms of heat generating equipment may only be used by subcontractors with prior approval from OBG and a Hot Work Permit is obtained;
- Fire hydrants and valves must not be obstructed or blocked. At least a **6-foot** clearance must be maintained on all sides for emergency access;
- Subcontractors **must inspect extinguishers monthly** in addition to annual service provided by an extinguisher service company. Inspections and testing must be documented on **weather-resistant tags or labels** attached to each fire extinguisher;
- In the event of a fire, the appropriate fire department, based on where work is being conducted, shall be notified immediately by the SSHC. It is the responsibility of the SSHC to understand which fire department covers the area where work is being conducted. The SSHC will communicate this information to workers at the beginning of each work shift, throughout the work day as work areas change, and include documentation in the daily Pre-Task Planner (Appendix B);
- In the event the work being performed associated with the maintenance and repair activities requires the use of fuel-powered engines or other flammable materials, then a fire extinguisher will be available during onsite activities. This is intended to control small fires; and
- When a fire cannot be controlled with the extinguisher, 911 will be called and workers will seek safe refuge.

9.6 Emergency Equipment

The following equipment, selected based on potential Site hazards, will be maintained in the work area for safety and emergency response purposes:

- Cell phone;
- Fire extinguisher (when fuel-powered engines or other flammable materials are present);
- Eye wash kit; and
- First aid kit.

9.7 Emergency Site Communications

As discussed in Section 7.4 herein, hand and verbal signals will be used at the Site for emergency communications.

9.8 Security and Control

Work zone security and control during emergencies, accidents, and incidents will be monitored by the SSHC. The duties of the SSHC include limiting access to the work zones to authorized personnel and overseeing emergency response activities.

10. SPECIAL PRECAUTIONS AND PROCEDURES

10.1 Additional Safety Practices

The following are important safety precautions that will be enforced during the completion of the activities listed in Section 2 of this HASP.

10.2 Cold Stress

The Project Manager and the SSHC will establish an appropriate work-warming regimen to avoid excessive exposure to cold temperatures that could result in cold stress. Employees can work in very cold conditions as long as they have the proper clothing and good areas to warm themselves frequently. Cold stress for extended periods of time can result in hypothermia. Hypothermia is a result of a drop in body temperature from 98.6 degrees Fahrenheit (°F) or 37 degrees Celsius (°C)(normal oral body temp.) to 96.8°F (36°C) or below. Severe hypothermia can result in death. Employees must be trained in cold stress, take breaks when symptoms of cold stress are observed, and not return to work after the onset of cold stress unless fully recovered.

The most obvious symptoms of cold stress include pain in one's finger tips, toes and extremities and severe shivering; these symptoms can be alleviated by taking breaks in a warming area. More serious symptoms, which require medical attention prior to returning to work, include clouded consciousness, progressive loss of consciousness, stop of shivering, breathing decreases, unconsciousness and/or heart attack.

It is important to recognize the effect of wind speed on the perceived decrease in air temperature felt by the body on exposed skin. The table below provides estimated wind chill temperatures based on air temperature and wind speed (in miles per hour [mph]). Wind chill must be considered when following the procedures to prevent cold stress provided below.

Minimum procedures to be followed to prevent cold stress include the following:

- If an employee becomes immersed in water or their clothing becomes wet during cold temperatures (below 35°F/2°C]), then the employee should immediately get a new change of clothing and be evaluated for hypothermia;
- If an employee gets wet feet when the temperature is below 50°F (10°C), then they should get dry foot apparel as soon as possible;
- If the air temperature (taking wind chill into account based on the table below) falls below 32°F (0°C), insulating gloves should be used; and

- If prolonged work in 20°F (-7°C) temperatures (or below) is necessary, a work-warming regimen shall be established.

Wind Chill Chart (Temperature vs. Wind Speed)							
Wind Speed (mph)							
Calm	**5**	**10**	**15**	**20**	**25**	**30**	**35**
Temperature (°F)	**Wind Chill (°F)**						
45	43	34	29	26	23	21	20
40	37	28	23	19	16	13	12
35	32	22	16	12	8	6	4
30	27	16	9	4	1	-2	-4
25	22	10	2	-3	-7	-10	-12
20	16	3	-5	-10	-15	-18	-20
15	11	-3	-11	-17	-22	-25	-27
10	6	-9	-18	-24	-29	-33	-35
5	0	-15	-25	-31	-36	-41	-43
0	-5	-22	-31	-39	-44	-49	-52
-5	-10	-27	-38	-46	-51	-59	-64
-10	-15	-34	-45	-51	-59	-64	-67
-15	-21	-40	-51	-60	-66	-71	-74
-20	-26	-46	-58	-67	-74	-79	-82
-25	-31	-52	-65	-74	-81	-86	-89

10.3 Heat Stress

The Project Manager and the SSHC will establish an appropriate work regimen to avoid excessive exposure to hot temperatures that could result in heat stress. Employees should be aware of the symptoms of heat stress with themselves and co-workers. Some symptoms associated with heat stress are:

- An elevated heart rate, lack of concentration, difficulty focusing on a task, fatigue;
- Irritability and/or sickness;
- Cramps, rash, headache;
- Loss of desire to drink water;
- Fainting;
- Skin clammy, moist and pale (severe heat exhaustion); and
- Skin extremely dry and red (heat stroke).

To help prevent heat stress, employees should intake plenty of water throughout the work day (sometimes as much as a quart per worker per hour) and employees should know where drinking water is located. Employees should adjust their work pace and expectations on how much work can be done during periods of high heat. If possible, heavy work should be scheduled during the cooler parts of the day (i.e., early morning) and rest periods should be taken in cool areas for longer periods. Employees using PPE (e.g., Tyvek® suits or other equipment which may retain heat) can be more susceptible to heat stress due to the fact that heat/sweat often cannot escape the suits and/or the equipment.

For instances of *mild heat stress*: Immediately bring employee to a cool place and have them rest and drink liquids. Provide offsite medical attention for employees who do not fully recover within one hour.

For instances of *severe heat stress/heat stroke*: If an employee faints, experiences coordination problems or appears confused or disoriented, then immediately contact emergency services. If employee is suspected of heat stroke, soak employee in their clothes in cool water and contact emergency services.

It is important to recognize the effect of humidity on the perceived increase in air temperature felt by the body. The body cools itself through the evaporation of sweat. Humidity reduces the evaporation rate, which results in lower rates of heat removal from the body. The table below provides estimated heat index temperatures based on air temperature and relative humidity. Workers must be aware of heat index and heat-related disorders.

Heat Index Chart

Temperature (°F) vs. Relative Humidity

	10 %	15 %	20 %	25 %	30 %	35 %	40 %	45 %	50 %	55 %	60 %	65 %	70 %	75 %	80 %
115	111	115	120	127	135	143	151								
110	105	108	112	117	123	130	137	143	151						
105	100	102	105	109	113	118	123	129	135	142	149				
100	95	97	99	101	104	107	110	115	120	126	132	136	144		
95	90	91	93	94	96	98	101	104	107	110	114	119	124	130	136
90	85	86	87	88	90	91	93	95	96	98	100	102	106	109	113
85	80	81	82	83	84	85	86	87	88	89	90	91	93	95	97
80	75	76	77	77	78	79	79	80	81	81	82	83	85	86	86
75	70	71	72	72	73	73	74	74	75	75	76	76	77	77	78

Heat Index/Heat Disorders

Heat Index	Possible heat disorders for people in higher risk groups
DANGER 130 or higher	Heatstroke/sunstroke highly likely with continued exposure. • **Moderate and strenuous outdoor activity prohibited**
WARNING 105-130	Sunstroke, heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity. • **Strenuous outdoor activity while wearing Tyvek is prohibited without the use of personal cooling devices.** • **Workers must drink every 15 minutes or more frequently at their discretion** • **Air conditioned break areas must be available.**
CAUTION 90-105	Sunstroke, heat cramps and heat exhaustion possible with prolonged exposure and/or physical activity. • **Strenuous outdoor activity while wearing Tyvek is prohibited above a heat stress index (HSI) of 99 without the use of personal cooling devices and is recommended for lower HSI.** • **SSHC to monitor employees for symptoms of heat stress.** • **Workers must drink every 30 minutes or more frequently at their discretion.** • **Air conditioned break areas must be made available for morning, lunch, and afternoon breaks.**
CONCERN 75-90	Fatigue possible with prolonged exposure and/or physical activity. • **SSHC to monitor employees for symptoms of heat stress.** • **Workers must drink every 60 minutes or more frequently at their discretion.**

Heat Index Chart

Temperature (°F) vs. Relative Humidity

10 %	15 %	20 %	25 %	30 %	35 %	40 %	45 %	50 %	55 %	60 %	65 %	70 %	75 %	80 %
			• Shaded break areas must be made available for morning, lunch, and afternoon breaks. Air conditioning is recommended.											

Source: National Weather Service [Modified – The initial HSI for the lowest ("CONCERN") heat stress category was reduced from 80 to 75 because of the potential for increased heat stress when wearing Tyvek.]

10.4 Natural Hazards

Lightning storms, hurricanes, tornadoes, floods, and severe snow storms may be treated as natural hazards. In the event of severe weather conditions, Site work will be halted by the SSHC or designee. Site evacuation may take place and the Site shall be secured to the extent possible.

10.5 Heavy Machinery/Equipment

OBG employees performing Site activities may use or work near operating heavy equipment and machinery. Since protective equipment may reduce peripheral vision, hearing or general awareness of the wearer, OBG personnel should exercise extreme caution in the vicinity of operating equipment and machinery to avoid physical injury to themselves or others. Cell phones will not be used while operating heavy equipment and machinery or by workers on the ground in the area of heavy equipment and machinery operations to avoid physical injury to themselves or others.

A safety zone of a minimum of 25 feet shall be maintained when walking and working in the area of heavy equipment (e.g., "the 25 foot rule"). The "25 feet rule" also requires personnel to get the equipment operators attention and permission prior to approaching closer than 25 feet to heavy equipment.

Site personnel working near heavy equipment will be exposed to "struck-by" injuries and "crush" injuries if caught between heavy equipment (or counterweights) and a fixed object. While moving or operating heavy equipment, the SSHC or a designee will serve as a spotter to protect workers within the work zone from "struck-by" and "crush" injuries. Personnel working in the vicinity of heavy equipment will be notified of pinch points related to equipment operating in the work zone and maintain a clear line of sight to the operator(s) of that equipment and maintain a distance of at least 25 feet. Additionally, heavy equipment operators will regularly check to the location of other personnel in the work area prior to moving heavy equipment and the proximity of their equipment to other heavy equipment in the work area.

Hydraulic line pressures may be as high as 6,000 pounds per square inch (psi). Special care should be taken when handling hydraulic hoses. Hoses lying on the ground shall be marked by cones to minimize the tripping hazard.

All equipment must be secured after hours. Keys must be removed from equipment and secured away from the equipment. Mobile equipment that does not require an ignition key shall be disabled. All vehicles and heavy equipment must be turned off when left unattended.

Subcontractors shall submit a letter on company letterhead that designates which of their employees is competent and authorized to operate each type of equipment present on this project. Forklift and lull operators must have a license or certificate that indicates they have passed a written test and "road" test for the type of forklift they will be operating.
Operators will use seatbelts if so equipped. Heavy equipment will be equipped with overhead and rollover protection whenever feasible.

When equipment arrives at the Site, an "Acceptance Inspection" will be performed by the SSHC and documented on an OBG heavy equipment inspection form, or equivalent. Equipment will not be acceptable if critical-to-safety defects or other defects important for the safe use of equipment are identified.

Operators will also inspect equipment daily for leaks, damage, and other necessary repairs. The "Daily Inspection" will be documented on an OBG equipment inspection form, or acceptable alternative. Equipment will be removed from service if critical-to-safety defects or other defects important for the safe use of equipment are identified. "Acceptance Inspection" and "Daily Inspection" documentation will include the name and date of the person performing the inspection and will be retained onsite for the duration of the project.

For heavy equipment onsite for an extended period of time (e.g., greater than 30 days), a preventative maintenance schedule will be established and implemented in accordance with the OBG's Health, Safety & Environment Manual (OBG, 2019b).

Heavy equipment must be equipped with backup alarms, horns, and other safety devices installed by the manufacturer. Vehicles operated at night must have headlights, tail lamps, and reflectors. Safety devices must not be disabled.

10.6 Traffic Control Procedures

Temporary Traffic Control Procedures (TTCP) associated with work that may occur near or on shoulders of Sweets Crossing Road or Route 203 will be implemented in a manner consistent with Department of Transportation (DOT) guidelines in Section 6 (Temporary Traffic Control) of the Manual of Uniform Traffic Control Devices (MUTCD). Adjustments may be made at specific work locations to accommodate obstructions, limited driver sight distances or other location-specific conditions. Although road-side activities are not anticipated during the Site investigation, these activities may include soil sample collection, direct-push drilling, and temporary staging of support vehicles on the road shoulder. High-visibility vests will be donned while working on Site or near roadways.

While moving large vehicles (e.g., drill rigs and large support trucks) from driveways into the roadway the SSHC may act as a flagman to spot for the drivers of those vehicles and serve as a visual indication of the merging trucks to on-coming drivers. OBG personnel and subcontractors performing traffic flagging/signaling duties (e.g., acting as a flag person) will have DOT flagger training. Completion of training will be verified and copies of DOT flagger training certificates and related training records will be obtained.

10.7 Additional Safety Practices

The following are important safety precautions that will be enforced during the completion of the

activities listed in Section 2:

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases that probability of hand-to-mouth transfer and ingestion of material is prohibited in exclusion zone and buffer zones;
- Hands must be thoroughly washed before eating or drinking;
- No firearms may be brought onsite;
- Contact with potentially-contaminated surfaces should be avoided whenever possible;
- Activities in an exclusion zone will be conducted using the "buddy system." The "buddy" is another worker fully dressed in the appropriate PPE who can perform the following activities:
    - Provide partner with assistance
    - Observe partner for signs of chemical or heat exposure
    - Periodically check the integrity of partner's PPE
    - Notify others if emergency help is needed
- Avoid breathing chemical odors;
- Do not expose skin to water, chemicals, or soil. If one becomes dirty or wet with contaminated fluids, clean up immediately using plenty of water;
- Unsafe or inoperable equipment left unattended will be identified by a "DANGER, DO NOT OPERATE" tag; and
- The HASP will be reviewed frequently for its applicability to the current and upcoming operations and activities.

10.8 Daily Log Contents

The Project Manager and the SSHC will establish a system that will record, at a minimum, the following information:

- The arrival and departure times of OBG personnel, subcontractors and visitors and their destination at the Site;
- Incidents and unusual activities that occur on the Site such as, but not limited to, accidents, breaches of security, injuries, equipment failures, and weather related problems;
- Changes to the scope of work and the HASP; and
- Daily information such as work accomplished and current Site status.

10.9 Daily Safety Meetings

Safety meetings must be held daily and documented using a daily Pre-Task Planner (see Appendix B) or equivalent document approved by the OBG SSHC. Supplemental safety meetings will also be held when the work location changes to communicate revised route(s) to the hospital and the appropriate fire department that should be contacted in the event of a fire.

The intent of daily safety meetings is to encourage daily safety planning (top portion of the daily Pre-Task Planner) by the SSHC and support communication between the SSHC, the subcontractor(s), and his/her respective field crews (bottom portion of the daily Pre-Task Planner).

The use of Pre-Task Planners during daily safety meetings provides documentation about what "safety messages" Site personnel are receiving on a daily basis. Pre-Task Planners also provide a checklist to monitor changes to Site personnel, equipment, work methods, or conditions that may affect hazards and require different safety precautions. Pre-Tasks Planners are intended to supplement, but not replace, pre-work AHAs and safety plans. Pre-Task Planners will be retained onsite for inspection during periodic safety audits.

The form will be completed as follows:

- The SSHC will prepare a daily Pre-Task Planner for that day's activities or the next day's activities if the daily Pre-Task Planner is prepared the prior afternoon;
- The SSHC will review the Pre-Task Planner with his/her respective field crew and subcontractor(s);
- Each Site worker will then sign the Pre-Task Planner; and
- All Pre-Task Planners will be ***returned to OBG*** after the day's activities are complete.

Any significant changes to the scope of work or work methods during the work shift will require revising the Pre-Task Planner. Recognition of previously unidentified hazards will also require revising this safety plan or pre-work AHAs.

11. REFERENCES

O'Brien & Gere Engineers, Inc., 2019a. Investigation Work Plan, Loeffel Route 203 Property. November 2019a.

O'Brien & Gere Engineers, Inc., 2019b. Health, Safety & Environment Manual. January 2019.

USEPA, Health and Safety Plan (HASP) Users Guide, Publication EPA 9285.8-01, July 1993.

USEPA, Integrated Health and Safety Policy for Field Activities, Office of Solid Waste and Emergency Response, OSWER Dir. #9010.15-01, May 15, 1988.

Weston Solutions, Inc., 2019a. Removal Assessment Sampling Report, Route 203 Site, Nassau, Rensselaer County, New York. Prepared for U.S. Environmental Protection Agency (USEPA), Region II Superfund and Emergency Management Division, Edison, New Jersey, May 23, 2019.

Weston Solutions, Inc., 2019b. Final Removal Assessment Sampling Report, Properties P021 and P026 Sampling Event, Route 203 Site, Nassau, Rensselaer County, New York. Prepared for U.S. Environmental Protection Agency (USEPA), Region II Superfund and Emergency Management Division, Edison, New Jersey, August 6, 2019.

29 CFR 1910.120, Hazardous Waste Operations and Emergency Response.

TABLES

Dewey Loeffel Route 203 Property
Nassau, New York
Health and Safety Plan

Table 1-1 Project Personnel	
Name and Title	**Telephone**
Lewis S. Streeter, Respondent's Project Coordinator Albany, New York	518-388-7552 518-225-4727 (cell)
Douglas M. Crawford, P.E., OBG Project Officer Syracuse, New York	315-956-6442 315-200-5204 (cell)
Jesse J. Vollick, P.G., OBG Project Manager Albany, New York	518-724-7265 215-906-6077 (cell)
Jeffrey Parsons, C.I.H., OBG Corporate Associate for Safety and Health Syracuse, New York	315-956-6870 315-391-0638 (cell)
Robert D. Hornung, P.G. (or Designee), OBG Site Safety and Health Coordinator Albany, New York	518-724-7260 607-435-0712 (cell)

Table 6-1 Organic Vapor Monitoring Requirements

Action Levels[1]	Method	Monitoring Zone	Monitoring Requirements	PPE
Benzene: <1 ppm AND Total VOCs: <5 ppm	CS-PID, PID	Work and breathing zones	Continue working with periodic monitoring (*i.e.*, 15 minutes); alternating between breathing zone and work zone.	Level D
Benzene: 1 – 10 ppm OR Total VOCs: 5 – 50 ppm	CS-PID, PID	Work and breathing zones	Monitor continuously; alternating between breathing zone and work zone. Implement additional engineering or administrative controls to reduce contaminant concentrations below action level(s).	Level D
Benzene: 5 - 10 ppm OR Total VOCs: 50 - 100 ppm	CS-PID, PID	Work and breathing zones	Monitor continuously; alternating between breathing zone and work zone. . Implement additional engineering or administrative controls to reduce contaminant concentrations below action level(s).	Level C with Half or Full Face Respirator (PF 10) and chemical resistant clothing
Benzene: >10 ppm OR Total VOCs: >100 ppm	CS-PID, PID	Work zone	Stop work and vacate the area until contaminant levels are reduced. Notify Project Manager and Client Representative	Vacate area

Notes:

1. Actions levels sustained for 1 minute.
2. VOC designates volatile organic compounds.
3. ppm designates parts per million.
4. PID designates photoionization detector.
5. CS-PID designates compound-specific PID capable of measuring benzene concentrations
6. PPE designates personal protective equipment.
7. Readings are considered continuous when the reading remains relatively constant over the course of 60 seconds.

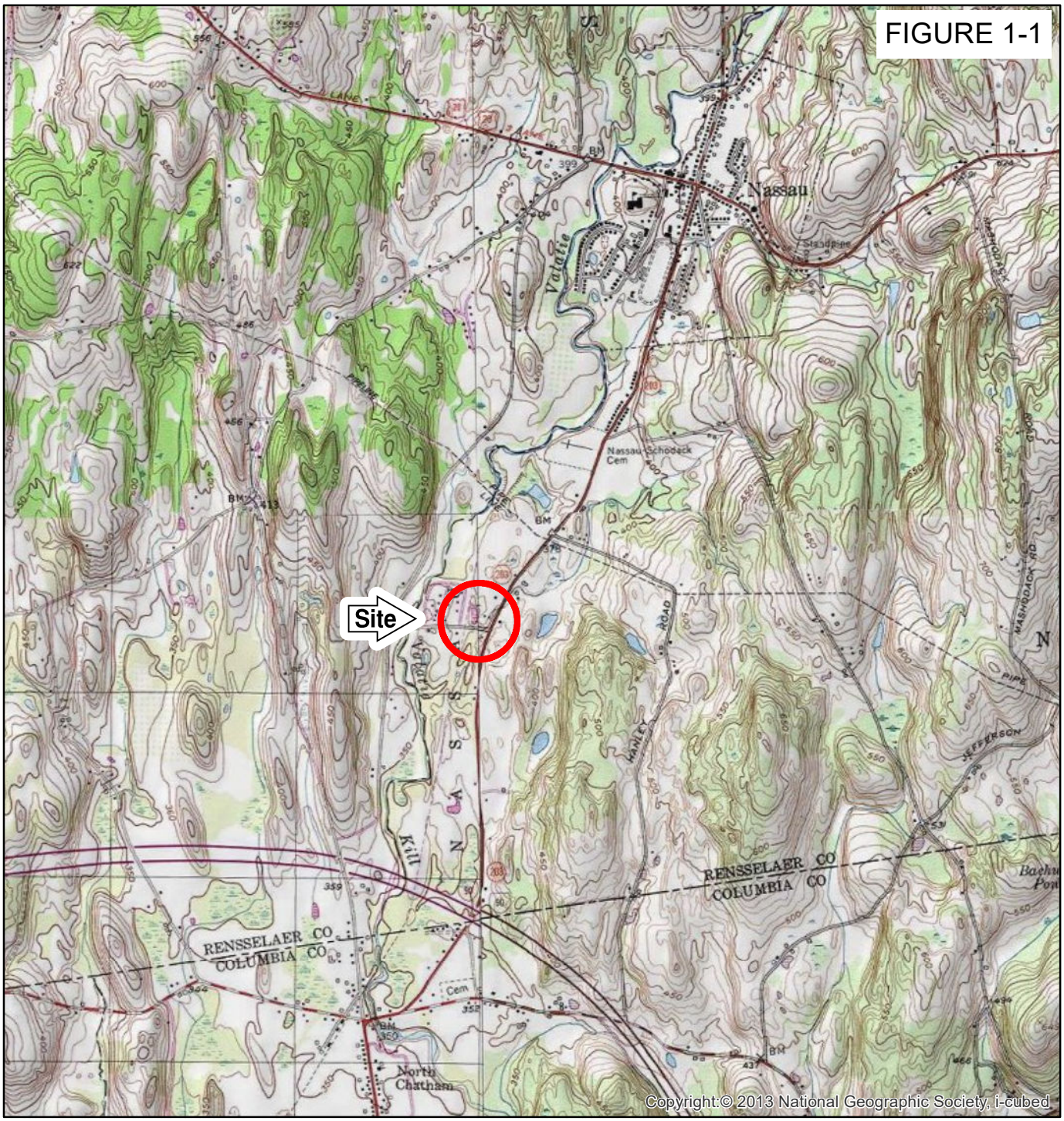
Dewey Loeffel Route 203 Property
Nassau, New York
Health and Safety Plan

Table 9-1 Emergency Contact Numbers	
Location	**Telephone**
Emergency	911
Non-Emergency	
WorkCare	(800) 455-6155
East Greenbush Urgent Care	(518) 479-5240
Fire Department	
Hoags Corners	(518) 766-5474
Nassau	(518) 766-3343
East Schodack	(518) 479-3366
Schodack Valley	(518) 477-4215
Police Departments	
New York State Police Department – Troop G Headquarters, Latham	(518) 783-3211
Rensselaer County Sheriff's Department	(518) 270-5448
Nassau	(518) 766-9293
Schodack	(518) 477-8077
Ambulance	
Hoags Corners	(518) 766-5474
Nassau	(518) 931-4160
Albany Memorial Hospital	(518) 471-3221
National Poison Control Center	(800) 222-1222
Spill Response	
NYS Emergency Response Spill Hot Line	(800) 457-7362
National Spill Response Center Spill Reporting Line	(800) 424-8802
Chemtrec Emergency Responders	(800) 424-9300
Emergency Management	
New York State Emergency Management Office	(518) 292-2200
New York State Emergency Response Hotline	(866) 723-3697
Underground Utilities Contact Information	
Electric	
NYSEG	(800) 572-1131
Natural Gas	
NYSEG	(800) 572-1121
Water and Sewer	
Town of Nassau	(518) 766-2343
Rensselaer County Sewer District	(518) 283-2235

Table 9-1 Emergency Contact Numbers	
Location	**Telephone**
United States Environmental Protection Agency On-Scene Coordinator – David Rosoff	(732) 906-6879

FIGURES

FIGURE 1-1



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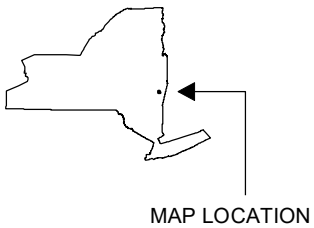
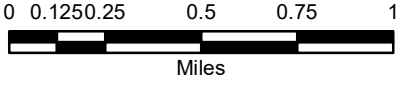


5225 - 5239 ROUTE 203 PROPERY
NASSAU, NEW YORK

SITE LOCATION MAP



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OCTOBER 2019

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O'BRIEN & GERE ENGINEERS, INC.

FIGURE 1-2

N

LEGEND

- 5225 – 5239 Route 203 Property
- Existing Supply Well
- Drum Area
- Former Above Ground Storage Tank / Lagoon Area
- Underground Storage Tank
- Approximate Pond Shoreline
- Ephemeral Stream
- Culvert

5225 - 5239 ROUTE 203 PROPERTY
NASSAU, NEW YORK

SITE MAP

0 50 100 200
Feet

612.73458
OCTOBER 2019

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Dewey Loeffel Route 203 Property
Nassau, New York
Health and Safety Plan

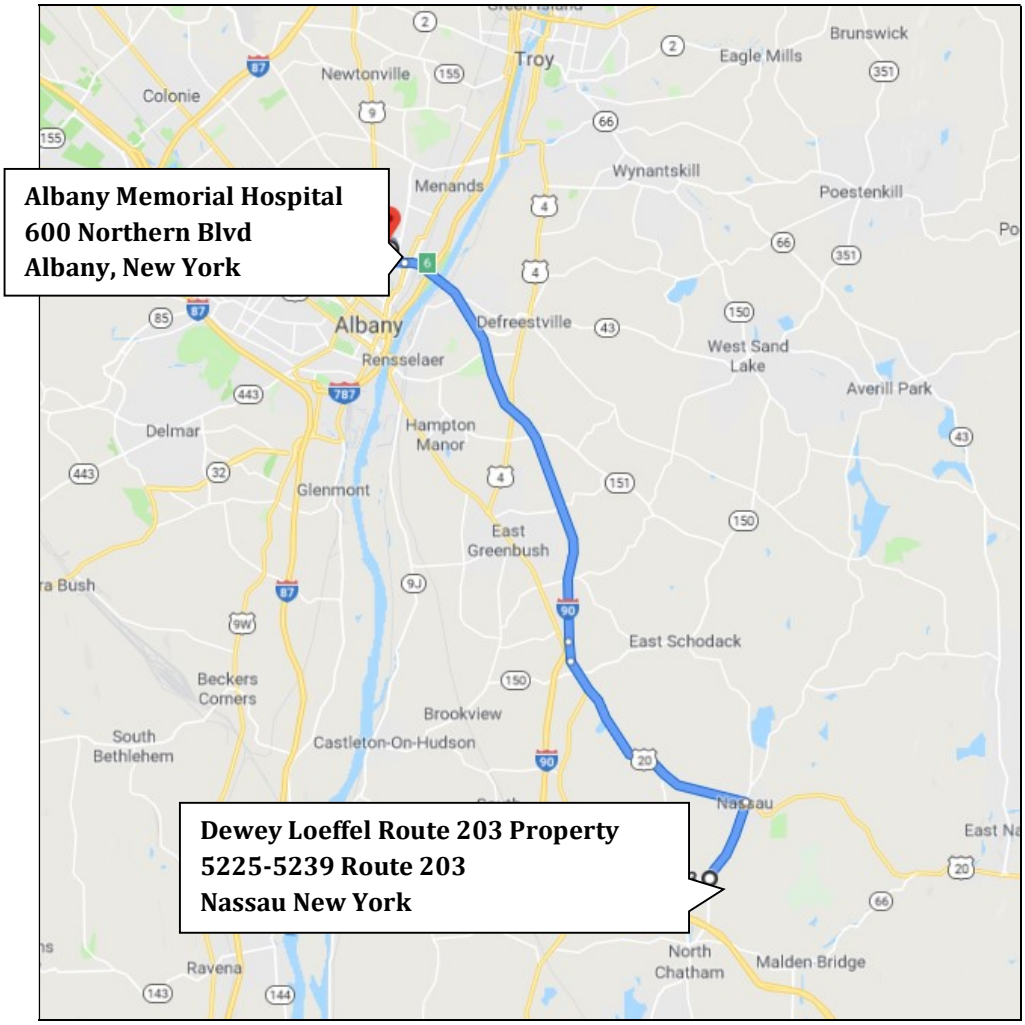

FIGURE 9-1: Hospital Route

Directions to Albany Memorial Hospital:

1. Exit Site and drive northeast on Route 203 toward Sweets Crossing Road (1.7 miles)
2. Turn left onto US-20 W (4.8 miles)
3. Take the Interstate 90 W ramp to Albany and merge onto I-90 W (9.1 miles)
4. Take Exit 6 for US-9 N toward Loudonville (0.4 miles)
5. Keep right, following signs for Northern Boulevard (0.1 miles)
6. Turn left onto Northern Boulevard, following signs for US-9/I-90 E. Albany Memorial Hospital will be on the left. (0.3 miles)

Approximate travel time: 20 to 25 minutes

Dewey Loeffel Route 203 Property
Nassau, New York
Health and Safety Plan

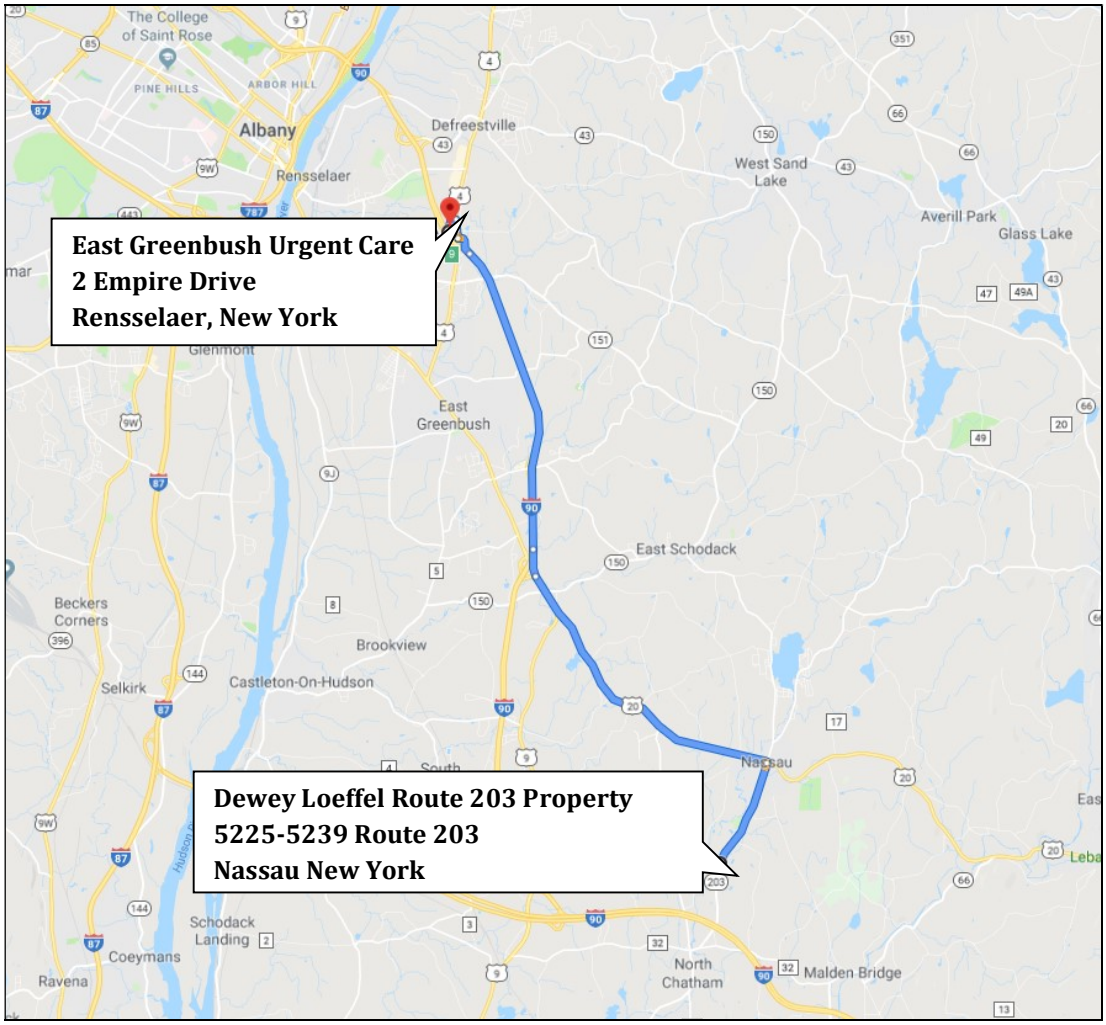

FIGURE 9-2: Urgent Care Center Route

Directions to East Greenbush Urgent Care:

1. Exit Site and drive northeast on Route 203 toward Sweets Crossing Road (1.7 miles)
2. Turn left onto US-20 W (4.8 miles)
3. Take the Interstate 90 W ramp to Albany and merge onto I-90 W (4.7 miles)
4. Take Exit 9 for US-4 N toward Rensselaer/Troy (0.3 miles)
5. Turn right onto US-4 N/Troy Road (0.1 miles)
6. At the traffic circle, continue straight onto US-4 N (0.2 miles)
7. Turn left onto Empire Drive. East Greenbush Urgent Care will be on the left. (0.2 miles)

Approximate travel time: 15 to 20 minutes

APPENDICES

APPENDIX A
SUBCONTRACTOR ACKNOWLEDGEMENT AND SIGN-OFF FORM

Dewey Loeffel Route 203 Property
Nassau, New York

Receipt of HASP – Subcontractor Acknowledgement and Signature Form

By signing this form, the subcontractor acknowledges receipt of this Health and Safety Plan (HASP) and the requirements set forth therein. Ramboll is not responsible for use of this HASP by subcontractors, nor guarantees the health and/or safety of any person working on this site. The subcontractor may use this HASP as guidance, however the subcontractor shall be solely responsible for the health and safety of its employees and agents during performance of the work at the Site. Strict adherence to the health and safety guidelines provided herein will reduce, but not eliminate, the potential for injury at this Site. To this end, health and safety becomes the inherent responsibility of personnel working at the site.

Printed Name	Company Name	Signature/Position	Date

APPENDIX B
DAILY PRE-TASK PLANNER

Dewey Loeffel Route 203 Property
Nassau, New York

Project Name:		**Date:**	
Company Name:		**Project No.:**	
Authorized Tasks **Scope of Work for the day (be specific):**			

Shaded (YES) Boxes Indicate Change and Must Be Addressed.

YES	NO	Daily Supervisor Safety Planning (focus on changes from previous work shift)
		Project Safety Orientation (PSO): Has a new person been added to the work crew or project? If YES, then perform one of the following (mark ☒ which) ☐ ***They received an*** appropriate Project Safety Orientation (PSO); ***or*** ☐ ***One (or more) persons were missing their PSO [I***ndicate under "*Key Safety Instructions*" who was sent for an orientation.]
		Pre-Work Documentation: Has a new person been added to the work crew or project? If YES, then perform one of the following (mark ☒ which) ☐ ***Pre-work documentation (such as training certifications or medical clearance) was checked and found complete***; ***or*** ☐ ***One (or more) persons were missing pre-work documentation which was resolved. [Describe*** under "*Key Safety Instructions*"]
		Recent ***changes to the work scope, work methods, tools, and equipment*** may have introduced new hazards which are not fully addressed in the ***Health & Safety Plan (HASP) or Job Safety Analysis (JSA). IF YES***, then (choose one): ☐ Identify new hazards and controls in the following sections and communicate new hazards and controls in this planner OR ☐ Revise the safety plan or JSA and review with site personnel.
		ANY ***unusual or changed site conditions*** that may affect safety hazards. ***IF YES***, explain in "***Key Safety Instructions***" and review appropriate changes to safety equipment or procedures. ☐ Heavy Rain ☐ Possible Lightening ☐ High Winds ☐ Heat ☐ Cold or Ice ☐ New Work Area ☐ Other:
		ANY ***new tools or equipment or changes to work methods*** that may affect safety hazards. ***IF YES***, explain in "***Key Safety Instructions***" and review appropriate changes to safety equipment or procedures.
		Do ANY of the following ***coordination or notification conditions*** apply to today's authorized tasks? ***IF YES***, take necessary measures (or verify that such measures have already been taken) to coordinate with, or notify, affected organizations including: ☐ Process owners or operators when working near active process equipment including electrical substations, chemical/bulk storage areas, water/wastewater treatment equipment, active production areas, etc. ☐ Contractors performing work in adjacent work areas or other areas potentially impacted by project activities. ☐ Public officials or regulatory agencies for work that may impact public roads, navigable waterways, sewer discharges, etc. ☐ Railroad and Utility Companies for work in rights-of-way OR crossing rights-of-way including "Dig Safe" notifications. ☐ Rescue services for permit-required confined space entry. ☐ Other:
		Permits & Inspections needed for authorized tasks? (**IF YES**, then check all that apply) ☐ Permit-Required Confined Space Entry ☐ Hot Work ☐ Daily Excavation Checklist ☐ Non-Permit Confined Space Downgrade ☐ Energized Electrical Work ☐ Daily Scaffolding Inspection ☐ Alternate Entry (Confined Space) ☐ Lifting & Rigging Plan ☐ Equipment Inspections (specify below) ☐ Other:

Key Safety Instructions or Message For The Day (to be reviewed with field personnel)

Check all that apply:

☐ PERMIT REVIEW - Work permits and inspections are applicable to today's work tasks (Review identified permits & inspections.)

☐ NO CHANGE - The safety plan or JSA is applicable to today's work tasks and PPE and safety procedures are the same as the previous work shift

☐ CHANGE - The safety plan or JSA is applicable to today's work tasks ***but PPE or safety procedures are different***. (Explain below.)

☐ CHANGE - The safety plan or JSA is ***NOT*** applicable to today's work tasks. ***New hazards and safety controls are identified.*** (Explain below.)

Ramboll Representative (review):		
Subcontractor Foreman/Supervisor Signature (authorize):		
Crew Signatures (acknowledge):		

APPENDIX C
TASK-SPECIFIC ACTIVITY HAZARD ANALYSES

ACTIVITY HAZARD ANALYSIS – DEWEY LOEFFEL ROUTE 203 PROPERTY SITE INVESTIGATION – GENERAL SITE HAZARDS

Activity/Work Task: General Site Hazards	Overall Risk Assessment Code (RAC) (Use highest code)	**M**
Project Location: Dewey Loeffel Route 203 Property, Nassau, New York	**Risk Assessment Code (RAC) Matrix**	
Company: Ramboll		
Date Prepared: 10/8/19		
Prepared by (Name/Title): Melanie Marshall, Engineer III		
Reviewed by (Name/Title): Steven Thompson, CHST/ Safety Specialist III		

Severity	**Probability**				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Notes: (Key Hazards, References, Field Notes etc.)

Noise induced hearing loss working in close proximity to drill rig and/or heavy machinery, flying debris from drill rig and/or heavy machinery, slips, trips, falls, working over or near water (Pond Area) musculoskeletal injuries, safe hand tool usage, severe weather, environmental hazards, unauthorized entry to site and/or work area, on-site traffic hazards, reduced or poor work lighting while working close to dark, working from elevated surfaces (such as along frac tanks).

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

E = Extremely High Risk

H = High Risk

M = Moderate Risk

L = Low Risk

Job Steps	**Hazards**	**Controls**	**RAC**
Working near or in close proximity to drill rig or heavy machinery	Flying debris, hazards within close proximity to work area (*i.e.* keeping safe distance from moving parts, rotating parts, etc.)	• Personnel will maintain a safe distance to moving parts. All those working near moving or rotating parts will secure loose hair, clothing, and equipment. • All those working near the rods/casings are instructed to not put themselves in a position where they could get hurt if the rods/casings should turn or drop. • Visitors should maintain safe distance from operations (*i.e.* keep out of the immediate work area). • All personnel, except the driller, will remain out of the immediate area around the drill unless temporary entry is necessary for communication. • All personnel will be instructed on safe locations around/near the drill rig, by the driller, before work begins. • Personnel to remain upwind of drilling equipment exhausts whenever possible. • Personnel should exercise extreme caution in the vicinity of operating equipment and machinery to avoid physical injury to themselves or others. • Personnel will abide by the 25-foot rule. When coming within 25' of heavy equipment/machinery personnel shall obtain the operators attention and make their intentions clear.	**L**

Working near or in close proximity to equipment with excessive noise	Noise induced hearing loss and/or communication loss	• Utilize hearing protection when in close proximity to loud noise from the drill rig, cathead, engine or other heavy operating machinery. • Hearing protection must be donned when working around operating equipment if levels are greater than 85dBA. • OSHA's rule of thumb will be followed in the absence of formal noise monitoring. If personnel who are ~3'-5' away from each other must raise their voices to talk, then hearing protection will be required. • Establish hand signals for work activities with prolonged periods of excessive noise for communication. These signals will be communicated to all site personnel.	**L**
Walking and working surfaces	Slips, trips, falls	• To minimize the potential for slipping, safety shoes with good treads will be worn. If necessary, don slip-on traction device for additional support. • Keep walking paths clear of debris/materials/equipment and ensure walking surfaces are clear of ice, snow, or other slippery materials (*i.e.* oils, greases). • Cover open holes/openings immediately and level ruts or uneven ground as soon as possible. Hole covers will be marked "Hole", hold two times the intended weight, and be secured to the ground.	**M**
Working with miscellaneous tools and equipment, heavy lifting	Musculoskeletal injuries, hand lacerations and abrasions	• Wear gloves appropriate to task - leather work gloves (or cut resistant gloves) for general tasks and nitrile gloves when handling contaminated materials. Nitrile gloves may be worn over the cut resistant gloves, if they become cut then they should be replaced immediately. • Ensure proper training has been conducted prior to using a piece of equipment and inspect equipment for wear. Do not use if equipment is broken or faulty. If broken or faulty equipment is found it should be destroyed or marked "Out of Service" and removed from site as soon as possible. • Wear appropriate Personal Protective Equipment (PPE), as required, for the type of tool used. • Manual lifting more than 75 lbs by a single person will be avoided. A skid steer, or other similar vehicle, will be on site as a material handling aid. • Proper lifting techniques will be employed (*e.g.*, two-man lift, bending at the knees, limited pivoting at the waist). • The use of safety knives, scissors, or safety cutters is preferred over the use of fixed blade knives, razor knives, or box cutters.	**M**
Working near aggressive fauna or flora	Insect, snake, or wild animal bites and/or stings, contact with poisonous/irritating vegetation,	• Use DEET (25%-98%) repellent on skin for protection against mosquitoes, ticks, and similar insects. Use higher concentrations for heavily infested areas.	**M**

		• Use Permethrin repellent on clothing in areas heavily infested with ticks, chiggers, etc. When using permethrin, the manufacturer's instructions should be followed, and it should NEVER be sprayed directly onto the skin. • Poison ivy neutralizing wipes or rubbing alcohol will be used on hands and exposed skin following work activities or incidents where contact with poison ivy/oak/sumac is suspected. • Protective coveralls (such as Tyvek™) will be used to prevent contact with ticks or poison ivy in known or potential areas. • Appropriate work/rest regimens will be implemented while wearing protective coveralls to avoid heat stress. Personnel will have brakes out of the sun as needed and will be provided with adequate drinking water. • Protective coveralls may be modified (*e.g.* removed above the waist, etc.) as necessary, IF the modification does not limit protection from ticks or other aggressive fauna and/or flora. • Personnel will stay hydrated while working in protective coveralls to prevent dehydration. • Personnel will be notified during project kick-off meeting of venomous snakes and spiders that have the potential to be in work areas. If personnel become bitten by a potentially venomous snake or spider, they should immediately dial **911** for assistance from emergency response workers. • Site personnel with known allergies to bee/wasp stings, fire ant bites, or other insect bites carry an "EpiPen" or equivalent medication prescribed for treating allergic reaction. Site Safety Leader (SSL) will be notified by personnel with allergies. • Avoid, do not approach, and keep a safe distance from potential harmful wildlife.	
Working in severe weather, extreme heat or cold conditions	Cold stress, hypothermia, heat stress, heat exhaustion, heat stroke	• Work/rest regimens will be employed as deemed necessary by the SSL so that personnel do not suffer adverse effects from heat/cold stress. • Site workers will be trained to recognize the symptoms of heat/cold stress. • Once temperatures exceed 80°F the SSL will use the modified heat index table to implement controls to avoid heat related illnesses. A modified version of the table can be found in Section 7.1 of Rambolls "Heat and Cold Stress Procedure". • Work in protective coveralls will be prohibited at a Heat Index value over 99 unless cooling PPE is provided. • In the event of severe weather, personnel will seek shelter immediately. The SSL will advise personnel during severe weather accordingly. • The SLL and/or the PM will use their discretion to decide if inclement weather is cause for cancelling field work.	**L**
Working with machinery and near vehicles, visitors in vicinity of designated work areas	On-site traffic hazards, striking another vehicle, property, or worker, unauthorized entry into designated work areas	• Use spotters when backing up vehicles and equipment. • Inspect the work area by walking around the vehicle and equipment to identify any potential striking hazards. Insure back up alarms are functioning properly if vehicle or equipment is equipped. • Work zone should be delineated to keep visitors and unauthorized personnel from entering. Keep watch of work area and delineate with caution tape or other barrier to restrict access, as necessary.	**M**

Working near or on roadways	Traffic hazards, striking another vehicle, property, or worker	• Temporary Traffic control procedures will be implemented during work near or on the shoulders of Sweets Crossing Road, consistent with Department of Transportation guidelines in Section 6 (Temporary Traffic Control) of the Manual of Uniform Traffic Control Devices. • All flaggers will be DOT Flagger Trained. Verify training was completed and obtain copies of training certificates. • Flaggers will be in constant communication	**L**
Working in poor or reduced lighting	Slips, trips, falls from poor visibility, striking equipment, property, personnel due to poor or reduced lighting	• Personnel will minimize the need to work in the dark due to poor or reduced lighting. • Utilize flashlights or head lamps should you need to work in poor or reduced lighting due to darkness.	**L**
Working on elevated surfaces	Fall hazards	• Utilize hand rails and guard rails to minimize the risk of falling while working on frac tanks and elevated surfaces. • If elevated work surfaces greater than 6' are unguarded then tie off points will be identified on the pre-task planner prior to use and a harness and lanyard will be utilized as a personal fall arrest system. Anyone required to utilize this system will be required to have documented fall protection training.	**L**
Working near water near the on-Site Pone Area	Drowning, hypothermia, fall through ice	• Don appropriate PPE when working near (within 6 feet) or over water/ice, including a USCG-approved Type I, II or III personal floatation device. • Utilize the "buddy system" when working near water. • To minimize the potential for slipping, appropriate footwear with good treads will be worn.	**M**

Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
• Hard hat, safety glasses, safety shoes and high visibility safety vest (required for any on-site worker, visitor, or sub-contractor) • Nitrile gloves, cut-resistant gloves, hearing protection, Tyvek or other protective coverall (as necessary) • USCG-approved Type I, II or III personal floatation device to be used during work activities within 6 feet of the on-Site Pond Area.	• OSHA 40 or 24-hour certification with 8-hour annual refresher training (required for sub-contractors working on-site) • Annual site-specific training documentation for Ramboll personnel • Visitors without the proper training requirements must have escort while on-site • Users of PFAS must have fall protection training. • DOT Flagger Training • For SSHC: Project Safety – SSL1 training	• Daily equipment inspections

Client:	General Electric Company	
Project Name:	Dewey Loeffel Route 203 Property Investigation	**Project No.**
Project Location:	Nassau, New York	
Site Safety Leader:		
Main Points of Briefing:	☐ Ramboll Safety Requirements ☐ Site-Specific Safety Pan or JSA/AHA ☐ Site Owner Safety Requirements	**Other:**

The purpose of the Pre-Work Briefing is to provide a ***site-specific Project Safety Orientation (PSO)*** to employees and subcontractors. This certifies that undersigned individuals have read, understand, and agree to comply with applicable ***site-specific safety requirements*** that can be obtained from site safety plans, site Activity Hazard Analyses (AHAs), Job Safety Analyses (JSAs), site owner requirements, and/or other site safety documents furnished to them by Ramboll. The undersigned individuals acknowledge that these safety requirements are not "all-inclusive" and that they will be expected to follow any additional safe work practices applicable to their specific scope of work.

Print Name	Signature	Company	Date

-- All Site Personnel Must Acknowledge Their Review and Understanding of Safety Requirements --

ACTIVITY HAZARD ANALYSIS – DEWEY LOEFFEL ROUTE 203 PROPERTY SITE INVESTIGATION – DRILLING/MONITORING WELL INSTALLATION

Activity/Work Task: Drilling/Monitoring Well Installation	Overall Risk Assessment Code (RAC) (Use highest code)					**H**
Project Location: Dewey Loeffel Route 203 Property, Nassau, New York	**Risk Assessment Code (RAC) Matrix**					
Company: Ramboll	**Severity**	**Probability**				
Date Prepared: 10/11/19		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Melanie Marshall, Engineer III	Catastrophic	**E**	**E**	**H**	**H**	**M**
	Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by (Name/Title): Steven Thompson, CHST/ Safety Specialist III	Marginal	**H**	**M**	**M**	**L**	**L**
	Negligible	**M**	**L**	**L**	**L**	**L**

Notes: (Key Hazards, References, Field Notes etc.)

Scope:

As stated in Section 2 of the *Investigation Work Plan,* drilling and monitoring well installation programs will be completed to investigate potentially contaminated overburden soil and groundwater. Overburden drilling/well installation activities will be performed utilizing hollow-stem auger or direct push drilling techniques.

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

RAC Chart

E = Extremely High Risk

H = High Risk

M = Moderate Risk

Following the completion of drilling, development activities may be completed via air lift or submersible electric pumping techniques subsequent to monitoring well installation. Subcontractors include: drilling sub-contractor Key Hazards: Contact with potentially contaminated soil, bedrock or groundwater, moving parts on heavy machinery (*e.g.* cat-head, drill rods, wireline and hydraulic lines on the drill rig, skid-steer, and other heavy machinery), vehicle and heavy machinery traffic hazards, Pinch points on drilling equipment, machinery, and tools, electrically powered equipment and overhead electrical hazards, shock hazards, compressed, combustible, and toxic gas hazards, working near water, slips, trips, and falls on un-even terrain, mud, ice and/or snow, laceration hazards, heat/cold stress, musculoskeletal injuries from twisting, bending, and/or heavy lifting, severe weather, aggressive fauna and flora (*e.g.,* black flies, ticks, spiders, snakes, bees, wasps, rabid animals, poison ivy, poison oak, sumac, giant hogweed, etc.). References: *Investigation Work Plan,* Dewey Loeffel Route 203 Property, Nassau, NY Health and Safety Plan, Dewey Loeffel Route 203 Property, Nassau, NY Activity Hazard Analysis – General Site Hazards (*e.g.,* biological hazards, heat/cold stress, inclement weather)	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.	**L = Low Risk**

Job Steps	Hazards	Controls	RAC
General Site Safety **Walking and Working surfaces**	• Slipping on wet, muddy, or icy surfaces leading to potential sprains strains or broken bones. • Tripping over equipment or uneven surfaces leading to sprains Strains or falls. • Equipment falling over while being stored leading to potential personal injuries or property damage.	• To minimize the potential for slipping, safety shoes with good treads will be worn. If necessary, don slip-on traction device for additional support. • Keep walking paths clear of debris/materials/equipment and ensure walking surfaces are clear of ice, snow, or other slippery materials (i.e. oils, greases). • Equipment and materials will be stacked in laydown areas with aisles as necessary for safe access. All un-used equipment & materials will be returned to laydown areas daily. • Trash and debris will be removed daily and placed in designated containers.	**M**
General Site Safety **Working with miscellaneous tools and equipment, heavy lifting**	• Poor lifting and carrying practices leading to Musculoskeletal injuries. • Failure to wear appropriate or any Gloves Leading to hand injuries. • Use of fixed Blade Knives leading to Hand/arm Lacerations.	• Wear gloves appropriate to task - leather work gloves (or cut resistant gloves) for general tasks and nitrile gloves when handling contaminated materials. Nitrile gloves may be worn over the cut resistant gloves, if they become cut then they should be replaced immediately. • Ensure proper training has been conducted prior to using a piece of equipment and inspect equipment for wear. Do not use if equipment is broken or faulty. If broken or faulty equipment	**M**

	• Failure to wear appropriate Eye protection leading to eye injury • Improper use of or use of damaged electrical cords leading to electrical shock.	is found it should be destroyed or marked "Out of Service" and removed from site as soon as possible. • Use the correct tool for the task, in a manner for which they were designed. • GFCIs will be used for all extension cords and 120v power tools. • All extension cords are in good condition with no cuts through outer insulation, ground plugs are present, and no "vinyl tape" repairs. • User will inspect tools and electrical cords daily. • Wear appropriate Personal Protective Equipment (PPE), as required, for the type of tool used. • ANY task that requires the use of a face shield also requires the use of Eye Protection (i.e. safety glasses) • Hearing protection required for which tools or areas: Power tools, equipment that generates sustained noise above 90 db. OSHA guidance (If you have to raise your voice to be heard <5' away, you need hearing protection) • Proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist). • The use of safety knives, scissors, or safety cutters is required instead of the use of fixed blade knives, razor knives, or box cutters. If a fixed blade knife is the ONLY TOOL that can perform the task, a separate AHA is required detailing the procedure and Health and Safety Project Manager must approve of the plan and variance.	
General Site Safety **Working near water for drilling locations near the on-Site Pond Area**	Slipping into, falling into water, fall through ice leading to Drowning and or hypothermia	• Don appropriate PPE when working near (within 6 feet) or over water/ice, including a USCG-approved Type I, II or III personal floatation device. • Utilize the buddy system when working near water, work in teams of at least 2 people. • To minimize the potential for slipping, appropriate footwear with good treads will be worn.	**M**
Mobilize Drilling Rig into position **Moving to location**	• Fluid Leaks from engine or other lubricated mechanical parts leading to environmental contamination • Struck By, Run-Over while moving the rig onsite and not seeing ground personnel leading to personal injury • Electrical shock leading to property damage and or personal injury by coming into contact with overhead lines • Roll Over leading to property damage or personal injury due to unstable ground, traveling upon uneven surfaces, or moving the rig with the mast elevated • Injury while performing maintenance on mechanical parts of the rig.	• Qualified persons move and operate all drilling/boring equipment. Qualifications were determined by subcontractor work experience and pre work documentation verified by SSHC. • Equipment will be inspected upon mobilization (*i.e.*, "acceptance inspection") by: Operator and verified by the Site Safety Coordinator. • Prior to moving equipment every time, equipment will be inspected for signs of leakage (I.E. oil stains etc.). • High visibility vests always required for all on-Site and off-Site work.	**H**

	• Contact with other vehicles while working or moving rig along streets and roads leading to property damage and or personal injury.	• Maintain a safety zone of at least 25 feet when walking and working in the area of heavy equipment operation (*i.e.,* "the 25 feet rule"). • Drill rods, casings, and other equipment will be secured to prevent them from falling on, or rolling into, site personnel while in transit. • Drill rig will only be moved with mast lowered. Masts will be erected with outriggers fully extended, when equipped with outriggers. • Movement up or down inclines should be done at a 90degree angle to the slope. • Drilling/boring equipment will be de-energized and locked-out prior to maintenance. • Spill equipment is available for fuel and hydraulic fluid leaks. Location; Support vehicle and in the immediate work zone. • Operators are required to wear seat belts for all equipment provided with seatbelts. • Spotters are required when trucks or other heavy equipment are backing up. Spotters will use designated hand signals while vehicles are backing up. • Inform project and subcontractor personnel of 20' safety zones around energized power lines • Dedicate a spotter for all elevated work or operation of equipment that can contact lines • If roadway flaggers are used to temporarily control traffic, DOT Flagger Training is required. Verify training was completed and obtain copies of training certificates. • Traffic cones, flagging etc. will be used to define active work area	
Dill Rig Setup/Breakdown **Drill Rig operation**	• Contact with subsurface Utilities leading to property damage, service interruptions, Personal injury or death • Struck By, Caught In Between (pinch points) Leading to property damage, Personal injury or Death • Contact with rotating drill heads or other drill parts, which could "pull a worker into the equipment leading to Injury or Death • Tip Over • Fluid Leaks • Exposure to CO leading to illness • Contact with contaminated materials during intrusive activities leading to over exposure to hazardous chemicals, vapors, dust, contact with contaminated	• Local Dig Safe will be contacted for utility locations in public areas or rights of way prior to the start of intrusive activities. • Equipment will be inspected daily and documented by operator and verified by the SSHC • Personnel essential to the operation of the rig should exercise extreme caution in the vicinity of operating equipment and machinery to avoid physical injury to themselves or others. • Non-Essential personnel should maintain a safety zone of at least 25 feet when walking and working in the area of heavy equipment operation (*i.e.,* "the 25 feet rule"). • The SSL will define the perimeter of intrusive work areas.	**H**

	materials, including VOCs, PCBs, and chemical solutions causing illness • Contact with Drill rods or Casings while carrying or swinging into place leading to personal injury.	• Operators and helpers will maintain a safe distance to moving parts. All those working near moving or rotating parts will secure loose hair, clothing, and equipment. • Spill equipment is available for fuel and hydraulic fluid leaks. Location; Support vehicle and in the immediate work zone and verified by the SSHC. • Personnel to remain upwind of heavy equipment exhaust whenever possible. • Site personnel working in the area surrounding the drilling/boring rig will be informed where the emergency shutoff in the event of an emergency. • Avoid operation of heavy equipment on sloped areas, saturated areas, saturated ground surfaces and heavily rutted areas. • Cell phones will not be used while operating heavy equipment and machinery or by workers on the ground in the area of heavy equipment and machinery operations to avoid physical injury to themselves or others. • Site workers with minimal contact with contaminated materials and no work in Level C PPE will have OSHA 40-hour or 24-hour training, current 8-hour refresher, if necessary, and medical exam. • Work area air monitoring will be conducted for VOCs and gases during drilling, well development, and monitoring well installation. ○ Level D PPE - <1 ppm benzene and <5 ppm total VOCs ○ Half of full face Level C PPE, with organic vapor/P100 cartridges changed daily – 1-10 ppm benzene or 5-50 ppm Total VOCs ○ Full face Level C PPE - 5-50 ppm benzene or 50-200 ppm total VOCs (with Full Face and **Quantitative fit testing**) ○ >50 ppm or >200 ppm total VOCs – STOP work until contamination levels reduces and notify Project Manager and Client Representative **Parameter** / **Action Levels** (sustained for 1 minute) LEL / >10% **O_2** / 19.5% - 23.0% CO / 35 ppm	

		H_2S | 10 ppm - If O_2 levels become deficient or enriched, H_2S gas or CO is detected at a concentration that will pose a risk to personnel, or the LEL is reached while monitoring with the five gas meter, work will be suspended and the Project Manager and Client Representative will be notified immediately. Action limits for these atmospheric testing parameters are provided in the table above. - Work will be suspended until five gas meter and UltraRAE 3000 concentrations are deemed safe enough to work without engineering controls or with the appropriate engineering controls and/or respiratory protection as described by OSHA requirements in 29 CFR Part 1910.1000. • Intrusive work activities include drilling, well development and installation of monitoring wells.	
Welding Well Casings together	• Fire/Explosion/burns due to improper use or storage of torch cutting materials • Faulty welding equipment leading to shock or electrocution.	• To minimize potential for fires, trash and debris will be removed daily and placed in designated containers. • Oxygen and flammable gasses will be separated by 20' minimum and stored upright with their caps in place. • Remove all flammable materials from the area where Hot Wok is being performed. • All Hot work will have a Hot Work Permit, either the clients or OBG provided verified by the SSHC. • A 20-lb ABC type fire extinguisher will be present while performing hot work related activities. Designated personnel on "Fire Watch" will remain in the work area for **at least** 1 hour following the completion of hot work activities.	**M**
Elevated work on drill rig >6', to effect repairs of equipment or setting of mast.	Falling from a height greater than 6' leading to personal injury or death.	• All subcontractors performing work on elevated surfaces with the potential to fall will don a **fall arrest** system/ Positioning device with full body harness, or equivalent fall protection, to prevent a fall from occurring. • Tie-off points will be of an appropriate height and strength to support the worker and to prevent injury should a fall occur. • All subcontractors utilizing fixed stairs or elevated platforms on the drill rig during drilling operations will maintain three points of contact while performing work. • Subcontractors will be mindful of ice, snow and muddy surfaces that may cause a slip, trip, or fall. Steel-toe shoes with good tread should be worn to prevent slips, trips, or falls from taking place. • Walking working or standing surfaces will be maintained, to the best possible extent free of ice, mud, and other tools that may cause slip trip or fall hazards.	**M**
Mixing grout during monitoring well installation activities	Dust generated when emptying bags into mixer leading to exposure to greater than acceptable nuisance dust levels and or	• Personnel mixing grout and using silica during monitoring well installation activities will monitor for excess dust.	**L**

	exposure to Silica which can result in ailments from discomfort to Silicosis.	• When mixing large batches of grout, Unless the Grouting material clearly states it does not contain silica, either an exposure assessment should be performed to prove respirable dust levels are below acceptable limits, or a half face respirator should be worn (including medical clearance) with N95 or better filters. • Personnel are encouraged to utilize N95 particulate filters during mixing if mixing small amounts by hand. Excess dust will be controlled using a spray bottle with water, as needed, for dust suppression.	
Decontamination of Small tools and Heavy Equipment	• Equipment leaves site with contaminated soil or water on it's working surfaces leading to the potential for additional cleaning costs by vendor, cross contamination of samples, or exposure to chemicals by workers or public. • Misuse of Hotsy or pressure washer leading to burns, eye injuries or puncture like injuries to personnel.	• Personnel, small tools and heavy equipment shall be decontaminated. • Decontamination of heavy equipment using pressurized steam washer or equivalent. • Personal Protective equipment when using a pressure washer or Hotsy includes: Hard hat, Safety Glasses, Face Shield, rain suit or splash suit, and gloves. • Pressure washer will not be used to clean boots or clothing. • Heavy equipment leaving site will be inspected by the SSL prior to exit. • Decontamination of personnel and small tools will be conducted as follows: Phosphate-free detergent wash and distilled water rinse.	**L**

Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
• Hard hat, safety glasses, hearing protection, safety shoes and high visibility safety vest (required for any on-site worker, visitor, or sub-contractor) • Nitrile gloves, cut-resistant gloves, Tyvek or other protective coverall (as necessary) • USCG-approved Type I, II or III personal floatation device to be used during work activities within 6 feet of the on-Site Pond Area. • PID • 4 Gas Meter • Ultra Rae 3000 or similar	• OSHA 40 or 24-hour certification with 8-hour annual refresher training (required for sub-contractors working on-site) • Annual site-specific training documentation for Ramboll personnel • Visitors without the proper training requirements must have escort while on-site • DOT flagger training • For SSHC: Project Safety – SSL1 training	• Equipment acceptance inspection • Daily equipment inspections, including drill rigs, heavy equipment, tools, and electrical cords • Daily equipment inspections, including drill rigs, heavy equipment, tools, and electrical cords • Daily bump check for all meters and weekly full calibrations

Client:	General Electric Company	
Project Name:	Dewey Loeffel Route 203 Property Investigation	**Project No.**
Project Location:	Nassau, New York	
Site Safety Leader:		
Main Points of Briefing:	☐ Ramboll Safety Requirements ☐ Site-Specific Safety Pan or JSA/AHA ☐ Site Owner Safety Requirements	**Other:**

The purpose of the Pre-Work Briefing is to provide a ***site-specific Project Safety Orientation (PSO)*** to employees and subcontractors. This certifies that undersigned individuals have read, understand, and agree to comply with applicable ***site-specific safety requirements*** that can be obtained from site safety plans, site Activity Hazard Analyses (AHAs), Job Safety Analyses (JSAs), site owner requirements, and/or other site safety documents furnished to them by Ramboll. The undersigned individuals acknowledge that these safety requirements are not "all-inclusive" and that they will be expected to follow any additional safe work practices applicable to their specific scope of work.

Print Name	Signature	Company	Date

-- All Site Personnel Must Acknowledge Their Review and Understanding of Safety Requirements --

ACTIVITY HAZARD ANALYSIS – DEWEY LOEFFEL ROUTE 203 PROPERTY SITE INVESTIGATION – FIELD EQUIPMENT CALIBRATION

Activity/Work Task: Field Equipment Calibration	Overall Risk Assessment Code (RAC) (Use highest code)					**L**
Project Location: Dewey Loeffel Route 203 Property, Nassau, New York	**Risk Assessment Code (RAC) Matrix**					
Company: Ramboll	**Severity**	**Probability**				
Date Prepared: 10/11/19		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Melanie Marshall, Engineer III	Catastrophic	**E**	**E**	**H**	**H**	**M**
	Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by (Name/Title): Steven Thompson, CHST/ Safety Specialist III	Marginal	**H**	**M**	**M**	**L**	**L**
	Negligible	**M**	**L**	**L**	**L**	**L**

Notes: (Key Hazards, References, Field Notes etc.)

Scope:
As stated in Section 2 of the *Investigation Work Plan*, various field activities will be completed that require the use of air monitoring equipment and groundwater sampling and monitoring equipment. The equipment used during field activities will be calibrated prior to use.

Key Hazards:
Contact with chemical calibration solutions (*e.g.,* benzene, isobutylene, pH buffers, etc.), pinch points on equipment and tools, slips, trips, and falls on un-even terrain, mud, ice and/or snow, laceration hazards, musculoskeletal injuries from twisting, bending, and/or heavy lifting, heat/cold stress, severe weather, aggressive fauna and flora (*e.g.,* black flies, ticks, spiders, snakes, bees, wasps, rabid animals, poison ivy, poison oak, sumac, giant hogweed, etc.).

References:
Investigation Work Plan, Dewey Loeffel Route 203 Property, Nassau, NY
Health and Safety Plan, Dewey Loeffel Route 203 Property, Nassau, NY
Activity Hazard Analysis – General Site Hazards

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

E = Extremely High Risk

H = High Risk

M = Moderate Risk

L = Low Risk

Job Steps	Hazards	Controls	RAC
Calibration of field equipment	Exposure to hazardous chemicals, vapors, dust, contact with contaminated materials, including VOCs, PCBs, and chemical solutions	• Decontamination of personnel and small tools will be conducted as follows: **Phosphate-free detergent wash and distilled water rinse.** • Work-area monitoring is not anticipated for equipment calibration activities.	**L**
	Slips, trips, falls	• To minimize the potential for slipping, safety shoes with good treads will be worn. If necessary, don slip-on traction device for additional support.	**M**

		• Keep walking paths clear of debris/materials/equipment and ensure walking surfaces are clear of ice, snow, or other slippery materials (*i.e.* oils, greases). • Equipment and materials will be stacked in laydown areas with aisles as necessary for safe access. All un-used equipment & materials will be returned to laydown areas daily. • Trash and debris will be removed daily and placed in designated containers.	
	Musculoskeletal injuries, hand lacerations, abrasions, eye injury, dust, electrical shock when working with miscellaneous tools or moving equipment	• Wear gloves appropriate to task - leather work gloves (or cut resistant gloves) for general tasks and nitrile gloves when handling contaminated materials. Nitrile gloves may be worn over the cut resistant gloves, if they become cut then they should be replaced immediately. • Ensure proper training has been conducted prior to using a piece of equipment and inspect equipment for wear. Do not use if equipment is broken or faulty. If broken or faulty equipment is found it should be destroyed or marked "Out of Service" and removed from site as soon as possible. • Use the correct tool for the task, in a manner for which they were designed. • User will inspect tools and electrical cords daily • Wear appropriate Personal Protective Equipment (PPE), as required, for the type of tool used. • Proper lifting techniques will be employed (*e.g.*, two-man lift, bending at the knees, limited pivoting at the waist). • The use of safety knives, scissors, or safety cutters is preferred over the use of fixed blade knives, razor knives, or box cutters.	**M**

Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
• Hard hat, safety glasses, safety shoes and high visibility safety vest (required for any on-site worker, visitor, or sub-contractor) • Nitrile gloves, cut-resistant gloves, Tyvek or other protective coverall (as necessary)	• OSHA 40 or 24-hour certification with 8-hour annual refresher training (required for sub-contractors working on-site) • Annual site-specific training documentation for Ramboll personnel • Visitors without the proper training requirements must have escort while on-site • For SSHC: Project Safety – SSL1 training	• Daily equipment inspections, including monitoring equipment, tools, and electrical cords

Client:	General Electric Company	
Project Name:	Dewey Loeffel Route 203 Property Investigation	**Project No.**
Project Location:	Nassau, New York	
Site Safety Leader:		
Main Points of Briefing:	☐ Ramboll Safety Requirements ☐ Site-Specific Safety Pan or JSA/AHA ☐ Site Owner Safety Requirements	**Other:**

The purpose of the Pre-Work Briefing is to provide a ***site-specific Project Safety Orientation (PSO)*** to employees and subcontractors. This certifies that undersigned individuals have read, understand, and agree to comply with applicable ***site-specific safety requirements*** that can be obtained from site safety plans, site Activity Hazard Analyses (AHAs), Job Safety Analyses (JSAs), site owner requirements, and/or other site safety documents furnished to them by Ramboll. The undersigned individuals acknowledge that these safety requirements are not "all-inclusive" and that they will be expected to follow any additional safe work practices applicable to their specific scope of work.

Print Name	Signature	Company	Date

-- All Site Personnel Must Acknowledge Their Review and Understanding of Safety Requirements --

ACTIVITY HAZARD ANALYSIS – DEWEY LOEFFEL ROUTE 203 PROPERTY SITE INVESTIGATION – FIELD EQUIPMENT DECONTAMINATION

Activity/Work Task: Field Equipment Decontamination	Overall Risk Assessment Code (RAC) (Use highest code)					**M**
Project Location: Dewey Loeffel Route 203 Property, Nassau, New York	**Risk Assessment Code (RAC) Matrix**					
Company: Ramboll	**Severity**	**Probability**				
Date Prepared: 10/11/19		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Melanie Marshall, Engineer III	Catastrophic	**E**	**E**	**H**	**H**	**M**
	Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by (Name/Title): Steven Thompson, CHST / Safety Specialist III	Marginal	**H**	**M**	**M**	**L**	**L**
	Negligible	**M**	**L**	**L**	**L**	**L**

Notes: (Key Hazards, References, Field Notes etc.)

Scope:

To minimize the potential for cross-contamination between drilling and testing locations, and to minimize tracking of subsurface contaminants across the site, decontamination procedures will be implemented for the tasks and activities completed under Section 2 of the *Investigation Work Plan*. All tools and equipment, machinery, pumps and/or sondes, field instrumentation, etc. that has been in contact with potentially contaminated soil, groundwater, surface water and/or sediment will undergo decontamination. In addition, drill rigs, support vehicles, and heavy equipment used for IWP implementation will be decontaminated prior to entry to the site, and prior to leaving the site. Clean water will be used for all decontamination activities.

Subcontractors include: multiple sub-contractors will be utilized to implement the specific activities discussed above.

Key Hazards:

Contact with equipment exposed to potentially contaminated soil, groundwater, surface water, and/or sediment, pinch points on equipment and tools, slips, trips, and falls on un-even terrain, mud, ice and/or snow, laceration hazards, musculoskeletal injuries from twisting, bending, and/or heavy lifting, heat/cold stress, severe weather, aggressive fauna and flora (*e.g.,* black flies, ticks, spiders, snakes, bees, wasps, rabid animals, poison ivy, poison oak, sumac, giant hogweed, etc.).

References:

Investigation Work Plan, Dewey Loeffel Route 203 Property, Nassau, NY

Health and Safety Plan, Dewey Loeffel Route 203 Property, Nassau, NY

Activity Hazard Analysis – General Site Hazards

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

E = Extremely High Risk

H = High Risk

M = Moderate Risk

L = Low Risk

Job Steps	**Hazards**	**Controls**	**RAC**

General Site Safety **Moving around Site on foot**	• Slips, trips, falls	• To minimize the potential for slipping, safety shoes with good treads will be worn. If necessary, don slip-on traction device for additional support. • Keep walking paths clear of debris/materials/equipment and ensure walking surfaces are clear of ice, snow, or other slippery materials (i.e. oils, greases). • Equipment and materials will be stacked in laydown areas with aisles as necessary for safe access. All un-used equipment & materials will be returned to laydown areas daily. • Trash and debris will be removed daily and placed in designated containers.	**L**
General Site Safety **Working with miscellaneous tools and equipment, heavy lifting**	• Musculoskeletal injuries from lifting heavy objects or improper lifting techniques, • Hand lacerations, abrasions or puncture wounds while moving objects • Use of fixed Blade Knives leading to Hand/arm Lacerations. • Dust or other contaminates causing eye injury. • An electrical shock when working with miscellaneous tools and equipment due to wet conditions or faulty electrical equipment.	• Proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist). • Wear gloves appropriate to task - leather work gloves (or cut resistant gloves) for general tasks and nitrile gloves when handling contaminated materials. Nitrile gloves may be worn over the cut resistant gloves, if they become cut then they should be replaced immediately. • Ensure proper training has been conducted prior to using a piece of equipment and inspect equipment for wear. Do not use if equipment is broken or faulty. If broken or faulty equipment is found it should be destroyed or marked "Out of Service" and removed from site as soon as possible. • Use the correct tool for the task, in a manner for which they were designed. • GFCIs will be used for all extension cords and 120v power tools. • All extension cords are in good condition with no cuts through outer insulation, ground plugs are present, and no "vinyl tape" repairs. • User will inspect tools and electrical cords daily. • Wear appropriate Personal Protective Equipment (PPE), as required, for the type of tool used. • Hearing protection required for which tools or areas: Power tools, equipment that generates sustained noise above 90 db. OSHA guidance (If you have to raise your voice to be heard <5' away, you need hearing protection) • Proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist). • The use of safety knives, scissors, or safety cutters is required instead of the use of fixed blade knives, razor knives, or box cutters. If a fixed blade knife is the ONLY TOOL that can perform the task, a separate AHA is required detailing the procedure and Health and Safety Project Manager must approve of the plan and variance.	**M**

Movement of Heavy Equipment into position to be decontaminated	• Personnel or equipment Struck By, Run-Over, Caught In Between (pinch points) while relocating heavy equipment from work area into decontamination area leading to personal injuries or property damage • Roll Over of Heavy Equipment while relocating to a decontamination area due to overloading or operation on steep slopes leading to potential personal injury or fatality • Fluid Leaks from the heavy equipment leading to potential environmental impacts or personal injury.	• Qualified persons operate all heavy equipment. Qualifications were determined by subcontractor work experience. • Equipment will be inspected upon mobilization (i.e., "acceptance inspection") by: Operator and verified by the Site Safety Coordinator. • Operators are required to wear seat belts for all equipment provided with seatbelts. • High visibility vests required for all on-Site and off-Site work. • Personnel should exercise extreme caution in the vicinity of operating equipment and machinery to avoid physical injury to themselves or others. • Maintain a safety zone of at least 25 feet when walking and working in the area of heavy equipment operation (*i.e.,* "the 25 feet rule"). • Dump trucks, 4x4's, or other haul vehicles will not be loaded beyond manufacturer capacities or weight limits established by state and local authorities for transportation. • Spotters are required when trucks or other heavy equipment are backing up. Spotters will use designated hand signals while vehicles are backing up. • Operators and helpers will maintain a safe distance to moving parts. All those working near moving or rotating parts will secure loose hair, clothing, and equipment. • Spill equipment is available for fuel and hydraulic fluid leaks. Location; Support vehicle and in the immediate work zone. • Personnel to remain upwind of heavy equipment exhaust whenever possible. • Avoid operation of heavy equipment on sloped areas, saturated areas, saturated ground surfaces and heavily rutted areas. • Cell phones will not be used while operating heavy equipment and machinery or by workers on the ground in the area of heavy equipment and machinery operations to avoid physical injury to themselves or others.	**M**
Decontamination of heavy equipment using pressurized steam washer or equivalent	• Exposure to hazardous chemicals, vapors, dust, contact with contaminated materials, including VOCs, PCBs, and chemical solutions • Burns from either contact with "Hotsy" or from the hot water steam. • Injuries caused by contact with Pressure washer stream leading to personal injury. • Fire caused by faulty equipment.	• Remove "heavies" and larger debris from surfaces with a shovel or other hand tools prior to using a pressure washer to minimize debris. • Don appropriate PPE during heavy equipment decontamination, including cut-resistant gloves, hearing protection, and eye protection/face shield, and Tychem QC or other form of splash protection, as necessary • Have a fire extinguisher located near any equipment where flames and fuel are used or stored (i.e., "Hotsy") • Injuries caused to flesh by pressurized water streams are similar to severe puncture wounds that cut to the bone follow	**M**

	• Slips and falls caused by the formation of mud or wet surfaces.	the bone cutting the flesh away, do not attempt to clean close or boots with high pressure.	
Decontamination of personnel and small tools	• Exposure to hazardous chemicals, vapors, dust, contact with contaminated materials, including VOCs, PCBs, and chemical solutions	• Decontamination of personnel and small tools will be conducted as follows: Phosphate-free detergent wash and distilled water rinse. • Don appropriate PPE, including nitrile gloves and safety glasses	**L**

Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
• Hard hat, safety glasses, safety shoes and high visibility safety vest (required for any on-site worker, visitor, or sub-contractor) • Nitrile gloves, cut-resistant gloves, hearing protection, face shield (required for chemical handling, line breaks, pressure washing), Tyvek or other protective coverall (as necessary) • PID • 4 Gas Meter • Ultra Rae 3000 or similar	• OSHA 40 or 24-hour certification with 8-hour annual refresher training (required for sub-contractors working on-site) • Annual site-specific training documentation for Ramboll personnel • Visitors without the proper training requirements must have escort while on-site • For SSHC: Project Safety – SSL1 training	• Equipment acceptance inspections • Daily equipment inspections, including drill rigs, heavy equipment, tools, and electrical cords • Daily bump check for all meters and weekly full calibrations

Client:	General Electric Company		
Project Name:	Dewey Loeffel Route 203 Property Investigation		**Project No.**
Project Location:	Nassau, New York		
Site Safety Leader:			
Main Points of Briefing:	☐ Ramboll Safety Requirements ☐ Site-Specific Safety Pan or JSA/AHA ☐ Site Owner Safety Requirements	**Other:**	

The purpose of the Pre-Work Briefing is to provide a ***site-specific Project Safety Orientation (PSO)*** to employees and subcontractors. This certifies that undersigned individuals have read, understand, and agree to comply with applicable ***site-specific safety requirements*** that can be obtained from site safety plans, site Activity Hazard Analyses (AHAs), Job Safety Analyses (JSAs), site owner requirements, and/or other site safety documents furnished to them by Ramboll. The undersigned individuals acknowledge that these safety requirements are not "all-inclusive" and that they will be expected to follow any additional safe work practices applicable to their specific scope of work.

Print Name	Signature	Company	Date

-- All Site Personnel Must Acknowledge Their Review and Understanding of Safety Requirements --

ACTIVITY HAZARD ANALYSIS – DEWEY LOEFFEL ROUTE 203 PROPERTY SITE INVESTIGATION – GROUNDWATER MONITORING AND SAMPLING ACTIVITIES

Activity/Work Task: Groundwater Monitoring and Sampling Activities	Overall Risk Assessment Code (RAC) (Use highest code)					**L**
Project Location: Dewey Loeffel Route 203 Property, Nassau, New York	**Risk Assessment Code (RAC) Matrix**					
Company: Ramboll	**Severity**	**Probability**				
Date Prepared: 10/11/19		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Melanie Marshall, Engineer III	Catastrophic	**E**	**E**	**H**	**H**	**M**
	Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by (Name/Title): Steven Thompson, CHST/ Safety Specialist III	Marginal	**H**	**M**	**M**	**L**	**L**
	Negligible	**M**	**L**	**L**	**L**	**L**

Notes: (Key Hazards, References, Field Notes etc.)

Scope:

As stated in Section 2 of the *Investigation Work Plan,* groundwater monitoring and sampling activities will be completed, consisting of groundwater level monitoring, purging and groundwater sample collection.

Key Hazards:

Contact with potentially contaminated sediment or groundwater, pinch points on equipment and tools, electrically powered equipment, shock hazards, slips, trips, and falls on un-even terrain, mud, ice and/or snow, laceration hazards, working near water, heat/cold stress, musculoskeletal injuries from twisting, bending, and/or heavy lifting, severe weather, aggressive fauna and flora (*e.g.,* black flies, ticks, spiders, snakes, bees, wasps, rabid animals, poison ivy, poison oak, sumac, giant hogweed, etc.).

References:

Investigation Work Plan, Dewey Loeffel Route 203 Property, Nassau, NY

Health and Safety Plan, Dewey Loeffel Route 203 Property, Nassau, NY

Activity Hazard Analysis – General Site Hazards (*e.g.,* biological hazards, heat/cold stress, inclement weather)

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

E = Extremely High Risk

H = High Risk

M = Moderate Risk

L = Low Risk

Job Steps	Hazards	Controls	RAC
Groundwater level monitoring Groundwater sampling	Exposure to hazardous chemicals, vapors, contact with contaminated materials, including VOCs, PCBs	• Site workers with a potential for contact with contaminated materials and work in Level C PPE will have OSHA 40-hour current 8-hour refresher, and medical exam. • Intrusive work activities include monitoring well development. • The SSL will define the perimeter of intrusive work areas.	**L**

		• Personnel, small tools and heavy equipment shall be decontaminated using phosphate-free detergent wash and distilled water rinse. • Work area air monitoring will be conducted for VOCs during well development. - Level D PPE - <1 ppm benzene and <5 ppm total VOCs - Half of full face Level C PPE, with organic/P100 cartridges changed daily – 1-10 ppm benzene or 5-50 ppm Total VOCs - Full face Level C PPE -5-20 ppm benzene or 50-200 ppm total VOCs - >20 ppm or >200 ppm total VOCs – STOP work until contamination levels reduces and notify Project Manager and Client Representative • Wells will be allowed to vent prior to initiating monitoring well development, monitoring or sampling activities to minimize potential exposure to COCs that may have built up in the air inside the well. • Personnel should remain upwind of the well being developed or sampled, whenever possible. • MSDSs for COCs and other chemicals that personnel may have potential exposure to are listed in Appendix E of the Ramboll Health and Safety Plan.	
	Heavy lifting; muscle, back strain	Utilize proper lifting techniques. • Keep back neutral (no excessive bending at waist) • Use leg strength • Keep load as close to the body as possible and do not lift above chest/shoulder height • Do not twist upper torso while lifting Do not lift objects < 75 pounds under ideal lifting conditions and objects <55 pounds under less than ideal conditions. • Ask for assistance when lifting/moving sample coolers and/or equipment.	**L**
	Slips, trips and falls on uneven/slippery surfaces	• To minimize the potential for slipping, safety shoes with good treads will be worn. If necessary, don slip-on traction device for additional support. • Keep walking paths clear of debris/materials/equipment and ensure walking surfaces are clear of ice, snow, or other slippery materials (*i.e.* oils, greases).	**L**

		• Equipment and materials will be stacked in laydown areas with aisles as necessary for safe access. All un-used equipment & materials will be returned to laydown areas daily. • Trash and debris will be removed daily and placed in designated containers.	
Working with miscellaneous tools and equipment, heavy lifting	Musculoskeletal injuries, hand lacerations, abrasions, eye injury, dust, electrical shock	• Wear gloves appropriate to task - leather work gloves (or cut resistant gloves) for general tasks and nitrile gloves when handling contaminated materials. Nitrile gloves may be worn over the cut resistant gloves, if they become cut then they should be replaced immediately. • Ensure proper training has been conducted prior to using a piece of equipment and inspect equipment for wear. Do not use if equipment is broken or faulty. If broken or faulty equipment is found it should be destroyed or marked "Out of Service" and removed from site as soon as possible. • Use the correct tool for the task, in a manner for which they were designed. • GFCIs will be used for all extension cords and 120v power tools. • All extension cords are in good condition with no cuts through outer insulation, ground plugs are present, and no "vinyl tape" repairs. • User will inspect tools and electrical cords daily. • Wear appropriate Personal Protective Equipment (PPE), as required, for the type of tool used. • Hearing protection required for which tools or areas: Power tools, equipment that generates sustained noise above 90 db. • The use of safety knives, scissors, or safety cutters is preferred over the use of fixed blade knives, razor knives, or box cutters.	**L**
Working along roadways	Vehicle accident, struck by vehicle (pedestrian)	• If roadway flaggers are used to temporarily control traffic, DOT Flagger Training is required. Training is required. Verify training was completed and obtain copies of training certificates. • Traffic cones, flagging etc. will be used to define active work area	**M**
Working near water	Drowning, hypothermia, fall through ice	• Don appropriate PPE when working near (within 6 feet) or over water/ice, including a USCG-approved Type I, II or III personal floatation device. • Utilize the buddy system when working near water, work in teams of at least 2 people. • To minimize the potential for slipping, appropriate footwear with good treads will be worn.	**M**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
• Hard hat, safety glasses, hearing protection, safety shoes and high visibility safety vest (required for any on-site worker, visitor, or sub-contractor) • Nitrile gloves, cut-resistant gloves, Tyvek or other protective coverall (as necessary) • USCG-approved Type I, II or III personal floatation device equipped to be used during work activities within 6 feet of the on-Site Pond Area.	• OSHA 40 or 24-hour certification with 8-hour annual refresher training (required for sub-contractors working on-site) • Annual site-specific training documentation for OBG personnel • Visitors without the proper training requirements must have escort while on-site • DOT flagger training • For SSHC: Project Safety – SSL1 training	• Daily equipment inspections, including drill rigs, heavy equipment, tools, and electrical cords

Client:	General Electric Company		
Project Name:	Dewey Loeffel Route 203 Property Investigation		**Project No.**
Project Location:	Nassau, New York		
Site Safety Leader:			
Main Points of Briefing:	☐ OBG Safety Requirements ☐ Site-Specific Safety Pan or JSA/AHA ☐ Site Owner Safety Requirements	**Other:**	

The purpose of the Pre-Work Briefing is to provide a ***site-specific Project Safety Orientation (PSO)*** to employees and subcontractors. This certifies that undersigned individuals have read, understand, and agree to comply with applicable ***site-specific safety requirements*** that can be obtained from site safety plans, site Activity Hazard Analyses (AHAs), Job Safety Analyses (JSAs), site owner requirements, and/or other site safety documents furnished to them by OBG. The undersigned individuals acknowledge that these safety requirements are not "all-inclusive" and that they will be expected to follow any additional safe work practices applicable to their specific scope of work.

Print Name	Signature	Company	Date

-- All Site Personnel Must Acknowledge Their Review and Understanding of Safety Requirements --

ACTIVITY HAZARD ANALYSIS – DEWEY LOEFFEL ROUTE 203 PROPERTY SITE INVESTIGATION – INVESTIGATION-DERIVED MATERIALS MANAGEMENT

Activity/Work Task: Investigation-Derived Materials Management

Project Location: Dewey Loeffel Route 203 Property, Nassau, New York

Company: Ramboll

Date Prepared: 10/14/19

Prepared by (Name/Title): Melanie Marshall, Engineer III

Reviewed by (Name/Title): Steven Thompson, CHST/ Safety Specialist III

Overall Risk Assessment Code (RAC) (Use highest code): **L**

Risk Assessment Code (RAC) Matrix

Severity	**Probability**				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Notes: (Key Hazards, References, Field Notes etc.)

Scope:

As stated in Section 2 of the *Investigation Work Plan,* investigation-derived materials (IDM) generated during various activities during the investigation will require appropriate management. Potential IDM includes the following: soil cuttings, sediment, groundwater resulting from drilling and development of the overburden monitoring wells, groundwater resulting sampling, decontamination fluids, solids that have settled out of groundwater and/or decontamination fluids, and personal protective equipment (PPE) and debris associated with the various field activities (*e.g.* polyethylene sheeting, sample and/or development tubing, disposable equipment, etc.).

Subcontractors include: drilling sub-contractor(s)

Key Hazards:

Contact with potentially contaminated soil, sediment, or groundwater, moving parts on heavy machinery (*e.g.* hydraulic lines on the skid-steer and other heavy machinery), vehicle and heavy machinery traffic hazards, pinch points on equipment, machinery, and tools, electrically powered equipment, shock hazards, slips, trips, and falls on un-even terrain, mud, ice and/or snow, laceration hazards, heat/cold stress, musculoskeletal injuries from twisting, bending, and/or heavy lifting, severe weather, aggressive fauna and flora (*e.g.,* black flies, ticks, spiders, snakes, bees, wasps, rabid animals, poison ivy, poison oak, sumac, giant hogweed, etc.).

References:

Investigation Work Plan, Dewey Loeffel Route 203 Property, Nassau, NY

Health and Safety Plan, Dewey Loeffel Route 203 Property, Nassau, NY

Activity Hazard Analysis – General Site Hazards (*e.g.,* biological hazards, heat/cold stress, inclement weather)

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

E = Extremely High Risk

H = High Risk

M = Moderate Risk

L = Low Risk

Job Steps	Hazards	Controls	RAC
Contact with contaminated materials	Exposure to hazardous chemicals, vapors, dust, contact with contaminated materials, including VOCs, PCBs, and chemical solutions	• Site workers with minimal contact with contaminated materials and no work in Level C PPE will have OSHA 40-hour or 24-hour training, current 8-hour refresher, if necessary, and medical exam. • Intrusive work activities include drum IDM handling, handling of potentially contaminated groundwater, soil, and/or bedrock. • The SSL will define the perimeter of intrusive work areas. • Personnel, small tools and heavy equipment shall be decontaminated. • Decontamination of heavy equipment using pressurized steam washer or equivalent. • Heavy equipment leaving site will be inspected by the SSL prior to exit. • Decontamination of personnel and small tools will be conducted as follows: Phosphate-free detergent wash and distilled water rinse. • Personnel will allow storage tanks or drums to vent prior to initiating work activities to minimize potential exposure to COCs that may have built up in the air inside the containers. • MSDSs for COCs and other chemicals that personnel may have potential exposure to are listed in Appendix E of the Ramboll Health and Safety Plan. • Work area air monitoring will be conducted for VOCs during IDM Management: - Level D PPE - <1 ppm benzene and <5 ppm total VOCs - Half of full face Level C PPE, with organic/P100 cartridges changed daily – 1-10 ppm benzene or 5-50 ppm Total VOCs - Full face Level C PPE -5-20 ppm benzene or 50-200 ppm total VOCs - >20 ppm or >200 ppm total VOCs – STOP work until contamination levels reduces and notify Project Manager and Client Representative	**M**
Heavy equipment operation	Struck By, Run-Over, Caught In Between (pinch points), Roll Over, Fluid Leaks	• Qualified persons operate all heavy equipment. Qualifications were determined by subcontractor work experience. • Equipment will be inspected upon mobilization (*i.e.,* acceptance inspection) by: Site Safety Coordinator and Operator. • Operators are required to wear seat belts for all equipment provided with seatbelts. • High visibility vests required for all on-Site and off-Site work.	**M**

		• Personnel should exercise extreme caution in the vicinity of operating equipment and machinery to avoid physical injury to themselves or others. • Maintain a safety zone of at least 25 feet when walking and working in the area of heavy equipment operation (*i.e.,* "the 25 feet rule"). • Dump trucks, 4x4's, or other haul vehicles will not be loaded beyond manufacturer capacities or weight limits established by state and local authorities for transportation. • Spotters are required when trucks or other heavy equipment are backing up. Spotters will use designated hand signals while vehicles are backing up. • Operators and helpers will maintain a safe distance to moving parts. All those working near moving or rotating parts will secure loose hair, clothing, and equipment. • Spill equipment is available for fuel and hydraulic fluid leaks. Location; Support vehicle and in the immediate work zone. • Personnel to remain upwind of heavy equipment exhaust whenever possible. • Avoid operation of heavy equipment on sloped areas, saturated areas, saturated ground surfaces and heavily rutted areas. • Cell phones will not be used while operating heavy equipment and machinery or by workers on the ground in the area of heavy equipment and machinery operations to avoid physical injury to themselves or others.	
Walking and working surfaces	Slips, trips, falls	• To minimize the potential for slipping, safety shoes with good treads will be worn. If necessary, don slip-on traction device for additional support. • Keep walking paths clear of debris/materials/equipment and ensure walking surfaces are clear of ice, snow, or other slippery materials (*i.e.* oils, greases). • Equipment and materials will be stacked in laydown areas with aisles as necessary for safe access. All un-used equipment & materials will be returned to laydown areas daily. • Trash and debris will be removed daily and placed in designated containers.	**M**
Working with miscellaneous tools and equipment, heavy lifting	Musculoskeletal injuries, hand lacerations, abrasions, eye injury, dust, electrical shock	• Wear gloves appropriate to task - leather work gloves (or cut resistant gloves) for general tasks and nitrile gloves when handling contaminated materials. Nitrile gloves may be worn over the cut resistant gloves, if they become cut then they should be replaced immediately. • Anticipated tools to be used may include but are not limited to: hammers, wrenches, screwdrivers, power drills/impact drivers, knives/cutting implements, pry bars, shovels, drum dollies.	**M**

		• Ensure proper training has been conducted prior to using a piece of equipment and inspect equipment for wear. Do not use if equipment is broken or faulty. If broken or faulty equipment is found it should be destroyed or marked "Out of Service" and removed from site as soon as possible. • Use the correct tool for the task, in a manner for which they were designed. • GFCIs will be used for all extension cords and 120v power tools. • All extension cords are in good condition with no cuts through outer insulation, ground plugs are present, and no "vinyl tape" repairs. User will inspect tools and electrical cords daily. • Wear appropriate Personal Protective Equipment (PPE), as required, for the type of tool used. • Hearing protection required for which tools or areas: Power tools, equipment that generates sustained noise above 90 db. • Proper lifting techniques will be employed (*e.g.*, two-man lift, bending at the knees, limited pivoting at the waist). Use of drum dolly or other lifting/moving aid when moving drums of IDM. • The use of safety knives, scissors, or safety cutters is preferred over the use of fixed blade knives, razor knives, or box cutters.	

Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
• Hard hat, safety glasses, hearing protection, safety shoes and high visibility safety vest (required for any on-site worker, visitor, or sub-contractor) • Nitrile gloves, cut-resistant gloves, Tyvek or other protective coverall (as necessary)	• OSHA 40 or 24-hour certification with 8-hour annual refresher training (required for sub-contractors working on-site) • Annual site-specific training documentation for Ramboll personnel • Visitors without the proper training requirements must have escort while on-site • For SSHC: Project Safety – SSL1 training	• Equipment acceptance inspection • Daily equipment inspections, including drill rigs, heavy equipment, tools, and electrical cords

Client:	General Electric Company		
Project Name:	Dewey Loeffel Route 203 Property Investigation		**Project No.**
Project Location:	Nassau, New York		
Site Safety Leader:			
Main Points of Briefing:	☐ Ramboll Safety Requirements ☐ Site-Specific Safety Pan or JSA/AHA ☐ Site Owner Safety Requirements	**Other:**	

The purpose of the Pre-Work Briefing is to provide a ***site-specific Project Safety Orientation (PSO)*** to employees and subcontractors. This certifies that undersigned individuals have read, understand, and agree to comply with applicable ***site-specific safety requirements*** that can be obtained from site safety plans, site Activity Hazard Analyses (AHAs), Job Safety Analyses (JSAs), site owner requirements, and/or other site safety documents furnished to them by Ramboll. The undersigned individuals acknowledge that these safety requirements are not "all-inclusive" and that they will be expected to follow any additional safe work practices applicable to their specific scope of work.

Print Name	Signature	Company	Date

-- All Site Personnel Must Acknowledge Their Review and Understanding of Safety Requirements --

ACTIVITY HAZARD ANALYSIS – DEWEY LOEFFEL ROUTE 203 PROPERTY SITE INVESTIGATION – SOIL AND SEDIMENT SAMPLING ACTIVITIES

Activity/Work Task: Soil and Sediment Sampling Activities	Overall Risk Assessment Code (RAC) (Use highest code)	**H**
Project Location: Dewey Loeffel Route 203 Property, Nassau, New York	**Risk Assessment Code (RAC) Matrix**	
Company: Ramboll		
Date Prepared: 10/11/19		
Prepared by (Name/Title): Melanie Marshall, Engineer III		
Reviewed by (Name/Title): Steven Thompson, CHST/ Safety Specialist III		

Severity	**Probability**				
	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	**E**	**E**	**H**	**H**	**M**
Critical	**E**	**H**	**H**	**M**	**L**
Marginal	**H**	**M**	**M**	**L**	**L**
Negligible	**M**	**L**	**L**	**L**	**L**

Notes: (Key Hazards, References, Field Notes etc.)

Scope:

As stated in Section 2 of the *Investigation Work Plan,* surface soil, subsurface soil and sediment sampling activities will be completed at on-Site and off-Site locations using direct push, rotary drilling, or hand auger or similar hand-operated sampling equipment.

Subcontractor: drilling sub-contractor

Key Hazards:

Contact with potentially contaminated soil or sediment, pinch points on equipment and tools, electrically powered equipment, shock hazards, slips, trips, and falls on un-even terrain, mud, ice and/or snow, laceration hazards, working over or near water, heat/cold stress, musculoskeletal injuries from twisting, bending, and/or heavy lifting, severe weather, aggressive fauna and flora (*e.g.,* black flies, ticks, spiders, snakes, bees, wasps, rabid animals, poison ivy, poison oak, sumac, giant hogweed, etc.).

References:

Investigation Work Plan, Dewey Loeffel Route 203 Property, Nassau, NY

Health and Safety Plan, Dewey Loeffel Route 203 Property, Nassau, NY

Activity Hazard Analysis – General Site Hazards (*e.g.,* biological hazards, heat/cold stress, inclement weather)

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

E = Extremely High Risk

H = High Risk

M = Moderate Risk

L = Low Risk

Job Steps	**Hazards**	**Controls**	**RAC**
Dill Rig Setup/Breakdown **Drill Rig operation for soil/sediment sampling**	• Contact with subsurface Utilities leading to property damage, service interruptions, Personal injury or death	• Local Dig Safe will be contacted for utility locations in public areas or rights of way prior to the start of intrusive activities. • Equipment will be inspected daily and documented by operator and verified by the SSHC	**H**

	• Struck By, Caught In Between (pinch points) Leading to property damage, Personal injury or Death
	• Contact with rotating drill heads or other drill parts, which could "pull a worker into the equipment leading to Injury or Death
	• Tip Over
	• Fluid Leaks
	• Exposure to CO leading to illness
	• Contact with contaminated materials during intrusive activities leading to over exposure to hazardous chemicals, vapors, dust, contact with contaminated materials, including VOCs, PCBs, and chemical solutions causing illness
	• Contact with Drill rods or Casings while carrying or swinging into place leading to personal injury.
		• Personnel essential to the operation of the rig should exercise extreme caution in the vicinity of operating equipment and machinery to avoid physical injury to themselves or others.
		• Non-Essential personnel should maintain a safety zone of at least 25 feet when walking and working in the area of heavy equipment operation (*i.e.,* "the 25 feet rule").
		• The SSL will define the perimeter of intrusive work areas.
		• Operators and helpers will maintain a safe distance to moving parts. All those working near moving or rotating parts will secure loose hair, clothing, and equipment.
		• Spill equipment is available for fuel and hydraulic fluid leaks. Location; Support vehicle and in the immediate work zone and verified by the SSHC.
		• Personnel to remain upwind of heavy equipment exhaust whenever possible.
		• Site personnel working in the area surrounding the drilling/boring rig will be informed where the emergency shutoff in the event of an emergency.
		• Avoid operation of heavy equipment on sloped areas, saturated areas, saturated ground surfaces and heavily rutted areas.
		• Cell phones will not be used while operating heavy equipment and machinery or by workers on the ground in the area of heavy equipment and machinery operations to avoid physical injury to themselves or others.
		• Site workers with minimal contact with contaminated materials and no work in Level C PPE will have OSHA 40-hour or 24-hour training, current 8-hour refresher, if necessary, and medical exam.
		• Work area air monitoring will be conducted for VOCs and gases during drilling, well development, and monitoring well installation.
		  ○ Level D PPE - <1 ppm benzene and <5 ppm total VOCs
		  ○ Half of full face Level C PPE, with organic vapor/P100 cartridges changed daily – 1-10 ppm benzene or 5-50 ppm Total VOCs
		  ○ Full face Level C PPE - 5-50 ppm benzene or 50-200 ppm total VOCs (with **Quantitative fit testing**)
		  ○ >50 ppm or >200 ppm total VOCs – STOP work until contamination levels reduces and notify Project Manager and Client Representative
		
		Parameter | **Action Levels**	

		<table><tr><td></td><td>(sustained for 1 minute)</td></tr><tr><td>LEL</td><td>>10%</td></tr><tr><td>**O_2**</td><td>19.5% - 23.0%</td></tr><tr><td>CO</td><td>35 ppm</td></tr><tr><td>H_2S</td><td>10 ppm</td></tr></table> ▪ If O_2 levels become deficient or enriched, H_2S gas or CO is detected at a concentration that will pose a risk to personnel, or the LEL is reached while monitoring with the five gas meter, work will be suspended and the Project Manager and Client Representative will be notified immediately. Action limits for these atmospheric testing parameters are provided in the table above. ▪ Work will be suspended until five gas meter and UltraRAE 3000 concentrations are deemed safe enough to work without engineering controls or with the appropriate engineering controls and/or respiratory protection as described by OSHA requirements in 29 CFR Part 1910.1000. • Intrusive work activities include drilling, well development and installation of monitoring wells.	
Welding Well Casings together	• Fire/Explosion/burns due to improper use or storage of torch cutting materials • Faulty welding equipment leading to shock or electrocution.	• To minimize potential for fires, trash and debris will be removed daily and placed in designated containers. • Remove all flammable materials from the area where Hot Wok is being performed. • All Hot work will have a Hot Work Permit, either the clients or OBG provided verified by the SSHC. • A 20-lb ABC type fire extinguisher will be present while performing hot work related activities. Designated personnel on "Fire Watch" will remain in the work area for **at least** 1 hour following the completion of hot work activities.	**M**
Elevated work on drill rig >6', to effect repairs of equipment or setting of mast	• Falling from a height greater than 6' leading to personal injury or death.	• All subcontractors performing work on elevated surfaces with the potential to fall will don a **fall arrest** system/ Positioning device with full body harness, or equivalent fall protection, to prevent a fall from occurring. • Tie-off points will be of an appropriate height and strength to support the worker and to prevent injury should a fall occur. • All subcontractors utilizing fixed stairs or elevated platforms on the drill rig during drilling operations will maintain three points of contact while performing work. • Subcontractors will be mindful of ice, snow and muddy surfaces that may cause a slip, trip, or fall. Steel-toe shoes with good	**L**

		tread should be worn to prevent slips, trips, or falls from taking place. • Walking working or standing surfaces will be maintained, to the best possible extent free of ice, mud, and other tools that may cause slip trip or fall hazards.	
General Site Safety **Working with miscellaneous tools and equipment, heavy lifting**	• Poor lifting and carrying practices leading to Musculoskeletal injuries. • Failure to wear appropriate or any Gloves Leading to hand injuries. • Use of fixed Blade Knives leading to Hand/arm Lacerations. • Failure to wear appropriate Eye protection leading to eye injury • Improper use of or use of damaged electrical cords leading to electrical shock.	• Wear gloves appropriate to task - leather work gloves (or cut resistant gloves) for general tasks and nitrile gloves when handling contaminated materials. Nitrile gloves may be worn over the cut resistant gloves, if they become cut then they should be replaced immediately. • Ensure proper training has been conducted prior to using a piece of equipment and inspect equipment for wear. Do not use if equipment is broken or faulty. If broken or faulty equipment is found it should be destroyed or marked "Out of Service" and removed from site as soon as possible. • Use the correct tool for the task, in a manner for which they were designed. • GFCIs will be used for all extension cords and 120v power tools. • All extension cords are in good condition with no cuts through outer insulation, ground plugs are present, and no "vinyl tape" repairs. • User will inspect tools and electrical cords daily. • Wear appropriate Personal Protective Equipment (PPE), as required, for the type of tool used. • ANY task that requires the use of a face shield also requires the use of Eye Protection (i.e. safety glasses) • Hearing protection required for which tools or areas: Power tools, equipment that generates sustained noise above 90 db. OSHA guidance (If you have to raise your voice to be heard <5' away, you need hearing protection) • Proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist). • The use of safety knives, scissors, or safety cutters is required instead of the use of fixed blade knives, razor knives, or box cutters. If a fixed blade knife is the ONLY TOOL that can perform the task, a separate AHA is required detailing the procedure and Health and Safety Project Manager must approve of the plan and variance	**M**
General Site Safety **Walking and Working surfaces**	• Slipping on wet, muddy, or icy surfaces leading to potential sprains strains or broken bones. • Tripping over equipment or uneven surfaces leading to sprains Strains or falls.	• To minimize the potential for slipping, safety shoes with good treads will be worn. If necessary, don slip-on traction device for additional support.	**L**

	• Equipment falling over while being stored leading to potential personal injuries or property damage.	• Keep walking paths clear of debris/materials/equipment and ensure walking surfaces are clear of ice, snow, or other slippery materials (i.e. oils, greases). • Equipment and materials will be stacked in laydown areas with aisles as necessary for safe access. All un-used equipment & materials will be returned to laydown areas daily. • Trash and debris will be removed daily and placed in designated containers.	

General Site Safety
 	
Working with miscellaneous tools and equipment, heavy lifting
	• Musculoskeletal injuries from lifting heavy objects or improper lifting techniques,
	• hand lacerations, abrasions or puncture wounds while moving objects
	• Use of fixed Blade Knives leading to Hand/arm Lacerations.
	• Dust or other contaminates causing eye injury.
	• An electrical shock when working with miscellaneous tools and equipment due to wet conditions or faulty electrical equipment.
		• Proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist).
		• Utilize proper lifting techniques.
		  ○ Keep back neutral (no excessive bending at waist)
		  ○ Use leg strength
		  ○ Keep load as close to the body as possible and do not lift above chest/shoulder height
		  ○ Do not twist upper torso while lifting
		  ○ Do not lift objects < 75 pounds under ideal lifting conditions and objects <55 pounds under less than ideal conditions.
		  ○ Ask for assistance when lifting/moving sample coolers and/or equipment.
		• Wear gloves appropriate to task - leather work gloves (or cut resistant gloves) for general tasks and nitrile gloves when handling contaminated materials. Nitrile gloves may be worn over the cut resistant gloves, if they become cut then they should be replaced immediately.
		• Ensure proper training has been conducted prior to using a piece of equipment and inspect equipment for wear. Do not use if equipment is broken or faulty. If broken or faulty equipment is found it should be destroyed or marked "Out of Service" and removed from site as soon as possible.
		• Use the correct tool for the task, in a manner for which they were designed.
		• GFCIs will be used for all extension cords and 120v power tools.
		• All extension cords are in good condition with no cuts through outer insulation, ground plugs are present, and no "vinyl tape" repairs.
		• User will inspect tools and electrical cords daily.
		• Wear appropriate Personal Protective Equipment (PPE), as required, for the type of tool used.
		• Hearing protection required for which tools or areas: Power tools, equipment that generates sustained noise above 90 db.
			M

		OSHA guidance (If you have to raise your voice to be heard <5' away, you need hearing protection) • Proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist). • The use of safety knives, scissors, or safety cutters is required instead of the use of fixed blade knives, razor knives, or box cutters. If a fixed blade knife is the ONLY TOOL that can perform the task, a separate AHA is required detailing the procedure and Health and Safety Project Manager must approve of the plan and variance.	
General Site Safety **Working along roadways**	• Vehicle accident, struck by vehicle (pedestrian)	• If roadway flaggers are used to temporarily control traffic, DOT Flagger Training is required. Training is required. Verify training was completed and obtain copies of training certificates. • Traffic cones, flagging etc. will be used to define active work area	**L**
Working over/near water for Pond Area sediment sample locations and soil sample locations near the on-Site Pond Area	• Slipping when wadding in the shallows leading to personal injury or illness • Falling from a boat or barge leading to hypothermia or Drowning. • Falling through ice leading to hypothermia, or death by drowning.	• Don appropriate PPE when working near (within 6 feet) or over water/ice, including a USCG-approved Type I, II or III personal floatation device. • The "buddy system" will be used during reconnaissance and sampling activities to provide immediate assistance to an individual in the event of an emergency. The "buddy" is an individual that must remain in direct line of sight with another group member during the installation activity. • When samples need to be collected from water depths that are greater than three feet, samples will be collected from the bank or by extending a sample container affixed to a sampling pole device to the sampling point. • To minimize the potential for slipping, appropriate footwear with good treads will be worn. A sediment probe should be used to evaluate water depth and bed conditions before wading. As the Pond bed may be slippery and uneven, proceed with caution at all times. • For construction-related activities, a rescue skiff will be staged such that one person can immediately access and launch the skiff. • Boats and barges will not operate above their weight capacity. • See also walking and working surfaces for slipping hazards of potentially wet boat/barge surfaces.	**H**

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
• Hard hat, safety glasses, hearing protection, safety shoes and high visibility safety vest (required for any on-site worker, visitor, or sub-contractor) • Nitrile gloves, cut-resistant gloves, Tyvek or other protective coverall (as necessary) • USCG-approved Type I, II or III personal floatation device to be used during work activities within 6 feet of the on-Site Pond Area. • PID	• OSHA 40 or 24-hour certification with 8-hour annual refresher training (required for sub-contractors working on-site) • Annual site-specific training documentation for Ramboll personnel • Visitors without the proper training requirements must have escort while on-site • DOT flagger training • For SSHC: Project Safety – SSL1 training	• Equipment acceptance inspection • Daily equipment inspections, including drill rigs, heavy equipment, tools, and electrical cords • Daily bump check for all meters and weekly full calibrations

• 4 Gas Meter • Ultra Rae 3000 or similar		

Client:	General Electric Company		
Project Name:	Dewey Loeffel Route 203 Property Investigation		**Project No.**
Project Location:	Nassau, New York		
Site Safety Leader:			
Main Points of Briefing:	☐ Ramboll Safety Requirements ☐ Site-Specific Safety Pan or JSA/AHA ☐ Site Owner Safety Requirements	**Other:**	

The purpose of the Pre-Work Briefing is to provide a ***site-specific Project Safety Orientation (PSO)*** to employees and subcontractors. This certifies that undersigned individuals have read, understand, and agree to comply with applicable ***site-specific safety requirements*** that can be obtained from site safety plans, site Activity Hazard Analyses (AHAs), Job Safety Analyses (JSAs), site owner requirements, and/or other site safety documents furnished to them by Ramboll. The undersigned individuals acknowledge that these safety requirements are not "all-inclusive" and that they will be expected to follow any additional safe work practices applicable to their specific scope of work.

Print Name	Signature	Company	Date

-- All Site Personnel Must Acknowledge Their Review and Understanding of Safety Requirements --

ACTIVITY HAZARD ANALYSIS – DEWEY LOEFFEL ROUTE 203 PROPERTY SITE INVESTIGATION – SURFACE WATER STAFF GAUGE INSTALLATION

Activity/Work Task: Surface Water Staff Gauge Installation	Overall Risk Assessment Code (RAC) (Use highest code)					**H**
Project Location: Dewey Loeffel Route 203 Property, Nassau, New York	**Risk Assessment Code (RAC) Matrix**					
Company: Ramboll	**Severity**	**Probability**				
Date Prepared: 11/14/19		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Melanie Marshall, Engineer III	Catastrophic	**E**	**E**	**H**	**H**	**M**
	Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by (Name/Title): Steven Thompson, CHST/ Safety Specialist III	Marginal	**H**	**M**	**M**	**L**	**L**
	Negligible	**M**	**L**	**L**	**L**	**L**

Notes: (Key Hazards, References, Field Notes etc.)

Scope:
As stated in Section 2 of the *Investigation Work Plan,* surface water staff gauge installation is expected to be completed to at the on-Site Pond to monitor surface water elevation.

Key Hazards:

Drowning, contact with potentially contaminated surface water or sediment in the streambed, pinch points on equipment and tools, slips, trips, and falls on un-even terrain, mud, ice and/or snow, laceration hazards, heat/cold stress, musculoskeletal injuries from twisting, bending, and/or heavy lifting, severe weather, aggressive fauna and flora (*e.g.,* black flies, ticks, spiders, snakes, bees, wasps, rabid animals, poison ivy, poison oak, sumac, giant hogweed, etc.).

References:

Investigation Work Plan, Dewey Loeffel Route 203 Property, Nassau, NY
Health and Safety Plan, Dewey Loeffel Route 203 Property, Nassau, NY
Activity Hazard Analysis – General Site Hazards (*e.g.,* biological hazards, heat/cold stress, inclement weather)

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

E = Extremely High Risk

H = High Risk

M = Moderate Risk

L = Low Risk

Job Steps	Hazards	Controls	RAC
General Site Safety **Moving around Site on foot**	• Slips, trips, falls due to uneven walking surfaces leading to sprains or strains.	• To minimize the potential for slipping, safety shoes with good treads will be worn. If necessary, don slip-on traction device for additional support. • Keep walking paths clear of debris/materials/equipment and ensure walking surfaces are clear of ice, snow, or other slippery materials (i.e. oils, greases).	**L**

		• Equipment and materials will be stacked in laydown areas with aisles as necessary for safe access. All un-used equipment & materials will be returned to laydown areas daily. • Trash and debris will be removed daily and placed in designated containers. • Cover open holes/openings immediately and level ruts or uneven ground as soon as possible. Hole covers will be marked "Hole", hold two times the intended weight, and be secured to the ground.	
Workers shall access submerged work Areas in the pond via one of 3 methods depending upon existing conditions. **Wading** **Boat/Barge** **On the surface of the ice**	**Wading:** • Slipping or tripping on underwater obstacles and becoming wet leading to low body temperature • Slipping or tripping and causing a sprain or strain **Boat/Barge** • Slipping on wet walking surfaces and either causing direct injury or illness • Falling into the water out of the boat or off the barge leading to possible hypothermia or drowning. • Overloading of barge leading to damage and sinking of barge or boat. **Working on the ice** • Windy conditions could lead to hypothermia. • Breaking through the ice, leading to hypothermia, drowning, or death. • Slipping on the ice leading to sprains or strains.	• Don appropriate PPE when working near (within 6 feet) or over water/ice, including a USCG-approved Type I, II or III personal floatation device. NOTE: If a barge includes 100% fall protection (*i.e.* legal guardrails, restraint system etc.) then a PFD is not required. • The "buddy system" will be used during reconnaissance and sampling activities to provide immediate assistance to an individual in the event of an emergency. The "buddy" is an individual that must remain in direct line of sight with another group member during the installation activity. • Wading to access surface water gauge is permitted provided that water depths are three feet or less and the pond substrate is firm. • To minimize the potential for slipping, appropriate footwear with good treads will be worn. A sediment probe should be used to evaluate water depth and bed conditions before wading. As the stream bed may be slippery and uneven, proceed with caution at all times. • For construction-related activities, a rescue skiff will be staged such that one person can immediately access and launch the skiff. • Boats and barges will not operate above their weight capacity. • See also walking and working surfaces for slipping hazards of potentially wet boat/barge surfaces.	**H**
Placement and handling of the water staff gauges	• Exposure to hazardous chemicals, vapors, contact with contaminated materials, including VOCs, PCBs	• Work area air monitoring is not anticipated for staff gauge installation. • To minimize potential exposure to COCs, disposable gloves will be worn that are long enough to provide sufficient protection from dermal contact with surface water. • SDSs for COCs and other chemicals that personnel may have potential exposure to are listed in Appendix E of the Ramboll Health and Safety Plan.	**L**
General Site Safety	• Musculoskeletal injuries from lifting heavy objects or improper lifting techniques,	• Proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist).	**M**

Working with miscellaneous tools and equipment, heavy lifting	• hand lacerations, abrasions or puncture wounds while moving objects • Use of fixed Blade Knives leading to Hand/arm Lacerations. • Dust or other contaminates causing eye injury. • An electrical shock when working with miscellaneous tools and equipment due to wet conditions or faulty electrical equipment.	• Wear gloves appropriate to task - leather work gloves (or cut resistant gloves) for general tasks and nitrile gloves when handling contaminated materials. Nitrile gloves may be worn over the cut resistant gloves, if they become cut then they should be replaced immediately. • Ensure proper training has been conducted prior to using a piece of equipment and inspect equipment for wear. Do not use if equipment is broken or faulty. If broken or faulty equipment is found it should be destroyed or marked "Out of Service" and removed from site as soon as possible. • Use the correct tool for the task, in a manner for which they were designed. • GFCIs will be used for all extension cords and 120v power tools. • All extension cords are in good condition with no cuts through outer insulation, ground plugs are present, and no "vinyl tape" repairs. • User will inspect tools and electrical cords daily. • Wear appropriate Personal Protective Equipment (PPE), as required, for the type of tool used. • Hearing protection required for which tools or areas: Power tools, equipment that generates sustained noise above 90 db. OSHA guidance (If you have to raise your voice to be heard <5' away, you need hearing protection) • Proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist). • The use of safety knives, scissors, or safety cutters is required instead of the use of fixed blade knives, razor knives, or box cutters. If a fixed blade knife is the ONLY TOOL that can perform the task, a separate AHA is required detailing the procedure and Health and Safety Project Manager must approve of the plan and variance.	

Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
• Hard hat, safety glasses, safety shoes and high visibility safety vest (required for any on-site worker, visitor, or sub-contractor) • Nitrile gloves, cut-resistant gloves, hearing protection, Tyvek or other protective coverall (as necessary) • USCG-approved Type I, II or III personal floatation device to be used during work activities within 6 feet of the on-Site Pond Area. • Rescue Skiff (for construction-related activities), Buoys with 90' 0f rope	• OSHA 40 or 24-hour certification with 8-hour annual refresher training (required for sub-contractors working on-site) • Annual site-specific training documentation for Ramboll personnel • Visitors without the proper training requirements must have escort while on-site • Users of PFAS must have fall protection training. • For SSHC: Project Safety – SSL1 training	• Daily equipment inspections • Skiff Inspection (for construction-related activities)

Client:	General Electric Company		
Project Name:	Dewey Loeffel Route 203 Property Investigation		**Project No.**
Project Location:	Nassau, New York		
Site Safety Leader:			
Main Points of Briefing:	☐ Ramboll Safety Requirements ☐ Site-Specific Safety Pan or JSA/AHA ☐ Site Owner Safety Requirements	**Other:**	

The purpose of the Pre-Work Briefing is to provide a ***site-specific Project Safety Orientation (PSO)*** to employees and subcontractors. This certifies that undersigned individuals have read, understand, and agree to comply with applicable ***site-specific safety requirements*** that can be obtained from site safety plans, site Activity Hazard Analyses (AHAs), Job Safety Analyses (JSAs), site owner requirements, and/or other site safety documents furnished to them by Ramboll. The undersigned individuals acknowledge that these safety requirements are not "all-inclusive" and that they will be expected to follow any additional safe work practices applicable to their specific scope of work.

Print Name	Signature	Company	Date

-- All Site Personnel Must Acknowledge Their Review and Understanding of Safety Requirements --

ACTIVITY HAZARD ANALYSIS – DEWEY LOEFFEL ROUTE 203 PROPERTY SITE INVESTIGATION – SURVEYING

Activity/Work Task: Surveying	Overall Risk Assessment Code (RAC) (Use highest code)					**H**
Project Location: Dewey Loeffel Route 203 Property, Nassau, New York	**Risk Assessment Code (RAC) Matrix**					
Company: Ramboll	**Severity**	**Probability**				
Date Prepared: 11/14/19		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Melanie Marshall, Engineer III	Catastrophic	**E**	**E**	**H**	**H**	**M**
	Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by (Name/Title): Steven Thompson, CHST / Safety Specialist III	Marginal	**H**	**M**	**M**	**L**	**L**
	Negligible	**M**	**L**	**L**	**L**	**L**

Notes: (Key Hazards, References, Field Notes etc.)

Scope:

As stated in Section 2 of the *Investigation Work Plan,* surveying activities will be completed to document and geo-reference current site features. Surveying for horizontal coordinates and/or vertical control will include: soil, sediment and surface water sample locations, surface water gauges, soil borings, and overburden monitoring wells.

Key Hazards:

Vehicle traffic hazards, pinch points on machinery and tools, slips, trips, and falls on un-even terrain, mud, ice and/or snow, laceration hazards, heat/cold stress, working over/near water, musculoskeletal injuries from twisting, bending, and/or heavy lifting, severe weather, aggressive fauna and flora (*e.g.,* black flies, ticks, spiders, snakes, bees, wasps, rabid animals, poison ivy, poison oak, sumac, giant hogweed, etc.).

References:

Investigation Work Plan, Dewey Loeffel Route 203 Property, Nassau, NY
Health and Safety Plan, Dewey Loeffel Route 203 Property, Nassau, NY
Activity Hazard Analysis – General Site Hazards (*e.g.,* biological hazards, heat/cold stress, inclement weather)

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

E = Extremely High Risk

H = High Risk

M = Moderate Risk

L = Low Risk

Job Steps	Hazards	Controls	RAC
General Site Safety **Moving around Site on foot**	• Slips, trips, falls due to uneven walking surfaces leading to sprains or strains.	• To minimize the potential for slipping, safety shoes with good treads will be worn. If necessary, don slip-on traction device for additional support.	**L**

		• Keep walking paths clear of debris/materials/equipment and ensure walking surfaces are clear of ice, snow, or other slippery materials (i.e. oils, greases). • Equipment and materials will be stacked in laydown areas with aisles as necessary for safe access. All un-used equipment & materials will be returned to laydown areas daily. • Trash and debris will be removed daily and placed in designated containers. • Cover open holes/openings immediately and level ruts or uneven ground as soon as possible. Hole covers will be marked "Hole", hold two times the intended weight, and be secured to the ground.	
Workers will set up and survey along public roads	• Drivers not seeing the Surveyors and accidentally hitting the worker leading to equipment damage, injury or potentially death. • Contact between employees vehicle and another vehicle on the road leading to property damage, injury or potential death. • Backing into an object or person leading to potential property damage, injury or death.	• Remain aware of on- and off-Site vehicle traffic when working near public and private roadways and driveways. • Wear appropriate PPE, include steel towed boots and reflective safety vest • Use spotters when backing up vehicles • Drive slowly	**M**
General Site Safety **Working with miscellaneous tools and equipment, heavy lifting**	• Musculoskeletal injuries from lifting heavy objects or improper lifting techniques, • hand lacerations, abrasions or puncture wounds while moving objects • Use of fixed Blade Knives leading to Hand/arm Lacerations. • Dust or other contaminates causing eye injury. • An electrical shock when working with miscellaneous tools and equipment due to wet conditions or faulty electrical equipment. • Use of Laser containing equipment to survey leading to potential eye damage.	• Proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist). • Wear gloves appropriate to task - leather work gloves (or cut resistant gloves) for general tasks and nitrile gloves when handling contaminated materials. Nitrile gloves may be worn over the cut resistant gloves, if they become cut then they should be replaced immediately. • Ensure proper training has been conducted prior to using a piece of equipment and inspect equipment for wear. Do not use if equipment is broken or faulty. If broken or faulty equipment is found it should be destroyed or marked "Out of Service" and removed from site as soon as possible. • Use the correct tool for the task, in a manner for which they were designed. • GFCIs will be used for all extension cords and 120v power tools. • All extension cords are in good condition with no cuts through outer insulation, ground plugs are present, and no "vinyl tape" repairs. • User will inspect tools and electrical cords daily.	**M**

		• Wear appropriate Personal Protective Equipment (PPE), as required, for the type of tool used. • Hearing protection required for which tools or areas: Power tools, equipment that generates sustained noise above 90 db. OSHA guidance (If you have to raise your voice to be heard <5' away, you need hearing protection) • Proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist). • The use of safety knives, scissors, or safety cutters is required instead of the use of fixed blade knives, razor knives, or box cutters. If a fixed blade knife is the ONLY TOOL that can perform the task, a separate AHA is required detailing the procedure and Health and Safety Project Manager must approve of the plan and variance. • Do not look directly at the rotating laser light. • Follow all warning regarding the use of equipment within the users manuals provided with laser equipped items.	
Workers shall access submerged work Areas in the pond via one of 3 methods depending upon existing conditions. **Wading** **Boat/Barge** **On the surface of the ice**	**Wading:** • Slipping or tripping on underwater obstacles and becoming wet leading to low body temperature • Slipping or tripping and causing a sprain or strain **Boat/Barge** • Slipping on wet walking surfaces and either causing direct injury or illness • Falling into the water out of the boat or off the barge leading to possible hypothermia or drowning. • Overloading of barge leading to damage and sinking of barge or boat. **Working on the ice** • Windy conditions could lead to hypothermia. • Breaking through the ice, leading to hypothermia, drowning, or death. • Slipping on the ice leading to sprains or strains.	• Don appropriate PPE when working near (within 6 feet) or over water/ice, including a USCG-approved Type I, II or III personal floatation device. NOTE: if a barge includes 100% fall protection (i.e. legal guardrails, restraint system etc.) then a PFD is not required. • The "buddy system" will be used during reconnaissance and sampling activities to provide immediate assistance to an individual in the event of an emergency. The "buddy" is an individual that must remain in direct line of sight with another group member during the installation activity. • Wading to access surface water gauge is permitted provided that water depths are three feet or less and the pond substrate is firm. • To minimize the potential for slipping, appropriate footwear with good treads will be worn. A sediment probe should be used to evaluate water depth and bed conditions before wading. As the stream bed may be slippery and uneven, proceed with caution at all times. • For construction-related activities, a rescue skiff will be staged such that one person can immediately access and launch the skiff. • Boats and barges will not operate above their weight capacity. • See also walking and working surfaces for slipping hazards of potentially wet boat/barge surfaces.	**H**

Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**

• Hard hat, safety glasses, safety shoes and high visibility safety vest (required for any on-site worker, visitor, or sub-contractor) • Nitrile gloves, cut-resistant gloves, hearing protection, Tyvek or other protective coverall (as necessary) • USCG-approved Type I, II or III personal floatation device to be used during work activities within 6 feet of the on-Site Pond Area. • Surveying GPS gear • Boat or Barge • Rescue skiff properly equipped throw buoys with 90’ of rope (if work is construction-related)	• OSHA 40 or 24-hour certification with 8-hour annual refresher training (required for sub-contractors working on-site) • Annual site-specific training documentation for Ramboll personnel • Visitors without the proper training requirements must have escort while on-site • Users of PFAS must have fall protection training. • For SSHC: Project Safety – SSL1 training	• Daily equipment inspections

Client:	General Electric Company	
Project Name:	Dewey Loeffel Route 203 Property Investigation	**Project No.**
Project Location:	Nassau, New York	
Site Safety Leader:		
Main Points of Briefing:	☐ Ramboll Safety Requirements ☐ Site-Specific Safety Pan or JSA/AHA ☐ Site Owner Safety Requirements	**Other:**

The purpose of the Pre-Work Briefing is to provide a ***site-specific Project Safety Orientation (PSO)*** to employees and subcontractors. This certifies that undersigned individuals have read, understand, and agree to comply with applicable ***site-specific safety requirements*** that can be obtained from site safety plans, site Activity Hazard Analyses (AHAs), Job Safety Analyses (JSAs), site owner requirements, and/or other site safety documents furnished to them by Ramboll. The undersigned individuals acknowledge that these safety requirements are not "all-inclusive" and that they will be expected to follow any additional safe work practices applicable to their specific scope of work.

Print Name	Signature	Company	Date

-- All Site Personnel Must Acknowledge Their Review and Understanding of Safety Requirements --

ACTIVITY HAZARD ANALYSIS – DEWEY LOEFFEL ROUTE 203 PROPERTY SITE INVESTIGATION – CHARACTERIZATION OF UST CONTENTS

Activity/Work Task: Characterization of UST Contents	Overall Risk Assessment Code (RAC) (Use highest code)					**M**
Project Location: Dewey Loeffel Route 203 Property, Nassau, New York	**Risk Assessment Code (RAC) Matrix**					
Company: Ramboll	**Severity**	**Probability**				
Date Prepared: 10/17/19		Frequent	Likely	Occasional	Seldom	Unlikely
Prepared by (Name/Title): Melanie Marshall, Engineer III	Catastrophic	**E**	**E**	**H**	**H**	**M**
	Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by (Name/Title): Steven Thompson, CHST / Safety Specialist III	Marginal	**H**	**M**	**M**	**L**	**L**
	Negligible	**M**	**L**	**L**	**L**	**L**

Notes: (Key Hazards, References, Field Notes etc.)

Scope:

As stated in Section 2 of the *Investigation Work Plan,* soft digging techniques will be used to removed shallow soil (to approximately 2 feet below grade) to access a port on top of the UST. If a port is located, samples will be collected via pumping or manual methods to characterize the contents of the UST.

Subcontractors include: drilling or excavation sub-contractor

Key Hazards:

Contact with potentially contaminated soil, moving parts on heavy machinery (*e.g.* skid-steer, vacuum truck and other heavy machinery), vehicle and heavy machinery traffic hazards, Pinch points on machinery, and tools, electrically powered equipment, shock hazards, compressed, combustible, and toxic gas hazards, slips, trips, and falls on un-even terrain, mud, ice and/or snow, laceration hazards, heat/cold stress, musculoskeletal injuries from twisting, bending, and/or heavy lifting, severe weather, aggressive fauna and flora (*e.g.,* black flies, ticks, spiders, snakes, bees, wasps, rabid animals, poison ivy, poison oak, sumac, giant hogweed, etc.).

References:

Investigation Work Plan, Dewey Loeffel Route 203 Property, Nassau, NY

Health and Safety Plan, Dewey Loeffel Route 203 Property, Nassau, NY

Activity Hazard Analysis – General Site Hazards (*e.g.,* biological hazards, heat/cold stress, inclement weather)

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

E = Extremely High Risk

H = High Risk

M = Moderate Risk

L = Low Risk

Job Steps	**Hazards**	**Controls**	**RAC**

Mobilize Vacuum Truck into position **Moving to location**	• Fluid Leaks from engine or other lubricated mechanical parts leading to environmental contamination • Struck By, Run-Over while moving the rig onsite and not seeing ground personnel leading to personal injury • electrical shock leading to property damage and or personal injury by coming into contact with overhead lines • Roll Over leading to property damage or personal injury due to unstable ground, traveling upon uneven surfaces, or moving the rig with the mast elevated • Injury while performing maintenance on mechanical parts of the rig. • Contact with other vehicles while working or moving rig along streets and roads leading to property damage and or personal injury.	• Qualified persons move and operate all vacuum truck equipment. Qualifications were determined by subcontractor work experience and pre work documentation verified by SSHC. • Equipment will be inspected upon mobilization (*i.e.*, "acceptance inspection") by: Operator and verified by the Site Safety Coordinator. • Prior to moving equipment every time, equipment will be inspected for signs of leakage (I.E. oil stains etc.). • High visibility vests always required for all on-Site and off-Site work. • Maintain a safety zone of at least 25 feet when walking and working in the area of heavy equipment operation (*i.e.,* "the 25 feet rule"). • Movement up or down inclines should be done at a 90degree angle to the slope. • Vacuum equipment will be de-energized and locked-out prior to maintenance. • Spill equipment is available for fuel and hydraulic fluid leaks. Location; Support vehicle and in the immediate work zone. • Operators are required to wear seat belts for all equipment provided with seatbelts. • Spotters are required when trucks or other heavy equipment are backing up. Spotters will use designated hand signals while vehicles are backing up. • Inform project and subcontractor personnel of 20' safety zones around energized power lines • Dedicate a spotter for all elevated work or operation of equipment that can contact lines • If roadway flaggers are used to temporarily control traffic, DOT Flagger Training is required. Verify training was completed and obtain copies of training certificates. • Traffic cones, flagging etc. will be used to define active work area	**M**
Use of Vacuum excavation truck or similar equipment to remove soil to locate access port.	• Contact with underground utilities leading to potential service disruptions, property damage, or personal injury. • Cave in/ collapse trapping workers lower body leading to possible sprains strains, or even broken bones. • Pedestrians falling into the exposed hole leading to injury and or potential lawsuits.	• Local Dig Safe will be contacted for utility locations in public areas or rights of way prior to the start of intrusive activities. • An Excavation Competent (EC) person will be identified and documented, including name and company. The EC person must have sufficient experience and formal training, including NUCU training or equivalent that covers 29CFR1926 Subpart P. • A Daily Excavation checklist will be completed each day that workers are exposed to excavation/cave-in hazards.	**M**

	• Contact with the end of the Vacuum Hose leading to injury, IE huge blood blisters, torn flesh, or socket injuries. • Hearing damage due to loud noises. • Explosion within truck collection due to the intake of potentially explosive/flammable atmosphere. • Static electricity from the vacuum truck hose leading to the ignition of flammable atmosphere created by vapors from the soil. • Repairing/replacing hose while under pressurized conditions leading to personal injury. • Exposure to dust and chemicals in soil when dumping soils.	• Sloping/shoring required for shallow excavations (<5') where cave-in hazards are identified. • Perimeter fencing will be erected to prevent access to the excavation and potential falls into the excavation. • Workers should keep face, hands, and feet away from the end of the vacuum hose. Use of a rod or pole to control the working end of the vacuum hose is recommended. • A qualified Operator should always be near the Vaccum release valve when workers are using the hose. • The employee working the hose should also have a means to De-Energize the system. • Workers within 25' of the vacuum truck should wear hearing protection. When a vacuum truck is "sucking air" it creates a high-pitched whine that is damaging to the ears. • Soils and work area should be checked periodically for LEL conditions. • The vacuum truck should be grounded if possible, this can be achieved with a copper grounding rod and a clip that most vac trucks come equipped with. • Damaged hoses should be replaced with the truck on idle and the vacuum shut down. Hoses should not be replaced while the truck is pulling air. • When emptying the truck, workers should avoid contact with soils. • Spill equipment is available for fuel and hydraulic fluid leaks. Location; Support vehicle and in the immediate work zone.	
Opening access port to draw samples	• Contact with contaminated materials, including VOCs, PCBs, and chemical solutions leading to potential Over exposure and illness. • Explosion caused by a sparking tool in a flammable atmosphere leading to injury or death.	• Site workers with minimal contact with contaminated materials and no work in Level C PPE will have OSHA 40-hour or 24-hour training, current 8-hour refresher, if necessary, and medical exam. • The SSL will define the perimeter of intrusive work areas. • Personnel, small tools and heavy equipment shall be decontaminated. • Work area air monitoring will be conducted for VOCs and gases. - Level D PPE - <1 ppm benzene and <5 ppm total VOCs - Half of full face Level C PPE, with organic/P100 cartridges changed daily – 1-10 ppm benzene or 5-50 ppm Total VOCs - Full face Level C PPE -5-20 ppm benzene or 50-200 ppm total VOCs (WITH QUATITATIVE FIT TESTING ONLY)	**M**

<table>
<tr>
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<td>
- >20 ppm or >200 ppm total VOCs – STOP work until contamination levels reduces and notify Project Manager and Client Representative
<table>
<tr><th>Parameter</th><th>Action Levels
(sustained for 1 minute)</th></tr>
<tr><td>LEL</td><td>>10%</td></tr>
<tr><td>O_2</td><td>19.5% - 23.0%</td></tr>
<tr><td>CO</td><td>35 ppm</td></tr>
<tr><td>H_2S</td><td>10 ppm</td></tr>
</table>
- If O_2 levels become deficient or enriched, H_2S gas or CO is detected at a concentration that will pose a risk to personnel, or the LEL is reached while monitoring with the five gas meter, work will be suspended and the Project Manager and Client Representative will be notified immediately. Action limits for these atmospheric testing parameters are provided in the table above.
- Work will be suspended until five gas meter and UltraRAE 3000 concentrations are deemed safe enough to work without engineering controls or with the appropriate engineering controls and/or respiratory protection as described by OSHA requirements in 29 CFR Part 1910.1000.

• No hot methods should be used to loosen bolts or torch the UST.

• The atmosphere in the space immediately above the access port should be checked prior to working above it. Hand tools should be used to open the hatch and workers crack the access hatch and monitor the released material.
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<tr>
<td>Decontamination of heavy equipment using pressurized steam washer or equivalent</td>
<td>
• Exposure to hazardous chemicals, vapors, dust, contact with contaminated materials, including VOCs, PCBs, and chemical solutions

• Crush injuries from door hydraulics failure causing injury or death.

• Collapse due to oxygen deficiency or toxic atmospheres within the truck container.

• Burns from either contact with “Hotsy” or from the hot water steam.

• Injuries caused by contact with Pressure washer stream leading to personal injuy.
</td>
<td>
• Do not enter the vac truck container unless all confined space requirements have been met and the Truck door is supported ie locked open with a safety bar.

• Remove “heavies” and larger debris from surfaces with a shovel or other hand tools prior to using a pressure washer to minimize debris.

• Don appropriate PPE during heavy equipment decontamination, including cut-resistant gloves, hearing protection, and eye protection/face shield, and Tychem QC or other form of splash protection, as necessary

• Have a fire extinguisher located near any equipment where flames and fuel are used or stored (ie “Hotsy”)
</td>
<td>M</td>
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</table>

	• Fire caused by faulty equipment. • Slips and falls caused by the formation of mud or wet surfaces.	• Injuries caused to flesh by pressurized water streams are similar to severe puncture wounds that cut to the bone follow the bone cutting the flesh away, do not attempt to clean close or boots with high pressure.	
Decontamination of personnel and small tools	• Exposure to hazardous chemicals, vapors, dust, contact with contaminated materials, including VOCs, PCBs, and chemical solutions	• Decontamination of personnel and small tools will be conducted as follows: Phosphate-free detergent wash and distilled water rinse. • Don appropriate PPE, including nitrile gloves and safety glasses	**L**
General Site Safety **Walking and Working surfaces**	• Slipping on wet, muddy, or icy surfaces leading to potential sprains strains or broken bones. • Tripping over equipment or uneven surfaces leading to sprains Strains or falls. • Equipment falling over while being stored leading to potential personal injuries or property damage.	• To minimize the potential for slipping, safety shoes with good treads will be worn. If necessary, don slip-on traction device for additional support. • Keep walking paths clear of debris/materials/equipment and ensure walking surfaces are clear of ice, snow, or other slippery materials (i.e. oils, greases). • Equipment and materials will be stacked in laydown areas with aisles as necessary for safe access. All un-used equipment & materials will be returned to laydown areas daily. • Trash and debris will be removed daily and placed in designated containers.	**L**
General Site Safety **Working with miscellaneous tools and equipment, heavy lifting**	• Poor lifting and carrying practices leading to Musculoskeletal injuries. • Failure to wear appropriate or any Gloves Leading to hand injuries. • Use of fixed Blade Knives leading to Hand/arm Lacerations. • Failure to wear appropriate Eye protection leading to eye injury • Improper use of or use of damaged electrical cords leading to electrical shock.	• Wear gloves appropriate to task - leather work gloves (or cut resistant gloves) for general tasks and nitrile gloves when handling contaminated materials. Nitrile gloves may be worn over the cut resistant gloves, if they become cut then they should be replaced immediately. • Ensure proper training has been conducted prior to using a piece of equipment and inspect equipment for wear. Do not use if equipment is broken or faulty. If broken or faulty equipment is found it should be destroyed or marked "Out of Service" and removed from site as soon as possible. • Use the correct tool for the task, in a manner for which they were designed. • GFCIs will be used for all extension cords and 120v power tools. • All extension cords are in good condition with no cuts through outer insulation, ground plugs are present, and no "vinyl tape" repairs. • User will inspect tools and electrical cords daily. • Wear appropriate Personal Protective Equipment (PPE), as required, for the type of tool used. • ANY task that requires the use of a face shield also requires the use of Eye Protection (i.e. safety glasses) • Hearing protection required for which tools or areas: Power tools, equipment that generates sustained noise above 90 db.	**M**

		OSHA guidance (If you have to raise your voice to be heard <5' away, you need hearing protection) • Proper lifting techniques will be employed (e.g., two-man lift, bending at the knees, limited pivoting at the waist). • The use of safety knives, scissors, or safety cutters is required instead of the use of fixed blade knives, razor knives, or box cutters. If a fixed blade knife is the ONLY TOOL that can perform the task, a separate AHA is required detailing the procedure and Health and Safety Project Manager must approve of the plan and variance	
Workers will set up and work along public roads	• Drivers not seeing the Surveyors and accidentally hitting the worker leading to equipment damage, injury or potentially death. • Contact between employees vehicle and another vehicle on the road leading to property damage, injury or potential death. • Backing into an object or person leading to potential property damage, injury or death.	• Remain aware of on- and off-Site vehicle traffic when working near public and private roadways and driveways. • Wear appropriate PPE, include steel towed boots and reflective safety vest • Use spotters when backing up vehicles • Drive slowly • If roadway flaggers are used to temporarily control traffic, DOT Flagger Training is required. Verify training was completed and obtain copies of training certificates. • Traffic cones, flagging etc. will be used to define active work area	**M**

Equipment to be Used	**Training Requirements/Competent or Qualified Personnel name(s)**	**Inspection Requirements**
• Hard hat, safety glasses, hearing protection, safety shoes and high visibility safety vest (required for any on-site worker, visitor, or sub-contractor) • Nitrile gloves, cut-resistant gloves, Tyvek or other protective coverall (as necessary) • USCG-approved Type I, II or III personal floatation device to be used during work activities within 6 feet of the on-Site Pond Area. • PID • 4 Gas Meter • Ultra Rae 3000 or similar	• OSHA 40 or 24-hour certification with 8-hour annual refresher training (required for sub-contractors working on-site) • Annual site-specific training documentation for Ramboll personnel • Visitors without the proper training requirements must have escort while on-site • DOT flagger training • For SSHC: Project Safety – SSL1 training	• Equipment acceptance inspection • Daily equipment inspections, including drill rigs, heavy equipment, tools, and electrical cords • Daily Excavation inspection and checklist • Daily bump check for all meters and weekly full calibrations

Client:	General Electric Company		
Project Name:	Dewey Loeffel Route 203 Property Investigation		**Project No.**
Project Location:	Nassau, New York		
Site Safety Leader:			
Main Points of Briefing:	☐ Ramboll Safety Requirements ☐ Site-Specific Safety Pan or JSA/AHA ☐ Site Owner Safety Requirements	**Other:**	

The purpose of the Pre-Work Briefing is to provide a ***site-specific Project Safety Orientation (PSO)*** to employees and subcontractors. This certifies that undersigned individuals have read, understand, and agree to comply with applicable ***site-specific safety requirements*** that can be obtained from site safety plans, site Activity Hazard Analyses (AHAs), Job Safety Analyses (JSAs), site owner requirements, and/or other site safety documents furnished to them by Ramboll. The undersigned individuals acknowledge that these safety requirements are not "all-inclusive" and that they will be expected to follow any additional safe work practices applicable to their specific scope of work.

Print Name	Signature	Company	Date

-- All Site Personnel Must Acknowledge Their Review and Understanding of Safety Requirements --

APPENDIX D
ACTIVITY HAZARD ANALYSIS TEMPLATE

Activity/Work Task:	Overall Risk Assessment Code (RAC) (*Use highest code*)	
Project Location:	**Risk Assessment Code (RAC) Matrix**	
Company:	**Severity**	**Probability**
Date Prepared:		Frequent / Likely / Occasional / Seldom / Unlikely
Prepared by (Name/Title):	Catastrophic	E / E / H / H / M
	Critical	E / H / H / M / L
Reviewed by (Name/Title):	Marginal	H / M / M / L / L
	Negligible	M / L / L / L / L

Notes: (Key Hazards, References, Field Notes etc.)

Ensure AHA covers applicable responsibilities identified in the SSL Tab of the PSRF.

Step 1: Review each **"Hazard"** with identified safety **"Controls"** and determine RAC (See above)

"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.

"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart

- **E = Extremely High Risk**
- **H = High Risk**
- **M = Moderate Risk**
- **L = Low Risk**

Job Steps	Hazards	Controls	RAC
[insert new lines as needed]			

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements
	Right to Stop Unsafe Work (all project personnel must be informed of their right to stop unsafe tasks)	

EMERGENCY RESPONSE CONTACT INFORMATION			
(911 Service is Available ☐ Yes ☐ No **Cell Phone Required** ☐ Yes ☐ No)			
Alternate Emergency Number (if not "911"):			
Site Address:			
Muster Point in case of site evacuation:			
Emergency Medical Treatment - Hospital Name: Hospital Address:		**Number:**	
Non-Emergency Med. Treatment - Clinic Name: Occupational Clinic Address:		**Number:**	
Minor Injury Support for OBG Employees:	**WorkCare Incident Intervention**	**Number:**	888-449-7787
Fire Department Name		**Number:**	
Spill Response:		**Number:**	
Client Representative Name:		**Office Number:** **Cell Number:**	
OBG **Project Manager** Name:		**Office Number:** **Cell Number:**	
OBG **Site Safety Leader** Name:		**Office Number:** **Cell Number:**	
OBG **Corporate H&S** Name:		**Office Number:** **Cell Number:**	
Contact Name:		**Office Number:** **Cell Number:**	

EMERGENCY RESPONSE PLANS:

1. ***NOTIFICATIONS*** - Upon occurrence of any injury, fire, explosion, major spill (beyond incidental), property damage >$1,000, or near-miss that could have resulted in a fatality or disabling injury, **IMMEDIATELY NOTIFY** the OBG Project Manager, OBG Manager of Corporate H&S, and the Client Representative.
2. ***WRITTEN REPORT*** - Complete an *Incident Report* within **24 hours** and submit to the OBG Manager of Corporate H&S for review. Report may be submitted as a "draft" or "preliminary" and updated as additional information is identified.
3. ***INJURY RESPONSE***
   - First aid injuries will be handled on site with FA-trained personnel. First aid and CPR supplies are located: _____.
   - If a person (OBG employee or subcontractor employee) may be **working alone** at times when the job site is unoccupied, then regular "check-ins" will be conducted between the lone site person and their supervisor or another designated person. The method of communication (radio, cell phone), the frequency of check-ins, and the names of individual(s) with whom the lone worker will be checking in must be outlined below under "*Other Emergency Information*." Employees should not be assigned to "High Hazard Work" when working alone.
   - **All O'Brien & Gere employees will call WorkCare for minor injuries** that include any strains, cuts for which an employee is not confident that a band aid is sufficient, tick/insect bites for which the employee is concerned about infection or Lyme, any other work-related injury for which the employee would like to talk to a WorkCare medical professional regarding proper treatment or follow-up.
   - **WorkCare posters must be posted at each job site with a field office or trailer.**
   - Minor (not life threatening) injuries that require medical attention will be treated at the "Non-Emergency Med Treatment" clinic identified above **unless an alternate clinic is recommended by WorkCare**. If no clinic is available or identified, then default to the "Emergency Medical Treatment" facility.
   - If an OBG employee feels that a minor injury is not healing properly or may be more severe than originally anticipated, they should call WorkCare and discuss their concerns. At this time, WorkCare may direct the employee to a local clinic, or alternately, employees may request evaluation at a local clinic. In either situation, **WorkCare will facilitate the employee's visit to a suitable, local clinic for further evaluation**.
   - Life Threatening injuries are an emergency and require implementing emergency response (911 or alternate).
4. ***FIRE or EXPLOSION***
   - Incipient stage (trash can size) fires may be handled by site personnel using fire extinguishers or hoses.
   - Larger fires will require that affected personnel are evacuation to the identified muster point and implementing emergency response (911 or alternate).
5. ***SPILL RESPONSE***
   - Major spills that exceed the available supplies and resources to safely control and cleanup will require contacting an off-site spill responder indicated above for "Spill Response" and in accordance with existing site spill response plans. If a specific spill responder is not identified, a large spill will require implementing emergency response (911 or alternate).
   - Review available spill control and prevention plans that may be applicable to the work area. Ensure project personnel are familiar with plan requirements.
   - Minor or incident spills will be cleaned up by site personnel using supplies that are located: _____.
   - The site owner will make notifications for reportable spills unless OBG is authorized to make those notifications.
6. ***POSTING*** - Emergency numbers and Hospital Route Map are posted: _____.
7. ***OTHER EMERGENCY INFORMATION:***

Client:		
Project Name:		**Project No.**
Project Location:		
Site Safety Leader:		
Main Points of Briefing:	☐ OBG Safety Requirements ☐ Site-Specific Safety Pan or JSA/AHA ☐ Site Owner Safety Requirements	**Other:**

The purpose of the Pre-Work Briefing is to provide a ***site-specific Project Safety Orientation (PSO)*** to employees and subcontractors. This certifies that undersigned individuals have read, understand, and agree to comply with applicable ***site-specific safety requirements*** that can be obtained from site safety plans, site Activity Hazard Analyses (AHAs), Job Safety Analyses (JSAs), site owner requirements, and/or other site safety documents furnished to them by OBG. The undersigned individuals acknowledge that these safety requirements are not "all-inclusive" and that they will be expected to follow any additional safe work practices applicable to their specific scope of work.

Print Name	Signature	Company	Date

-- All Site Personnel Must Acknowledge Their Review and Understanding of Safety Requirements -

APPENDIX E
CHEMICAL HAZARD INFORMATION/SAFETY DATA SHEETS

PCOC Chemical Hazard Information
Dewey Loeffel Route 203 Property
Nassau, New York

Compound	Max Conc. in Soil (µg/kg)	Max Conc. in Sediment (µg/kg)	OSHA PEL (ppm)	ACGIH TLV (ppm)	IDLH (ppm)	Routes of Entry/Exposure Symptoms
1,2,3-Trichlorobenzene	42400	15100	-	-	-	See MSDS
1,2,4-Trichlorobenzene	94000	36600	-	5	-	See MSDS
1,3-Dichlorobenzene	3500	12900	75	-	150	See MSDS
1,4-Dichlorobenzene	22900	114700	75	10	150	See MSDS
2-Butanone	2400	1100	200	200	3000	See MSDS
2-Methylnaphthalene	13600	10500	-	-	-	See MSDS
Acenaphthylene	3100	200	-	-	-	See MSDS
Acetone	12600	2600	1000	500	2500	See MSDS
Aroclor-1016	4.800[C]	14.0[C]	-	-	-	See MSDS
Aroclor-1248	1.400[C]	0.500[C]	-	-	-	See MSDS
Aroclor-1254	0.250[C]	1.600[C]	0.5[b]	0.5[b]	5[b]	See MSDS
Aroclor-1260	1200[C]	100[C]	-	-	-	See MSDS
Arsenic	23.4[C]	9.34[C]	0.5[b]	-	5[b]	See MSDS
Barium	424[C]	576[C]	0.5[b]	0.5[b]	50[b]	See MSDS
Benzene	750	1500	1	0.5	500	See MSDS
Benzo[a]anthracene	13100	-	-	-	-	See MSDS
Benzo[a]pyrene	10000	-	-	-	-	See MSDS
Benzo[b]fluoranthene	11900	-	-	-	-	See MSDS
Benzo[g,h,i]perylene	6800	-	-	-	-	See MSDS
Bis(2-Ethylhexyl)phthalate	10600	490	5[b]	5[b]	5000[b]	See MSDS
Cadmium	1.55[C]	0.607[C]	0.005[b]	0.01[b]	9[b]	See MSDS
Chlorobenzene	6200	47000	75	10	1000	See MSDS
Chromium	76.6[C]	16.5[C]	0.5[b]	0.5[b]	250[b]	See MSDS
Chrysene	14200	-	-	-	-	See MSDS
Cyclohexane	6100	24900	300	300	1300	See MSDS
Dimethylphthalate	1000	800	5[b]	5[b]	2000[b]	See MSDS
Ethylbenzene	375900	315300	100	20	800	See MSDS
Fluoranthene	19600	-	-	-		See MSDS
Indeno[1,2,3-cd]pyrene	5500	-	-	-	-	See MSDS
Isopropylbenzene	9900	8600	50	50	900	See MSDS
Lead	3960[C]	134[C]	0.05[b]	0.05[b]	100[b]	See MSDS
m,p-Xylene	2263400	1660600	100[a]	100[a]	900[a]	See MSDS
Mercury	0.843[C]	0.228[C]	0.25[b]	0.25[b]	10[b]	See MSDS
Methylcyclohexane	18000	42900	500	400	1200	See MSDS
Naphthalene	14500	10600	10	10	250	See MSDS
o-Xylene	585400	473800	100[a]	100[a]	900[a]	See MSDS
Phenanthrene	16900	2400	0.2[b]	0.2[b]	-	See MSDS
Phenol	2800	1400	5	5	250	See MSDS
Polychlorinated biphenyls (PCBs)	1200[C]	114[C]	-	-	5[b]	See MSDS
Pyrene	26200	200	0.2[b]	0.2[b]	-	See MSDS
Selenium	2.48[C]	1.55[C]	0.2[b]	0.2[b]	1[b]	See MSDS
Silver	0.83[C]	0.166[C]	0.01[b]	0.01[b]	10[b]	See MSDS
Toluene	2685800	1432700	200*	20	500	See MSDS

Notes:

1. PCOC designates Potential Consituents of Concern.
2. Max Conc. in Soil designates Maximum Concentration Detected in Soil.
3. Max Conc. in Sediment designates Maximum Concentration Detected in Sediment.
4. µg/kg designates micrograms per kilogram.
5. OSHA PEL designates Occupational Safety and Health Administration Permissible Exposure Limit.
6. ACGIH TLV designates American Conference of Government Industrial Hygenist Threshold Limit Value.
7. IDLH designates Immediately Dangerous to Life and Health. Values are defined by U.S. National Institute for Occupational Safety and Health (NIOSH).
8. Units of PELs, TLVs, and IDLH values are parts per million (ppm), except where indicated.
9. - designates value not available/not applicable.
10. [b] designates units in mg/m3.
11. MSDS designates Material Safety Data Sheet (aka Safety Data Sheet [SDS]. MSDSs are provided in Appedix E herein.
12. [a] designates PEL and TLV apply to all isomers of compound.
13. * designates C 300 ppm 500 ppm.
14. [c] designates milligrams per kilogram (mg/kg).

SAFETY DATA SHEET

Version 4.4
Revision Date 08/21/2014
Print Date 07/02/2015

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : 1,2,3-Trichlorobenzene

Product Number : T54402
Brand : Aldrich

CAS-No. : 87-61-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H302 Harmful if swallowed.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
H411 Toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.

P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P312	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312	Call a POISON CENTER or doctor/ physician if you feel unwell.
P321	Specific treatment (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	$C_6H_3Cl_3$
Molecular weight	:	181.45 g/mol
CAS-No.	:	87-61-6
EC-No.	:	201-757-1

Hazardous components

Component	Classification	Concentration
1,2,3-Trichlorobenzene		
	Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; Aquatic Acute 2; Aquatic Chronic 2; H302, H315, H319, H335, H411	-

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.Normal measures for preventive fire protection.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: beige
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 51 - 53 °C (124 - 127 °F) - lit.
f)	Initial boiling point and boiling range	218 - 219 °C (424 - 426 °F) - lit.
g)	Flash point	127.0 °C (260.6 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 6.6 %(V) Lower explosion limit: 2.5 %(V)
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available

n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 4.016
p)	Auto-ignition temperature	571.0 °C (1,059.8 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 1,830 mg/kg

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a

known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: DC2095000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Gambusia affinis (Mosquito fish) - 2.2 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - 1.45 mg/l - 48 h

12.2 Persistence and degradability

12.3 Bioaccumulative potential

Bioaccumulation	Oncorhynchus mykiss (rainbow trout) - 48 h - 0.0096 mg/l
	Bioconcentration factor (BCF): 710

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (1,2,3-Trichlorobenzene)
Marine pollutant: No

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (1,2,3-Trichlorobenzene)
Marine pollutant: Marine pollutant

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (1,2,3-Trichlorobenzene)

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
1,2,3-Trichlorobenzene	87-61-6	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
1,2,3-Trichlorobenzene	87-61-6	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
1,2,3-Trichlorobenzene	87-61-6	1993-04-24

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Eye Irrit.	Eye irritation
H302	Harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H401	Toxic to aquatic life.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	1
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	1
Reactivity Hazard:	0

Further information

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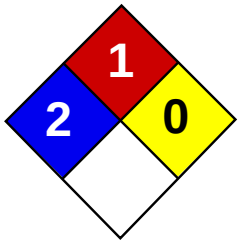
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.4 Revision Date: 08/21/2014 Print Date: 07/02/2015



Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
1,2,4-Trichlorobenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,2,4-Trichlorobenzene

Catalog Codes: SLT3619

CAS#: 120-82-1

RTECS: DC2100000

TSCA: TSCA 8(b) inventory: 1,2,4-Trichlorobenzene

CI#: Not applicable.

Synonym:

Chemical Name: 1,2,4,-Trichlorobenzene

Chemical Formula: C6H3Cl3

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{1,2,4-}Trichlorobenzene	120-82-1	100

Toxicological Data on Ingredients: 1,2,4-Trichlorobenzene: ORAL (LD50): Acute: 756 mg/kg [Rat.]. 300 mg/kg [Mouse]. DERMAL (LD50): Acute: 6139 mg/kg [Rat.].

Section 3: Hazards Identification

Potential Acute Health Effects:
Extremely hazardous in case of skin contact (irritant, permeator), of eye contact (irritant). Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (sensitizer). Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to blood, kidneys, liver, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 571°C (1059.8°F)

Flash Points: CLOSED CUP: 110°C (230°F).

Flammable Limits: LOWER: 2.5% UPPER: 6.6%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances:
Flammable in presence of open flames and sparks, of oxidizing materials. Slightly flammable to flammable in presence of heat, of reducing materials, of combustible materials. Non-flammable in presence of moisture.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Keep container tightly closed.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
If the product is in its solid form: Use a shovel to put the material into a convenient waste disposal container. If the product is in its liquid form: Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents, reducing agents, organic materials, metals, acids, alkalis.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 5 (ppm) TWA: 37 (mg/m3) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Pungent. (Slight.)

Taste: Toxic by ingestion.

Molecular Weight: 181.46 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 213°C (415.4°F)

Melting Point: 17°C (62.6°F)

Critical Temperature: Not available.

Specific Gravity: 1.45 (Water = 1)

Vapor Pressure: Not available.

Vapor Density: 6.26 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, n-octanol.

Solubility:
Easily soluble in diethyl ether. Soluble in methanol, n-octanol. Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances:
Highly reactive with oxidizing agents. Reactive with reducing agents, organic materials, metals, acids, alkalis.

Corrosivity:
Slightly corrosive to corrosive in presence of steel, of copper. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 300 mg/kg [Mouse]. Acute dermal toxicity (LD50): 6139 mg/kg [Rat.].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, liver, upper respiratory tract.

Other Toxic Effects on Humans:
Extremely hazardous in case of skin contact (irritant, permeator). Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (sensitizer).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Can cause gastrointestinal disturbances.

Special Remarks on other Toxic Effects on Humans: Exposure can cause nausea, headache and vomiting.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichlorobenzene : UN2321 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: 1,2,4-Trichlorobenzene Florida: 1,2,4-Trichlorobenzene Minnesota: 1,2,4-Trichlorobenzene Massachusetts RTK: 1,2,4-Trichlorobenzene New Jersey: 1,2,4-Trichlorobenzene TSCA 8(b) inventory: 1,2,4-Trichlorobenzene SARA 313 toxic chemical notification and release reporting: 1,2,4-Trichlorobenzene CERCLA: Hazardous substances.: 1,2,4-Trichlorobenzene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R38- Irritating to skin. R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References:
-Material safety data sheet emitted by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II.

Other Special Considerations: Not available.

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1,3-DICHLOROBENZENE, 98%

1. Product Identification

Synonyms: m-Dichlorobenzene; Benzene, 1,3-dichloro-; m-Phenylenedichloride
CAS No.: 541-73-1
Molecular Weight: 147.00
Chemical Formula: C6H4Cl2
Product Codes: D0030

2. Composition/Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
541-73-1	1,3-Dichlorobenzene	98	208-792-1

3. Hazards Identification

EMERGENCY OVERVIEW

Appearance: Clear - Colorless Liquid. Flash Point: 67 deg C.
Warning! Harmful if swallowed. Causes eye and skin irritation. Combustible liquid and vapor. May be absorbed through intact skin. Causes digestive and respiratory tract irritation.
Target Organs: Kidneys, liver.

Potential Health Effects

Eye: Causes eye irritation.
Skin: Causes skin irritation. May be absorbed through the skin.
Ingestion: Harmful if swallowed. Causes gastrointestinal irritation with nausea, vomiting and diarrhea.
Inhalation: Causes respiratory tract irritation.
Chronic: Chronic exposure may cause liver damage. Chronic exposure may cause kidney damage.

4. First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.
Skin: Get medical aid immediately. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
Inhalation: Remove from exposure and move to fresh air immediately. If breathing is difficult, give oxygen. Get medical aid. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.
Notes to Physician: Treat symptomatically and supportively.

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5. Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Combustible liquid. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Containers may explode when heated.
Extinguishing Media: Do NOT get water inside containers. For small fires, use dry chemical, carbon dioxide, or water spray. For large fires, use dry chemical, carbon dioxide, alcohol-resistant foam, or water spray. Cool containers with flooding quantities of water until well after fire is out.
Flash Point: 67 deg C (152.60 deg F)
Autoignition Temperature: 640 deg C (1,184.00 deg F)
Explosion Limits, Lower:Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 2; Flammability: 2; Instability: 0

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6. Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Avoid runoff into storm sewers and ditches which lead to waterways. Remove all sources of ignition. Provide ventilation. Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading and contact with water. Stop leak only if you can do so without risk.

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7. Handling and Storage

Handling: Wash thoroughly after handling. Use only in a well-ventilated area. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Keep away from heat, sparks and flame. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

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8. Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
1,3-Dichlorobenzene	none listed	none listed	none listed

OSHA Vacated PELs: 1,3-Dichlorobenzene: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

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9. Physical and Chemical Properties

Physical State: Liquid
Appearance: Clear - Colorless Liquid
Odor: None reported.
pH: Not available.
Vapor Pressure: 1.8 hPa @ 20 C
Vapor Density: 5.07
Evaporation Rate:Not available.
Viscosity: 1.045 cP 23 deg C
Boiling Point: 172.0 - 173.0 deg C @ 760.00m
Freezing/Melting Point:-24 deg C
Decomposition Temperature:> 300 deg C
Solubility: Insoluble.
Specific Gravity/Density:1.2880g/cm3
Molecular Formula:C6H4Cl2
Molecular Weight:147.00

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10. Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Incompatible materials, ignition sources, excess heat.
Incompatibilities with Other Materials: Strong oxidizing agents, aluminum.
Hazardous Decomposition Products: Hydrogen chloride, carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

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11. Toxicological Information

RTECS#:
CAS# 541-73-1: CZ4499000
LD50/LC50:
Not available.

intraperitoneal, mouse: LD50 = 1062 mg/kg.; Oral, rat: TDLo = 1470 mg/kg/10D-I.; Oral, rat: TDLo = 3330 mg/kg/90D-I.; CAS# 106-46-7 Oral, rat LD50 = 500 mg/kg.; Dermal, rat: LD50 = >2gm/kg. The toxicity of this product is partially based on the hazards associated with
Carcinogenicity:
CAS# 541-73-1: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information.
Teratogenicity: No data available.
Reproductive Effects: No information.
Mutagenicity: Gene conversion and mitotic recombination: Saccharomyces cerevisiae =5ppm.; Micronucleus test-Intraperitoneal, mouse = 175 mg/kg/24H.
Neurotoxicity: No information.
Other Studies:

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12. Ecological Information

Ecotoxicity: Fish: Fathead Minnow: 12.7 mg/L; 96 Hr; Static Bioassay Experimental BCF Values of 89-740 reported, and 1,3-Dichlorobenzene was detected in trout in Lake Ontario. Koc values of 12600-31600 calculated from sediment/water monitoring data in Great Lakes Area. An experimental Koc value of 293 was calculated in a silt loam soil containing 1.9% organic matter. 1,3-Dichlorobenzene can be moderately to highly absorbed to soil. Leaching can occur.
Environmental: No information available.
Physical: No information available.
Other: No information available.

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13. Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 541-73-1: waste number U071.

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14. Transport Information

	US DOT	Canada TDG
Shipping Name:	TOXIC LIQUIDS, ORGANIC, N.O.S.	TOXIC LIQUID ORGANIC NOS (1,3 - DICHLOROBENZENE)
Hazard Class:	6.1	6.1
UN Number:	UN2810	UN2810
Packing Group:	III	III

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15. Regulatory Information

US FEDERAL

TSCA
CAS# 541-73-1 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 541-73-1: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 541-73-1: immediate, delayed, fire.
Section 313
This material contains 1,3-Dichlorobenzene (CAS# 541-73-1, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 541-73-1 is listed as a Priority Pollutant under the Clean Water Act. CAS# 541-73-1 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 541-73-1 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
XN N
Risk Phrases:
R 22 Harmful if swallowed.
R 51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)
CAS# 541-73-1: 2
Canada - DSL/NDSL
CAS# 541-73-1 is listed on Canada's DSL List.
Canada - WHMIS
This product has a WHMIS classification of B3, D1B, D2A.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
Canadian Ingredient Disclosure List

CAS# 541-73-1 is listed on the Canadian Ingredient Disclosure List.

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16. Other Information

Product Use:
Laboratory Reagent.
Revision Information:
Jan. 2008.
Disclaimer:
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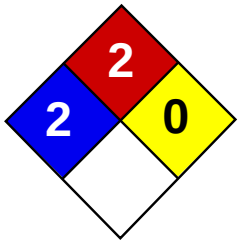

Material Safety Data Sheet
1,4-Dichlorobenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,4-Dichlorobenzene

Catalog Codes: SLD4093

CAS#: 106-46-7

RTECS: CZ4550000

TSCA: TSCA 8(b) inventory: 1,4-Dichlorobenzene

CI#: Not available.

Synonym:

Chemical Formula: C6H4Cl2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{1,4-}Dichlorobenzene	106-46-7	100

Toxicological Data on Ingredients: 1,4-Dichlorobenzene: ORAL (LD50): Acute: 500 mg/kg [Rat]. DERMAL (LD50): Acute: 6000 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Very hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation. CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2 (Reasonably anticipated.) by NTP. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, lungs, liver, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 413°C (775.4°F)

Flash Points: CLOSED CUP: 65.56°C (150°F). (TAG)

Flammable Limits: LOWER: 2.5% UPPER: 16%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of oxidizing materials.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive to explosive in presence of oxidizing materials.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 75 CEIL: 110 (ppm) TWA: 450 CEIL: 675 (mg/m3) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 147 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 174.12°C (345.4°F)

Melting Point: 53.75°C (128.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.46 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 5.08 (Air = 1)

Volatility: Not available.

Odor Threshold: 15 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:
Soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 500 mg/kg [Rat]. Acute dermal toxicity (LD50): 6000 mg/kg [Rabbit].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2 (Reasonably anticipated.) by NTP. The substance is toxic to kidneys, lungs, liver, mucous membranes.

Other Toxic Effects on Humans: Very hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 9: Miscellaneous hazardous material.

Identification: : Environmentally hazardous substance, solid, n.o.s. (p-Dichlorobenzene) : UN3077 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: 1,4-Dichlorobenzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: 1,4-Dichlorobenzene Pennsylvania RTK: 1,4-Dichlorobenzene Massachusetts RTK: 1,4-Dichlorobenzene TSCA 8(b) inventory: 1,4-Dichlorobenzene SARA 313 toxic chemical notification and release reporting: 1,4-Dichlorobenzene CERCLA: Hazardous substances.: 1,4-Dichlorobenzene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 2

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 05:07 PM

Last Updated: 06/09/2012 12:00 PM

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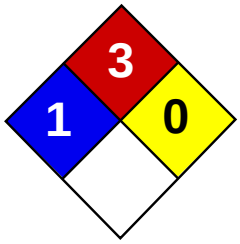

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Methyl ethyl ketone MSDS

Section 1: Chemical Product and Company Identification

Product Name: Methyl ethyl ketone

Catalog Codes: SLM2626, SLM3232

CAS#: 78-93-3

RTECS: EL6475000

TSCA: TSCA 8(b) inventory: Methyl ethyl ketone

CI#: Not applicable.

Synonym: 2-Butanone

Chemical Name: Methyl Ethyl Ketone

Chemical Formula: C4H8O

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Methyl ethyl ketone	78-93-3	100

Toxicological Data on Ingredients: Methyl ethyl ketone: ORAL (LD50): Acute: 2737 mg/kg [Rat]. 4050 mg/kg [Mouse]. DERMAL (LD50): Acute: 6480 mg/kg [Rabbit]. VAPOR (LC50): Acute: 23500 mg/m 8 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation (lung irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Classified POSSIBLE for human. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to gastrointestinal tract, upper respiratory tract, skin, eyes, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 404°C (759.2°F)

Flash Points: CLOSED CUP: -9°C (15.8°F). OPEN CUP: -5.5556°C (22°F) (Tag).

Flammable Limits: LOWER: 1.8% UPPER: 10%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Explosive in presence of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Ignition on contact with potassium t-butoxide. Vapor may cause a flash fire

Special Remarks on Explosion Hazards:
Reaction with Hydrogen Peroxide + nitric acid forms heat and shock-sensitive explosive product. Mixture with 2-propanol will produce explosive peroxides during storage.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined

areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 200 STEL: 300 (ppm) from ACGIH (TLV) [United States] [1999] TWA: 150 STEL: 300 (ppm) [Australia] TWA: 590 STEL: 885 (mg/m3) from NIOSH TWA: 200 STEL: 300 (ppm) from NIOSH TWA: 590 STEL: 885 (mg/m3) [Canada] TWA: 200 STEL: 300 (ppm) from OSHA (PEL) [United States] TWA: 590 STEL: 885 (mg/m3) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:
Acetone-like Pleasant. Pungent. Sweetish. (Strong.)

Taste: Not available.

Molecular Weight: 72.12g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 79.6 (175.3°F)

Melting Point: -86°C (-122.8°F)

Critical Temperature: 262.5°C (504.5°F)

Specific Gravity: 0.805(Water = 1)

Vapor Pressure: 10.3 kPa (@ 20°C)

Vapor Density: 2.41 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 0.3

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility: Soluble in cold water, diethyl ether, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, mechanical shock, incompatible materials.

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with chloroform, copper, hydrogen peroxide, nitric acid, potassium t-butoxide, 2-propanol, chlorosulfonic acid, strong oxidizers, amines, ammonia, inorganic acids, isocyanates, caustics, pyrindines. Vigorous reaction with chloroform +alkali.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2737 mg/kg [Rat]. Acute dermal toxicity (LD50): 6480 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 32000 mg/m3 4 hours [Mouse].

Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Classified POSSIBLE for human. May cause damage to the following organs: gastrointestinal tract, upper respiratory tract, skin, eyes, central nervous system (CNS).

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation (lung irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May cause birth defects based on animal dats. Embryotoxic and/or foetotoxic in animal.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation. May be absorbed through the skin. Eyes: Causes eye irritation. Inhalation: Inhalation of high concentrations may cause central nervous effects characterized by headache, dizziness, unconsciousness, and coma. Causes respiratory tract irritation and affects the sense organs. May affect the liver and urinary system. Ingestion: Causes gastrointestinal tract irritation with nausea, vomiting and diarrhea. May affect the liver. Chronic Potential Health Effects: Chronic inhalation may cause effects similar to those of acute inhalation. Prolonged or repeated skin contact may cause defatting and dermatitis.

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 3220 mg/l 96 hours [Fathead Minnow]. 1690 mg/l 96 hours [Bluegill].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Ethyl methyl ketone UNNA: 1193 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
New York release reporting list: Methyl ethyl ketone Rhode Island RTK hazardous substances: Methyl ethyl ketone Pennsylvania RTK: Methyl ethyl ketone Minnesota: Methyl ethyl ketone Massachusetts RTK: Methyl ethyl ketone New Jersey: Methyl ethyl ketone California Director's list of Hazardous Substances: Methyl ethyl ketone TSCA 8(b) inventory: Methyl ethyl ketone TSCA 8(d) H and S data reporting: Methyl ethyl ketone: Effective: 10/4/82; Sunset: 10/4/92 SARA 313 toxic chemical notification and release reporting: Methyl ethyl ketone CERCLA: Hazardous substances.: Methyl ethyl ketone: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable. R36/37- Irritating to eyes and respiratory system. S9- Keep container in a well-ventilated place. S16- Keep away from sources of ignition - No smoking. S25- Avoid contact with eyes. S33- Take precautionary measures against static discharges.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 05/21/2013 12:00 PM

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SAFETY DATA SHEET

Version 5.4
Revision Date 01/26/2016
Print Date 05/11/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : 2-Methylnaphthalene

Product Number : 442359
Brand : Supelco

CAS-No. : 91-57-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H302 Harmful if swallowed.
H411 Toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P301 + P312 + P330 IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P391 Collect spillage.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : β-Methylnaphthalene

Formula : $C_{11}H_{10}$

Molecular weight : 142.20 g/mol

CAS-No. : 91-57-6

EC-No. : 202-078-3

Hazardous components

Component	Classification	Concentration
2-Methylnaphthalene		
	Acute Tox. 4; Aquatic Acute 2; Aquatic Chronic 2; H302, H411	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Avoid breathing dust.

For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
2-Methylnaphthalene	91-57-6	TWA	0.500000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Skin contact does contribute to exposure. Not classifiable as a human carcinogen		
		TWA	0.5 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Lower Respiratory Tract irritation Lung damage Not classifiable as a human carcinogen Danger of cutaneous absorption		

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm

Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	34.0 - 36.0 °C (93.2 - 96.8 °F)
f)	Initial boiling point and boiling range	241.0 - 242.0 °C (465.8 - 467.6 °F)
g)	Flash point	98.0 °C (208.4 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	1.00 g/cm3
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 3.80
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available

r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 1,630 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Mild skin irritation

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: QJ9635000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 2.5 mg/l
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - 1.5 mg/l - 48 h

12.2 Persistence and degradability

12.3 Bioaccumulative potential

Bioaccumulation	Oncorhynchus mykiss (rainbow trout) - 28 d - 0.017 mg/l
	Bioconcentration factor (BCF): 23,500

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (2-Methylnaphthalene)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (2-Methylnaphthalene)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
2-Methylnaphthalene	91-57-6	2010-08-02

New Jersey Right To Know Components

	CAS-No.	Revision Date
2-Methylnaphthalene	91-57-6	2010-08-02

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H302	Harmful if swallowed.
H401	Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	1
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	1
Reactivity Hazard:	0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.4 Revision Date: 01/26/2016 Print Date: 05/11/2016

SAFETY DATA SHEET

Version 5.11
Revision Date 03/30/2016
Print Date 05/11/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Acenaphthylene

Product Number : 92549
Brand : Sigma-Aldrich

CAS-No. : 208-96-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H302 Harmful if swallowed.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.

Precautionary statement(s)
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear eye protection/ face protection.

P280	Wear protective gloves.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Rinse mouth.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	$C_{12}H_8$
Molecular weight	:	152.19 g/mol
CAS-No.	:	208-96-8
EC-No.	:	205-917-1

Hazardous components

Component	Classification	Concentration
Acenaphthylene		
	Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; H302, H315, H319, H335	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Move out of dangerous area.Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Recommended storage temperature 2 - 4 °C

Keep in a dry place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: light yellow
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	89 - 92 °C (192 - 198 °F)
f)	Initial boiling point and boiling range	280.0 °C (536.0 °F)
g)	Flash point	122.0 °C (251.6 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	0.90 g/cm3
n)	Water solubility	No data available

o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Mouse - 1,760 mg/kg
Remarks: Autonomic Nervous System:Other (direct) parasympathomimetic. Respiratory disorder Blood: Hemorrhage.

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a

carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: AB1254000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Acenaphthylene)
Reportable Quantity (RQ): 5000 lbs

Poison Inhalation Hazard: No

IMDG

Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Acenaphthylene	208-96-8	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Acenaphthylene	208-96-8	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Acenaphthylene	208-96-8	1993-04-24

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Acenaphthylene	208-96-8	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Eye Irrit.	Eye irritation
H302	Harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
Skin Irrit.	Skin irritation

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	1
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	1
Reactivity Hazard:	0

Further information
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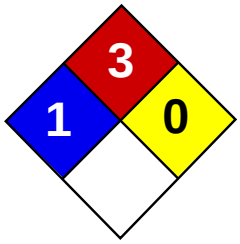
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.11 Revision Date: 03/30/2016 Print Date: 05/11/2016



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Acetone MSDS

Section 1: Chemical Product and Company Identification

Product Name: Acetone

Catalog Codes: SLA3502, SLA1645, SLA3151, SLA3808

CAS#: 67-64-1

RTECS: AL3150000

TSCA: TSCA 8(b) inventory: Acetone

CI#: Not applicable.

Synonym: 2-propanone; Dimethyl Ketone; Dimethylformaldehyde; Pyroacetic Acid

Chemical Name: Acetone

Chemical Formula: C3-H6-O

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Acetone	67-64-1	100

Toxicological Data on Ingredients: Acetone: ORAL (LD50): Acute: 5800 mg/kg [Rat]. 3000 mg/kg [Mouse]. 5340 mg/kg [Rabbit]. VAPOR (LC50): Acute: 50100 mg/m 8 hours [Rat]. 44000 mg/m 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED]. The substance is toxic to central nervous system (CNS). The substance may be toxic to kidneys, the reproductive system, liver, skin. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 465°C (869°F)

Flash Points: CLOSED CUP: -20°C (-4°F). OPEN CUP: -9°C (15.8°F) (Cleveland).

Flammable Limits: LOWER: 2.6% UPPER: 12.8%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards: Vapor may travel considerable distance to source of ignition and flash back.

Special Remarks on Explosion Hazards:
Forms explosive mixtures with hydrogen peroxide, acetic acid, nitric acid, nitric acid + sulfuric acid, chromic anydride, chromyl chloride, nitrosyl chloride, hexachloromelamine, nitrosyl perchlorate, nitryl perchlorate, permonosulfuric acid, thiodiglycol + hydrogen peroxide, potassium ter-butoxide, sulfur dichloride, 1-methyl-1,3-butadiene, bromoform, carbon, air, chloroform, thitriazylperchlorate.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis.

Storage:
Store in a segregated and approved area (flammables area) . Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Keep away from direct sunlight and heat and avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 500 STEL: 750 (ppm) from ACGIH (TLV) [United States] TWA: 750 STEL: 1000 (ppm) from OSHA (PEL) [United States] TWA: 500 STEL: 1000 [Austalia] TWA: 1185 STEL: 2375 (mg/m3) [Australia] TWA: 750 STEL: 1500 (ppm) [United Kingdom (UK)] TWA: 1810 STEL: 3620 (mg/m3) [United Kingdom (UK)] TWA: 1800 STEL: 2400 from OSHA (PEL) [United States]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Fruity. Mint-like. Fragrant. Ethereal

Taste: Pungent, Sweetish

Molecular Weight: 58.08 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 56.2°C (133.2°F)

Melting Point: -95.35 (-139.6°F)

Critical Temperature: 235°C (455°F)

Specific Gravity: 0.79 (Water = 1)

Vapor Pressure: 24 kPa (@ 20°C)

Vapor Density: 2 (Air = 1)

Volatility: Not available.

Odor Threshold: 62 ppm

Water/Oil Dist. Coeff.: The product is more soluble in water; log(oil/water) = -0.2

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, ignition sources, exposure to moisture, air, or water, incompatible materials.

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 3000 mg/kg [Mouse]. Acute toxicity of the vapor (LC50): 44000 mg/m3 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED]. Causes damage to the following organs: central nervous system (CNS). May cause damage to the following organs: kidneys, the reproductive system, liver, skin.

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May affect genetic material (mutagenicity) based on studies with yeast (S. cerevisiae), bacteria, and hamster fibroblast cells. May cause reproductive effects (fertility) based upon animal studies. May contain trace amounts of benzene and formaldehyde which may cancer and birth defects. Human: passes the placental barrier.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause skin irritation. May be harmful if absorbed through the skin. Eyes: Causes eye irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury. Inhalation: Inhalation at high concentrations affects the sense organs, brain and causes respiratory tract irritation. It also may affect the Central Nervous System (behavior) characterized by dizziness, drowsiness, confusion, headache, muscle weakeness, and possibly motor incoordination, speech abnormalities, narcotic effects and coma. Inhalation may also affect the gastrointestinal tract (nausea, vomiting). Ingestion: May cause irritation of the digestive (gastrointestinal) tract (nausea, vomiting). It may also

affect the Central Nevous System (behavior), characterized by depression, fatigue, excitement, stupor, coma, headache, altered sleep time, ataxia, tremors as well at the blood, liver, and urinary system (kidney, bladder, ureter) and endocrine system. May also have musculoskeletal effects. Chronic Potential Health Effects: Skin: May cause dermatitis. Eyes: Eye irritation.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 5540 mg/l 96 hours [Trout]. 8300 mg/l 96 hours [Bluegill]. 7500 mg/l 96 hours [Fatthead Minnow]. 0.1 ppm any hours [Water flea].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Acetone UNNA: 1090 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Benzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Benzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene, Formaldehyde Connecticut hazardous material survey.: Acetone Illinois toxic substances disclosure to employee act: Acetone Illinois chemical safety act: Acetone New York release reporting list: Acetone Rhode Island RTK hazardous substances: Acetone Pennsylvania RTK: Acetone Florida: Acetone Minnesota: Acetone Massachusetts RTK: Acetone Massachusetts spill list: Acetone New Jersey: Acetone New Jersey spill list: Acetone Louisiana spill reporting: Acetone California List of Hazardous Substances (8 CCR 339): Acetone TSCA 8(b) inventory: Acetone TSCA 4(a) final test rules: Acetone TSCA 8(a) IUR: Acetone

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable. R36- Irritating to eyes. S9- Keep container in a well-ventilated place. S16- Keep away from sources of ignition - No smoking. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References:
-Material safety data sheet issued by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. LOLI, RTECS, HSDB databases. Other MSDSs

Other Special Considerations: Not available.

Created: 10/10/2005 08:13 PM

Last Updated: 11/01/2010 12:00 PM

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SAFETY DATA SHEET

Version 5.3
Revision Date 02/27/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Aroclor 1016

Product Number : 48591
Brand : Supelco
Index-No. : 602-039-00-4

CAS-No. : 12674-11-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Specific target organ toxicity - repeated exposure (Category 2), H373
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H373 May cause damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P273 Avoid release to the environment.
P314 Get medical advice/ attention if you feel unwell.
P391 Collect spillage.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

CAS-No. : 12674-11-2
Index-No. : 602-039-00-4

Hazardous components

Component	Classification	Concentration
Aroclor 1016		
	STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H373, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Nature of decomposition products not known.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): Non Combustible Liquids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Aroclor 1016	12674-11-2	TWA	0.001000 mg/m3	USA. NIOSH Recommended Exposure Limits
	Remarks	Potential Occupational Carcinogen		

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance Form: liquid

b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	No data available
f)	Initial boiling point and boiling range	No data available
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 2,300 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Reproductive toxicity - Rat - Oral
Effects on Newborn: Biochemical and metabolic.

Reproductive toxicity - Monkey - Oral
Effects on Newborn: Behavioral.

Reproductive toxicity - Mammal - Oral
Effects on Fertility: Other measures of fertility Effects on Newborn: Weaning or lactation index (e.g., # alive at weaning per # alive at day 4). Effects on Newborn: Growth statistics (e.g., reduced weight gain).

No data available

Developmental Toxicity - Rat - Oral
Specific Developmental Abnormalities: Central nervous system.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: Not available

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.0010 mg/l - 96.0 h

12.2 Persistence and degradability

Biodegradability	Biotic/Aerobic Biochemical oxygen demand - Exposure time 28 d

12.3 Bioaccumulative potential

Bioaccumulation	Pimephales promelas (fathead minnow) - 8.7 µg/l
	Bioconcentration factor (BCF): 42,500

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2315 Class: 9 Packing group: II
Proper shipping name: Polychlorinated biphenyls, liquid
Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 2315 Class: 9 Packing group: II EMS-No: F-A, S-A
Proper shipping name: POLYCHLORINATED BIPHENYLS, LIQUID
Marine pollutant: yes

IATA
UN number: 2315 Class: 9 Packing group: II
Proper shipping name: Polychlorinated biphenyls, liquid

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
No SARA Hazards

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Aroclor 1016	12674-11-2	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Aroclor 1016	12674-11-2	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Aroclor 1016	12674-11-2	1993-04-24

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. Aroclor 1016	CAS-No. 12674-11-2	Revision Date 2008-08-01
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Aroclor 1016	CAS-No. 12674-11-2	Revision Date 2008-08-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H373	May cause damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
STOT RE	Specific target organ toxicity - repeated exposure

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.3 Revision Date: 02/27/2015 Print Date: 05/01/2016

SAFETY DATA SHEET

Version 5.3
Revision Date 09/11/2015
Print Date 05/11/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Aroclor 1248

Product Number : 48589
Brand : Supelco
Index-No. : 602-039-00-4

CAS-No. : 12672-29-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Specific target organ toxicity - repeated exposure (Category 2), H373
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H373 May cause damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P273 Avoid release to the environment.
P314 Get medical advice/ attention if you feel unwell.
P391 Collect spillage.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

CAS-No. : 12672-29-6
Index-No. : 602-039-00-4

Hazardous components

Component	Classification	Concentration
Aroclor 1248		
	STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H373, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Nature of decomposition products not known.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): Non Combustible Liquids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Aroclor 1248	12672-29-6	TWA	0.001000 mg/m3	USA. NIOSH Recommended Exposure Limits
	Remarks	Potential Occupational Carcinogen		

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance Form: liquid

b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	No data available
f)	Initial boiling point and boiling range	No data available
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 11,000 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Reproductive toxicity - Monkey - Oral
Maternal Effects: Menstrual cycle changes or disorders.

Reproductive toxicity - Monkey - Oral
Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Reproductive toxicity - Monkey - Oral
Effects on Fertility: Abortion.

Reproductive toxicity - Monkey - Oral
Effects on Newborn: Growth statistics (e.g., reduced weight gain). Effects on Newborn: Behavioral. Effects on Newborn: Other postnatal measures or effects.

No data available

Developmental Toxicity - Rabbit - Oral
Specific Developmental Abnormalities: Immune and reticuloendothelial system.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
May cause damage to organs through prolonged or repeated exposure.
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

Nausea, Dizziness, Headache, muscle pain, muscle weakness, neck stiffness, trunk stiffness, stiffness of extremities, thick feeling in the tongue, Thirst

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Lepomis macrochirus - 0.278 mg/l - 96.0 h
Toxicity to algae	Growth inhibition EC50 - Thalassiosira rotula - 0.02 mg/l - 44 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation: Pimephales promelas (fathead minnow) - 250 d - 3 µg/l

Bioconcentration factor (BCF): 120,000

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2315 Class: 9 Packing group: II
Proper shipping name: Polychlorinated biphenyls, liquid
Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 2315 Class: 9 Packing group: II EMS-No: F-A, S-A
Proper shipping name: POLYCHLORINATED BIPHENYLS, LIQUID
Marine pollutant: yes

IATA
UN number: 2315 Class: 9 Packing group: II
Proper shipping name: Polychlorinated biphenyls, liquid

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Aroclor 1248	12672-29-6	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Aroclor 1248	12672-29-6	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Aroclor 1248	12672-29-6	1993-04-24

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. Aroclor 1248	CAS-No. 12672-29-6	Revision Date 2008-08-01
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Aroclor 1248	CAS-No. 12672-29-6	Revision Date 2008-08-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H373	May cause damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
STOT RE	Specific target organ toxicity - repeated exposure

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.3 Revision Date: 09/11/2015 Print Date: 05/11/2016

SAFETY DATA SHEET

Version 5.2
Revision Date 02/27/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Aroclor 1254

Product Number : 48586
Brand : Supelco
Index-No. : 602-039-00-4

CAS-No. : 11097-69-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Specific target organ toxicity - repeated exposure (Category 2), H373
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H302 Harmful if swallowed.
H373 May cause damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P301 + P312 + P330 IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.

P314	Get medical advice/ attention if you feel unwell.
P391	Collect spillage.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

CAS-No. : 11097-69-1
Index-No. : 602-039-00-4

Hazardous components

Component	Classification	Concentration
Aroclor 1254		
	Acute Tox. 4; STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H302, H373, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Nature of decomposition products not known.

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): Non Combustible Liquids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Aroclor 1254	11097-69-1	TWA	0.5 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Remarks	Skin designation		
		TWA	0.500000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation		
		TWA	0.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Upper Respiratory Tract irritation Liver damage Chloracne Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	0.500000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Upper Respiratory Tract irritation Liver damage Chloracne Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	0.5 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		Skin notation		
		TWA	0.001000 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	No data available
f)	Initial boiling point and boiling range	No data available
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition	No data available

temperature

r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 1,010 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
Rat
Liver
Unscheduled DNA synthesis

Rat
Liver
DNA damage

Mouse
fibroblast
Morphological transformation.

Rat
Morphological transformation.

Rat
DNA damage

Rat
DNA damage

Carcinogenicity

Carcinogenicity - Rat - Oral
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Gastrointestinal:Tumors.

Carcinogenicity - Rat - Oral
Tumorigenic:Carcinogenic by RTECS criteria. Liver:Tumors.

Carcinogenicity - Mouse - Skin
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Skin and Appendages: Other: Tumors.
Tumorigenic:Tumors at site or application.

Carcinogenicity - Rat - Oral
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Gastrointestinal:Tumors.

Carcinogenicity - Mouse - Oral
Tumorigenic:Neoplastic by RTECS criteria. Liver:Tumors.

Carcinogenicity - Mouse - Intraperitoneal
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Tumorigenic Effects: Uterine tumors. Lungs, Thorax, or Respiration:Tumors.

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Reproductive toxicity - Rabbit - Oral
Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).
Effects on Fertility: Abortion. Effects on Embryo or Fetus: Fetal death.

Reproductive toxicity - Rabbit - Oral
Effects on Newborn: Biochemical and metabolic.

Reproductive toxicity - Rat - Oral
Effects on Newborn: Biochemical and metabolic.

Reproductive toxicity - Rat - Oral
Effects on Newborn: Behavioral.

Reproductive toxicity - Rat - Oral
Effects on Newborn: Delayed effects.

Reproductive toxicity - Rat - Intraperitoneal
Maternal Effects: Other effects. Effects on Newborn: Biochemical and metabolic.

Reproductive toxicity - Mouse - Oral
Effects on Newborn: Behavioral.

Reproductive toxicity - Mammal - Oral
Effects on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated).

No data available

Developmental Toxicity - Rat - Oral

Specific Developmental Abnormalities: Hepatobiliary system.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.22 µg/l - 96.0 h
Toxicity to algae	LC50 - Algae - 0.015 mg/l - 28 h

12.2 Persistence and degradability

12.3 Bioaccumulative potential

Bioaccumulation	Pimephales promelas (fathead minnow) - 8 Months - 1.8 µg/l
	Bioconcentration factor (BCF): 238,000

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2315 Class: 9 Packing group: II
Proper shipping name: Polychlorinated biphenyls, liquid
Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 2315 Class: 9 Packing group: II EMS-No: F-A, S-A

Proper shipping name: POLYCHLORINATED BIPHENYLS, LIQUID
Marine pollutant: yes

IATA

UN number: 2315 Class: 9 Packing group: II
Proper shipping name: Polychlorinated biphenyls, liquid

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Aroclor 1254	11097-69-1	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Aroclor 1254	11097-69-1	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Aroclor 1254	11097-69-1	1993-04-24

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. Aroclor 1254	CAS-No. 11097-69-1	Revision Date 1990-06-30
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Aroclor 1254	CAS-No. 11097-69-1	Revision Date 1990-06-30

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H302	Harmful if swallowed.
H373	May cause damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
STOT RE	Specific target organ toxicity - repeated exposure

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	1
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.2 Revision Date: 02/27/2015 Print Date: 05/01/2016

SAFETY DATA SHEET

Version 5.3
Revision Date 06/25/2015
Print Date 05/11/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : AROCLOR 1260

Product Number : CRM48736
Brand : Supelco

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Carcinogenicity (Category 1B), H350

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H350 May cause cancer.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

Hazardous components

Component		Classification	Concentration
Distillates (petroleum), hydrotreated middle			
CAS-No. EC-No. Index-No.	64742-46-7 265-148-2 649-221-00-X	Carc. 1B; H350	>= 90 - <= 100 %
Baseoil - unspecified			
CAS-No. EC-No. Index-No.	64742-53-6 265-156-6 649-466-00-2	Carc. 1B; H350	>= 30 - < 50 %
2,6-di-tert-Butyl-p-cresol			
CAS-No. EC-No.	128-37-0 204-881-4	Aquatic Acute 1; Aquatic Chronic 1; H410	>= 0.1 - < 1 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Nature of decomposition products not known.

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Distillates (petroleum), hydrotreated middle	64742-46-7	TWA	500.000000 ppm 2,000.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Remarks	The value in mg/m3 is approximate.		

		TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	10.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	5 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	5 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	10 mg/m3	USA. NIOSH Recommended Exposure Limits
Baseoil - unspecified	64742-53-6	TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Upper Respiratory Tract irritation Not classifiable as a human carcinogen		
		TWA	5.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	10.000000 mg/m3	USA. NIOSH Recommended Exposure Limits

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	No data available
f)	Initial boiling point and boiling range	No data available
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Strong oxidizing agents

10.6 Hazardous decomposition products

Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (2,6-di-tert-Butyl-p-cresol)

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Distillates (petroleum), hydrotreated middle)

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Nerves. - (Aroclor 1260)

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Distillates (petroleum), hydrotreated middle	64742-46-7	1989-08-11
Baseoil - unspecified	64742-53-6	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Distillates (petroleum), hydrotreated middle	64742-46-7	1989-08-11
Baseoil - unspecified	64742-53-6	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Distillates (petroleum), hydrotreated middle	64742-46-7	1989-08-11
Baseoil - unspecified	64742-53-6	1993-04-24

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Aroclor 1260	11096-82-5	2008-08-01
Distillates (petroleum), hydrotreated middle	64742-46-7	2013-12-20

WARNING: This product contains a chemical known to the	CAS-No.	Revision Date

State of California to cause birth defects or other reproductive harm. Aroclor 1260	11096-82-5	2008-08-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H350	May cause cancer.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.3 Revision Date: 06/25/2015 Print Date: 05/11/2016

SAFETY DATA SHEET

Version 4.7
Revision Date 05/23/2016
Print Date 06/23/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Arsenic

Product Number : 202657
Brand : Aldrich
Index-No. : 033-001-00-X

CAS-No. : 7440-38-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 3), H331
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H302 Harmful if swallowed.
H331 Toxic if inhaled.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P273 Avoid release to the environment.

P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Rinse mouth.
P304 + P340 + P311	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	As
Molecular weight	:	74.92 g/mol
CAS-No.	:	7440-38-2
EC-No.	:	231-148-6
Index-No.	:	033-001-00-X

Hazardous components

Component	Classification	Concentration
Arsenic		
	Acute Tox. 4; Acute Tox. 3; Aquatic Acute 1; Aquatic Chronic 1; H302, H331, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Arsenic	7440-38-2	TWA	0.01 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Lung cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed human carcinogen		
		C	0.0020 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A 15 minute ceiling value		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Arsenic	7440-38-2	inorganic arsenic plus methylated metabolites	35µg As/l	In urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of the workweek (After four or five consecutive working days			

		with exposure)			
		inorganic arsenic plus methylated metabolites	35µg As/l	Urine	ACGIH - Biological Exposure Indices (BEI)
		End of the workweek (After four or five consecutive working days with exposure)			

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N99 (US) or type P2 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: Pieces Colour: grey
b)	Odour	No data available
c)	Odour Threshold	No data available

d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 817 °C (1,503 °F) - lit.
f)	Initial boiling point and boiling range	613 °C (1,135 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	5.727 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
Heat Exposure to air may affect product quality.

10.5 Incompatible materials
Oxidizing agents, Halogens, Palladium undergoes a violent reaction with arsenic, Zinc, Platinum oxide, Nitrogen trichloride, Bromine azide

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Arsenic oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 763 mg/kg
Remarks: Behavioral:Ataxia. Diarrhoea

LD50 Oral - Mouse - 145 mg/kg
Remarks: Behavioral:Ataxia. Diarrhoea

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

IARC:	1 - Group 1: Carcinogenic to humans (Arsenic)
NTP:	Known to be human carcinogen (Arsenic)
	Known to be human carcinogen (Arsenic)
OSHA:	OSHA specifically regulated carcinogen (Arsenic)

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: CG0525000

Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 9.9 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 3.8 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1558 Class: 6.1 Packing group: II
Proper shipping name: Arsenic
Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1558 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: ARSENIC
Marine pollutant:yes

IATA
UN number: 1558 Class: 6.1 Packing group: II
Proper shipping name: Arsenic

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Arsenic	7440-38-2	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Arsenic	7440-38-2	2008-10-10

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H302	Harmful if swallowed.
H331	Toxic if inhaled.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7 Revision Date: 05/23/2016 Print Date: 06/23/2016

SAFETY DATA SHEET

Version 4.5
Revision Date 03/02/2015
Print Date 05/24/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Barium

Product Number : 237094
Brand : Aldrich

CAS-No. : 7440-39-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Substances and mixtures, which in contact with water, emit flammable gases (Category 2), H261
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H261 In contact with water releases flammable gases.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.

Precautionary statement(s)
P223 Keep away from any possible contact with water, because of violent reaction and possible flash fire.
P231 + P232 Handle under inert gas. Protect from moisture.
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.

P280	Wear protective gloves/ eye protection/ face protection.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P335 + P334	Brush off loose particles from skin. Immerse in cool water/ wrap in wet bandages.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P402 + P404	Store in a dry place. Store in a closed container.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Ba
Molecular weight	:	137.33 g/mol
CAS-No.	:	7440-39-3
EC-No.	:	231-149-1

Hazardous components

Component	Classification	Concentration
Barium		
	Water-react. 2; Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; H261, H315, H319, H335	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Dry powder

5.2 Special hazards arising from the substance or mixture
Barium oxide

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.Keep away from sources of ignition - No smoking.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Never allow product to get in contact with water during storage.

Store under inert gas.
Storage class (TRGS 510): Hazardous materials, which set free flammable gases upon contact with water

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Barium	7440-39-3	TWA	0.500000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Eye, skin, & Gastrointestinal irritation Muscular stimulation Not classifiable as a human carcinogen		

		TWA	0.500000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.500000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Eye irritation Muscular stimulation Skin irritation Gastrointestinal irritation Not classifiable as a human carcinogen		
		TWA	0.500000 mg/m3	USA. NIOSH Recommended Exposure Limits

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
impervious clothing, Flame retardant protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance Form: Rods

		Colour: grey
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 725 °C (1,337 °F) - lit.
f)	Initial boiling point and boiling range	1,640 °C (2,984 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	3.6 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Reacts violently with water.

10.4 Conditions to avoid
Exposure to moisture

10.5 Incompatible materials
Oxidizing agents, Water, acids, Oxygen, Chlorinated solvents, Carbon dioxide (CO2), Halogens, Halogenated hydrocarbon, Alcohols, Sulphur compounds, Hydrogen sulfide gas

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: CQ8370000

Stomach/intestinal disorders, Nausea, Vomiting, Drowsiness, Dizziness, Gastrointestinal disturbance, Weakness, Tremors, Seizures.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	mortality NOEC - Cyprinodon variegatus (sheepshead minnow) - 500 mg/l - 96 h
	LC50 - Cyprinodon variegatus (sheepshead minnow) - > 500 mg/l - 96 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1400 Class: 4.3 Packing group: II
Proper shipping name: Barium
Reportable Quantity (RQ): 1000 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1400 Class: 4.3 Packing group: II EMS-No: F-G, S-O
Proper shipping name: BARIUM

IATA
UN number: 1400 Class: 4.3 Packing group: II
Proper shipping name: Barium

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01

SARA 311/312 Hazards
Reactivity Hazard, Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date

Barium	7440-39-3	2007-07-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Eye Irrit.	Eye irritation
H261	In contact with water releases flammable gases.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
Skin Irrit.	Skin irritation
STOT SE	Specific target organ toxicity - single exposure
Water-react.	Substances and mixtures, which in contact with water, emit flammable gases

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	3
Physical Hazard	1

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	1
Special hazard.I:	W

Further information
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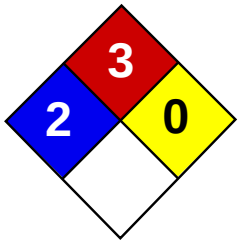
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.5 Revision Date: 03/02/2015 Print Date: 05/24/2016



Material Safety Data Sheet
Benzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Benzene

Catalog Codes: SLB1564, SLB3055, SLB2881

CAS#: 71-43-2

RTECS: CY1400000

TSCA: TSCA 8(b) inventory: Benzene

CI#: Not available.

Synonym: Benzol; Benzine

Chemical Name: Benzene

Chemical Formula: C6-H6

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Benzene	71-43-2	100

Toxicological Data on Ingredients: Benzene: ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. DERMAL (LD50): Acute: >9400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 10000 ppm 7 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE]. The substance is toxic to blood, bone marrow, central nervous system (CNS). The substance may be toxic to liver, Urinary System. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 497.78°C (928°F)

Flash Points: CLOSED CUP: -11.1°C (12°F). (Setaflash)

Flammable Limits: LOWER: 1.2% UPPER: 7.8%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Slightly flammable to flammable in presence of oxidizing materials. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Explosive in presence of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Extremely flammable liquid and vapor. Vapor may cause flash fire. Reacts on contact with iodine heptafluoride gas. Dioxygenyl tetrafluoroborate is as very powferful oxidant. The addition of a small particle to small samples of benzene, at ambient temperature, causes ignition. Contact with sodium peroxide with benzene causes ignition. Benzene ignites in contact with powdered chromic anhydride. Virgorous or incandescent reaction with hydrogen + Raney nickel (above 210 C) and bromine trifluoride.

Special Remarks on Explosion Hazards:
Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction

of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States] TWA: 1.6 STEL: 8 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.1 STEL: 1 from NIOSH TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States] TWA: 10 (ppm) from OSHA (PEL) [United States] TWA: 3 (ppm) [United Kingdom (UK)] TWA: 1.6 (mg/m3) [United Kingdom (UK)] TWA: 1 (ppm) [Canada] TWA: 3.2 (mg/m3) [Canada] TWA: 0.5 (ppm) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:
Aromatic. Gasoline-like, rather pleasant. (Strong.)

Taste: Not available.

Molecular Weight: 78.11 g/mole

Color: Clear Colorless. Colorless to light yellow.

pH (1% soln/water): Not available.

Boiling Point: 80.1 (176.2°F)

Melting Point: 5.5°C (41.9°F)

Critical Temperature: 288.9°C (552°F)

Specific Gravity: 0.8787 @ 15 C (Water = 1)

Vapor Pressure: 10 kPa (@ 20°C)

Vapor Density: 2.8 (Air = 1)

Volatility: Not available.

Odor Threshold: 4.68 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

Incompatibility with various substances: Highly reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powferful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 930 mg/kg [Rat]. Acute dermal toxicity (LD50): >9400 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 10000 7 hours [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE]. Causes damage to the following organs: blood, bone marrow, central nervous system (CNS). May cause damage to the following organs: liver, Urinary System.

Other Toxic Effects on Humans:
Very hazardous in case of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (female fertility, Embryotoxic and/or foetotoxic in animal) and birth defects. May affect genetic material (mutagenic). May cause cancer (tumorigenic, leukemia)) Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation. It can be absorbed through intact skin and affect the liver, blood, metabolism,and urinary system. Eyes: Causes eye irritation. Inhalation: Causes respiratory tract and mucous membrane irritation. Can be absorbed through the lungs. May affect behavior/Central and Peripheral nervous systems (somnolence, muscle weakness, general anesthetic, and other symptoms similar to ingestion), gastrointestinal tract (nausea), blood metabolism, urinary system. Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation including vomiting. May affect behavior/Central and Peripheral nervous systems (convulsions, seizures, tremor, irritability, initial CNS stimulation followed by depression, loss of coordination, dizziness, headache, weakness, pallor, flushing), respiration (breathlessness and chest constriction), cardiovascular system, (shallow/rapid pulse), and blood.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Benzene UNNA: 1114 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Benzene California prop. 65 (no significant risk level): Benzene: 0.007 mg/day (value) California prop. 65: This product contains the following ingredients

for which the State of California has found to cause cancer which would require a warning under the statute: Benzene Connecticut carcinogen reporting list.: Benzene Connecticut hazardous material survey.: Benzene Illinois toxic substances disclosure to employee act: Benzene Illinois chemical safety act: Benzene New York release reporting list: Benzene Rhode Island RTK hazardous substances: Benzene Pennsylvania RTK: Benzene Minnesota: Benzene Michigan critical material: Benzene Massachusetts RTK: Benzene Massachusetts spill list: Benzene New Jersey: Benzene New Jersey spill list: Benzene Louisiana spill reporting: Benzene California Director's list of Hazardous Substances: Benzene TSCA 8(b) inventory: Benzene SARA 313 toxic chemical notification and release reporting: Benzene CERCLA: Hazardous substances.: Benzene: 10 lbs. (4.536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable. R22- Harmful if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer. R62- Possible risk of impaired fertility. S2- Keep out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S39- Wear eye/face protection. S46- If swallowed, seek medical advice immediately and show this container or label. S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:35 PM

Last Updated: 06/09/2012 12:00 PM

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SAFETY DATA SHEET

Version 5.5
Revision Date 04/24/2015
Print Date 05/12/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Benz[*a*]anthracene

Product Number : 48563
Brand : Supelco
Index-No. : 601-033-00-9

CAS-No. : 56-55-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Carcinogenicity (Category 1B), H350
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H350 May cause cancer.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P273 Avoid release to the environment.
P281 Use personal protective equipment as required.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P391 Collect spillage.
P405 Store locked up.

P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : 1,2-Benzanthracene
Tetraphene

Formula : $C_{18}H_{12}$
Molecular weight : 228.29 g/mol
CAS-No. : 56-55-3
EC-No. : 200-280-6
Index-No. : 601-033-00-9

Hazardous components

Component	Classification	Concentration
Benz[a]anthracene		
	Carc. 1B; Aquatic Acute 1; Aquatic Chronic 1; H350, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber

Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 157 - 159 °C (315 - 318 °F)
f)	Initial boiling point and boiling range	437.6 °C (819.7 °F)
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available

t) Oxidizing properties No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

LD50 Intravenous - Rat - > 200 mg/kg

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Possible human carcinogen

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Benz[a]anthracene)

NTP: Reasonably anticipated to be a human carcinogen (Benz[a]anthracene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benz[a]anthracene)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benz[a]anthracene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Benz[a]anthracene	56-55-3	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Benz[a]anthracene	56-55-3	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Benz[a]anthracene	56-55-3	1993-04-24

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Benz[a]anthracene	56-55-3	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H350	May cause cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.5 Revision Date: 04/24/2015 Print Date: 05/12/2016

SAFETY DATA SHEET

Version 5.9
Revision Date 03/07/2015
Print Date 05/12/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Benzo[*a*]pyrene

Product Number : 51968
Brand : Sigma-Aldrich
Index-No. : 601-032-00-3

CAS-No. : 50-32-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin sensitisation (Category 1), H317
Germ cell mutagenicity (Category 1B), H340
Carcinogenicity (Category 1B), H350
Reproductive toxicity (Category 1B), H360
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H317 May cause an allergic skin reaction.
H340 May cause genetic defects.
H350 May cause cancer.
H360 May damage fertility or the unborn child.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and

	understood.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P272	Contaminated work clothing should not be allowed out of the workplace.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P333 + P313	If skin irritation or rash occurs: Get medical advice/ attention.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	$C_{20}H_{12}$
Molecular weight	:	252.31 g/mol
CAS-No.	:	50-32-8
EC-No.	:	200-028-5
Index-No.	:	601-032-00-3

Hazardous components

Component	Classification	Concentration
Benzo[a]pyrene		
	Skin Sens. 1; Muta. 1B; Carc. 1B; Repr. 1B; Aquatic Acute 1; Aquatic Chronic 1; H317, H340, H350, H360, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
	Remarks	Cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section), see BEI® for Polycyclic Aromatic Hydrocarbons (PAHs) Exposure by all routes should be carefully controlled to levels as low as possible. Suspected human carcinogen		
		Cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section), see BEI® for Polycyclic Aromatic Hydrocarbons (PAHs) Exposure by all routes should be carefully controlled to levels as low as possible. Suspected human carcinogen		

Benzo[a]pyrene	50-32-8	TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		1910.1002 As used in §1910.1000 (Table Z-1), coal tar pitch volatiles include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter. Asphalt (CAS 8052-42-4, and CAS 64742-93-4) is not covered under the 'coal tar pitch volatiles' standard OSHA specifically regulated carcinogen		
		TWA	0.100000 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen NIOSH considers coal tar, coal tar pitch, and creosote to be coal tar products. cyclohexane-extractable fraction See Appendix C See Appendix A		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Benzo[a]pyrene	50-32-8	1-Hydroxypyrene (1-HP)		Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an

industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: yellow
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	179.0 °C (354.2 °F)
f)	Initial boiling point and boiling range	495.0 °C (923.0 °F)
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	1.35 g/cm3
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 5.97
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

LD50 Subcutaneous - Rat - 50 mg/kg

Skin corrosion/irritation
Skin - Mouse
Result: Mild skin irritation

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
Chronic exposure may cause dermatitis.

Germ cell mutagenicity
May alter genetic material.
In vivo tests showed mutagenic effects

Carcinogenicity

This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Possible human carcinogen

IARC:	1 - Group 1: Carcinogenic to humans (Benzo[a]pyrene)
NTP:	Reasonably anticipated to be a human carcinogen (Benzo[a]pyrene)
OSHA:	OSHA specifically regulated carcinogen (Benzo[a]pyrene)

Reproductive toxicity
May cause congenital malformation in the fetus.
Presumed human reproductive toxicant

May cause reproductive disorders.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.25 mg/l - 48 h
Toxicity to algae	EC50 - Pseudokirchneriella subcapitata (green algae) - 0.02 mg/l - 72 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation: Lepomis macrochirus (Bluegill) - 48 h - 0.0005 mg/l

Bioconcentration factor (BCF): 3,208

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
Very toxic to aquatic life with long lasting effects.
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Benzo[a]pyrene)
Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benzo[a]pyrene)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benzo[a]pyrene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	1990-01-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H317	May cause an allergic skin reaction.
H340	May cause genetic defects.
H350	May cause cancer.
H360	May damage fertility or the unborn child.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
Muta.	Germ cell mutagenicity

HMIS Rating

Health hazard:	3
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	3
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.9 Revision Date: 03/07/2015 Print Date: 05/12/2016

SAFETY DATA SHEET

Version 5.5
Revision Date 04/24/2015
Print Date 05/12/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Benzo[*b*]fluoranthene

Product Number : 48490
Brand : Supelco
Index-No. : 601-034-00-4

CAS-No. : 205-99-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Carcinogenicity (Category 1B), H350
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H350 May cause cancer.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P273 Avoid release to the environment.
P281 Use personal protective equipment as required.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P391 Collect spillage.
P405 Store locked up.

P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : 3,4-Benzofluoranthene

Formula : $C_{20}H_{12}$
Molecular weight : 252.31 g/mol
CAS-No. : 205-99-2
EC-No. : 205-911-9
Index-No. : 601-034-00-4

Hazardous components

Component	Classification	Concentration
Benz[e]acephenanthrylene		
	Carc. 1B; Aquatic Acute 1; Aquatic Chronic 1; H350, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Recommended storage temperature 2 - 8 °C
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact

Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 163 - 165 °C (325 - 329 °F) - lit.
f)	Initial boiling point and boiling range	No data available
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available

s) Explosive properties No data available

t) Oxidizing properties No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
TDLo Oral - Mouse - 7.57 mg/kg
Remarks: Liver:Changes in liver weight. Endocrine:Changes in thymus weight.

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Possible human carcinogen

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Benz[e]acephenanthrylene)

NTP: Reasonably anticipated to be a human carcinogen (Benz[e]acephenanthrylene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - > 1.024 mg/l - 24 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benz[e]acephenanthrylene)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III

Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benz[e]acephenanthrylene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Benz[e]acephenanthrylene	205-99-2	2007-03-01

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Benz[e]acephenanthrylene	205-99-2	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Benz[e]acephenanthrylene	205-99-2	2007-03-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Benz[e]acephenanthrylene	205-99-2	2007-03-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Benz[e]acephenanthrylene	205-99-2	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H350	May cause cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the

product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.5 Revision Date: 04/24/2015 Print Date: 05/12/2016

SAFETY DATA SHEET

Version 5.8
Revision Date 11/24/2015
Print Date 05/12/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Benzo[*ghi*]perylene

Product Number : 55488
Brand : Sigma-Aldrich

CAS-No. : 191-24-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P273 Avoid release to the environment.
P391 Collect spillage.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula : $C_{22}H_{12}$

Molecular weight	:	276.33 g/mol
CAS-No.	:	191-24-2
EC-No.	:	205-883-8

Hazardous components

Component	Classification	Concentration
Benzo[ghi]perylene		
	Aquatic Acute 1; Aquatic Chronic 1; H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Handle under argon.

Moisture sensitive.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 277 - 279 °C (531 - 534 °F) - lit.
f)	Initial boiling point and boiling range	> 500 °C (> 932 °F) - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	log Pow: 6.63
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products

Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	3 - Group 3: Not classifiable as to its carcinogenicity to humans (Benzo[ghi]perylene)
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
Very toxic to aquatic life with long lasting effects.
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benzo[ghi]perylene)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benzo[ghi]perylene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Benzo[ghi]perylene	191-24-2	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Benzo[ghi]perylene	191-24-2	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Benzo[ghi]perylene	191-24-2	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Benzo[ghi]perylene	191-24-2	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.8 Revision Date: 11/24/2015 Print Date: 05/12/2016

Click **http://www.guidechem.com/cas-117/117-81-7.html** for suppliers of this product

Bis(2-ethylhexyl)phthalate (cas 117-81-7) MSDS

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product identifiers

Product name : Bis(2-ethylhexyl) phthalate

Product Number : 36735
Brand : Fluka
Index-No. : 607-317-00-9
REACH No. : 01-2119484611-38-XXXX
CAS-No. : **117-81-7**

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 [EU-GHS/CLP]
Reproductive toxicity (Category 1B)

Classification according to EU Directives 67/548/EEC or 1999/45/EC
May impair fertility. May cause harm to the unborn child.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008 [CLP]
Pictogram

Signal word Danger

Hazard statement(s)
H360FD May damage fertility. May damage the unborn child.

Precautionary statement(s)
P201 Obtain special instructions before use.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.

Supplemental Hazard Statements none

Restricted to professional users.

According to European Directive 67/548/EEC as amended.
Hazard symbol(s)

R-phrase(s)
R60 May impair fertility.
R61 May cause harm to the unborn child.

S-phrase(s)
S53 Avoid exposure - obtain special instructions before use.
S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

Restricted to professional users.

2.3 Other hazards - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : Phthalic acid bis(2-ethylhexyl ester)
'Dioctyl' phthalate
dehp

Formula : C24H38O4
Molecular Weight : 390,56 g/mol

Component Concentration

bis(2-Ethylhexyl) phthalate Included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH)

CAS-No.	117-81-7	-
EC-No.	204-211-0	
Index-No.	607-317-00-9	
Registration number	01-2119484611-38-XXXX	

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
Lung irritation, Gastrointestinal disturbance

4.3 Indication of any immediate medical attention and special treatment needed
no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
no data available

5.3 Advice for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information
no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.Avoid exposure - obtain special instructions before use.

7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end uses
no data available

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

Immersion protection
Material: Nitrile rubber
Minimum layer thickness: 0,2 mm

Break through time: > 480 min
Material tested:Dermatril? P (Z677388, Size M)

Splash protection
Material: Nitrile rubber
Minimum layer thickness: 0,11 mm
Break through time: > 30 min
Material tested:Dermatril? (Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 873000, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an Industrial Hygienist familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	pH	no data available
e)	Melting point/freezing point	-50,0 °C
f)	Initial boiling point and boiling range	386 °C - lit.
g)	Flash point	207,0 °C - closed cup
h)	Evaporation rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or explosive limits	Lower explosion limit: 0,3 %(V)
k)	Vapour pressure	1,6 hPa at 93,0 °C
l)	Vapour density	no data available
m)	Relative density	0,985 g/cm3 at 20 °C
n)	Water solubility	no data available
o)	Partition coefficient: n-octanol/water	no data available
p)	Autoignition	390,0 °C

	temperature	
q)	Decomposition temperature	no data available
r)	Viscosity	no data available
s)	Explosive properties	no data available
t)	Oxidizing properties	no data available

9.2 Other safety information
no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
no data available

10.2 Chemical stability
no data available

10.3 Possibility of hazardous reactions
no data available

10.4 Conditions to avoid
no data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - rat - 30.000 mg/kg

LD50 Dermal - rabbit - 25.000 mg/kg

Skin corrosion/irritation
Skin - rabbit - Mild skin irritation - 24 h

Serious eye damage/eye irritation
Eyes - rabbit - Mild eye irritation - 24 h

Respiratory or skin sensitization
no data available

Germ cell mutagenicity
no data available

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (bis(2-Ethylhexyl) phthalate)

Reproductive toxicity
May cause congenital malformation in the fetus.
Presumed human reproductive toxicant

May cause reproductive disorders.

Specific target organ toxicity - single exposure
no data available

Specific target organ toxicity - repeated exposure
no data available

Aspiration hazard
no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	Causes eye irritation.

Signs and Symptoms of Exposure

Lung irritation, Gastrointestinal disturbance

Additional Information
RTECS: TI0350000

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to **fish**	LC50 - Pimephales promelas (fathead minnow) - > 0,67 mg/l - 96 h
	LC50 - Oncorhynchus mykiss (rainbow trout) - > 0,32 mg/l - 96 h
	LC50 - Cyprinodon variegatus (sheepshead minnow) - > 0,17 mg/l - 96 h
	LC50 - Lepomis macrochirus (Bluegill) - > 0,20 mg/l - 96 h
	NOEC - other fish - > 0,3 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - > 0,16 mg/l - 48 h

12.2 Persistence and degradability
no data available

12.3 Bioaccumulative potential
Bioaccumulation: Oncorhynchus mykiss (rainbow trout) - 100 d -0,014 mg/l
Bioconcentration factor (BCF): 113

12.4 Mobility in soil
no data available

12.5 Results of PBT and vPvB assessment
no data available

12.6 Other adverse effects
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

14.1 UN number
ADR/RID: 3082 IMDG: 3082 IATA: 3082

14.2 UN proper shipping name
ADR/RID: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (bis(2-Ethylhexyl) phthalate)
IMDG: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (bis(2-Ethylhexyl) phthalate)
IATA: Environmentally hazardous substance, liquid, n.o.s. (bis(2-Ethylhexyl) phthalate)

14.3 Transport hazard class(es)
ADR/RID: 9 IMDG: 9 IATA: 9

14.4 Packaging group
ADR/RID: III IMDG: III IATA: III

14.5 Environmental hazards
ADR/RID: yes IMDG Marine pollutant: no IATA: yes

14.6 Special precautions for user

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

This safety datasheet complies with the requirements of Regulation (EC) No. 1907/2006.

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
no data available

15.2 Chemical Safety Assessment
no data available

16. OTHER INFORMATION

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information this document is based on the resent state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. guidechem shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

SAFETY DATA SHEET

Version 4.10
Revision Date 12/29/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Cadmium

Product Number : 414891
Brand : Aldrich
Index-No. : 048-002-00-0

CAS-No. : 7440-43-9

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Inhalation (Category 2), H330
Germ cell mutagenicity (Category 2), H341
Carcinogenicity (Category 1B), H350
Reproductive toxicity (Category 2), H361
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H330 Fatal if inhaled.
H341 Suspected of causing genetic defects.
H350 May cause cancer.
H361 Suspected of damaging fertility or the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P284	Wear respiratory protection.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Cd
Molecular weight	:	112.41 g/mol
CAS-No.	:	7440-43-9
EC-No.	:	231-152-8
Index-No.	:	048-002-00-0

Hazardous components

Component	Classification	Concentration
Cadmium Included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH)		
	Acute Tox. 2; Muta. 2; Carc. 1B; Repr. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H330, H341, H350, H361, H372, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Cadmium/cadmium oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Air sensitive.
Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Cadmium	7440-43-9	TWA	0.010000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section)		

		Suspected human carcinogen		
		TWA	0.002000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen		
		Substance listed; for more information see OSHA document 1910.1027		
		TWA	0.100000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.300000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.600000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		TWA	0.100000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.300000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		Potential Occupational Carcinogen See Appendix A		
		TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.600000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		PEL	0.005000 mg/m3	OSHA Specifically Regulated Chemicals/Carcinogens
		1910.1027 This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Occupational Safety and Health Act, except the construction-related industries, which are covered under 29 CFR 1926.63. OSHA specifically regulated carcinogen		

		Potential Occupational Carcinogen See Appendix A		
		Potential Occupational Carcinogen See Appendix A		
		TWA	0.010000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies		
		TWA	0.002000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies		
		PEL	0.005000 mg/m3	OSHA Specifically Regulated Chemicals/Carcinogens
		1910.1027 This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Occupational Safety and Health Act, except the construction-related industries, which are covered under 29 CFR 1926.63. OSHA specifically regulated carcinogen		
		TWA	0.1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.3 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.6 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		Substance listed; for more information see OSHA document 1910.1027		
		Potential Occupational Carcinogen See Appendix A		
		TWA	0.01 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies		

		TWA	0.002 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies		
		PEL	0.005 mg/m3	OSHA Specifically Regulated Chemicals/Carcinogens
		1910.1027 This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Occupational Safety and Health Act, except the construction-related industries, which are covered under 29 CFR 1926.63. OSHA specifically regulated carcinogen		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Cadmium	7440-43-9	cadmium	0.0050 mg/g	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	Not critical			
		cadmium	5.0000 µg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
		Not critical			
		cadmium	5 µg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
		Not critical			
		cadmium	5µg/g creatinine	Urine	ACGIH - Biological Exposure Indices (BEI)
		Not critical			

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: granular Colour: light grey
b)	Odour	odourless
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 320.9 °C (609.6 °F) - lit.
f)	Initial boiling point and boiling range	765 °C (1,409 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	8.65 g/cm3 at 25 °C (77 °F)
n)	Water solubility	0.0023 g/l at 20 °C (68 °F)
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents, acids

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 2,330 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC:	1 - Group 1: Carcinogenic to humans (Cadmium)
NTP:	Known to be human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Cadmium)
OSHA:	OSHA specifically regulated carcinogen (Cadmium)

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: EU9800000

Damage to the lungs., Kidney injury may occur., prolonged or repeated exposure can cause:, Vomiting, Diarrhoea, Lung irritation

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 0.001 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.024 mg/l - 48 h
Toxicity to algae	static test EC50 - Selenastrum capricornutum (green algae) - 0.023 mg/l - 72 h (OECD Test Guideline 201)

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation: Oncorhynchus mykiss (rainbow trout) - 72 d - 1.27 µg/l

Bioconcentration factor (BCF): 55

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3288 Class: 6.1 Packing group: II
Proper shipping name: Toxic solid, inorganic, n.o.s. (Cadmium)
Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3288 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, INORGANIC, N.O.S. (Cadmium)
Marine pollutant:yes

IATA
UN number: 3288 Class: 6.1 Packing group: II

Proper shipping name: Toxic solid, inorganic, n.o.s. (Cadmium)

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. Cadmium	CAS-No. 7440-43-9	Revision Date 2009-02-01
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Cadmium	CAS-No. 7440-43-9	Revision Date 2009-02-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H330	Fatal if inhaled.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H361	Suspected of damaging fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	4
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	4
Fire Hazard:	0

Reactivity Hazard: 0

Further information

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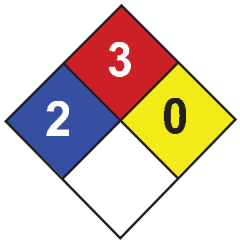
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.10 Revision Date: 12/29/2015 Print Date: 05/01/2016



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Chlorobenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Chlorobenzene

Catalog Codes: SLC1654

CAS#: 108-90-7

RTECS: CZ0175000

TSCA: TSCA 8(b) inventory: Chlorobenzene

CI#: Not available.

Synonym: Monochlorobenzene

Chemical Name: Not available.

Chemical Formula: C6H5Cl

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Chlorobenzene	108-90-7	100

Toxicological Data on Ingredients: Chlorobenzene: ORAL (LD50): Acute: 1110 mg/kg [Rat]. 2300 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, sensitizer, permeator). Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, sensitizer, permeator). CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, lungs, the nervous system, liver, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged inhalation of vapors may lead to chronic respiratory irritation.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands : Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 638°C (1180.4°F)

Flash Points: CLOSED CUP: 29.44°C (85°F).

Flammable Limits: LOWER: 1.3% UPPER: 7.1%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep container dry. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Never add water to this product In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 10 (ppm) TWA: 46 (mg/m3) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Almond-like.

Taste: Not available.

Molecular Weight: 112.56 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 132°C (269.6°F)

Melting Point: -45.6°C (-50.1°F)

Critical Temperature: Not available.

Specific Gravity: 1.1058 (Water = 1)

Vapor Pressure: 8.8 mm of Hg (@ 20°C)

Vapor Density: 3.88 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.2 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility:
Soluble in methanol, diethyl ether. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Not available.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 1110 mg/kg [Rat].

Chronic Effects on Humans: The substance is toxic to kidneys, lungs, the nervous system, liver, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, sensitizer, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Chlorobenzene : UN1134 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Chlorobenzene Massachusetts RTK: Chlorobenzene TSCA 8(b) inventory: Chlorobenzene SARA 313 toxic chemical notification and release reporting: Chlorobenzene CERCLA: Hazardous substances.: Chlorobenzene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R10- Flammable. R22- Harmful if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes. R43- May cause sensitization by skin contact.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:16 PM

Last Updated: 05/21/2013 12:00 PM

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SAFETY DATA SHEET

Version 4.7
Revision Date 12/02/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Chromium

Product Number : 255610
Brand : Aldrich

CAS-No. : 7440-47-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P273 Avoid release to the environment.
P391 Collect spillage.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula : Cr
Molecular weight : 52.00 g/mol

CAS-No. : 7440-47-3
EC-No. : 231-157-5

Hazardous components

Component	Classification	Concentration
Chromium		
	Aquatic Acute 1; Aquatic Chronic 1; H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Chromium oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Chromium	7440-47-3	TWA	0.500000 mg/m3	USA. NIOSH Recommended Exposure Limits
	Remarks	See Appendix C		
		TWA	1.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.500000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Liver impairment Not classifiable as a human carcinogen		
		TWA	1.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	1.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.500000 mg/m3	USA. NIOSH Recommended Exposure Limits
		See Appendix C		
		TWA	0.500000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Upper Respiratory Tract irritation Skin irritation Not classifiable as a human carcinogen varies		
		TWA	0.5 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Upper Respiratory Tract irritation Skin irritation Not classifiable as a human carcinogen varies		

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: chips Colour: light grey
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 1,857 °C (3,375 °F) - lit.
f)	Initial boiling point and boiling range	2,672 °C (4,842 °F) - lit.
g)	Flash point	Not applicable

h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	7.14 g/mL at 25 °C (77 °F)
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong acids, Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

Carcinogenicity - Rabbit - Implant
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Musculoskeletal:Tumors.

Carcinogenicity - Rat - Implant
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Blood:Lymphomas including Hodgkin's disease.
Tumorigenic:Tumors at site or application.

Carcinogenicity - Rat - Intravenous
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Gastrointestinal:Tumors. Blood:Lymphomas including Hodgkin's disease.

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	3 - Group 3: Not classifiable as to its carcinogenicity to humans (Chromium)
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: GB4200000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	mortality NOEC - Pimephales promelas (fathead minnow) - 12 mg/l - 7 d
	mortality LOEC - Pimephales promelas (fathead minnow) - 2.4 mg/l - 7 d
	LC50 - Cyprinus carpio (Carp) - 14.3 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.07 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation Oncorhynchus mykiss (rainbow trout) - 30 d
- 1.33 µg/l

Bioconcentration factor (BCF): 1.03 - 1.22

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Chromium)
Reportable Quantity (RQ): 5000 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Chromium)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Chromium)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Chromium	7440-47-3	2007-07-01

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Chromium	7440-47-3	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date

Chromium	7440-47-3	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Chromium	7440-47-3	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7 Revision Date: 12/02/2015 Print Date: 05/01/2016

SAFETY DATA SHEET

Version 5.3
Revision Date 03/04/2015
Print Date 05/13/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name	:	Chrysene
Product Number	:	35754
Brand	:	Sigma-Aldrich
Index-No.	:	601-048-00-0
CAS-No.	:	218-01-9

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses	:	Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #	:	(314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Germ cell mutagenicity (Category 2), H341
Carcinogenicity (Category 1B), H350
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

H341	Suspected of causing genetic defects.
H350	May cause cancer.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P273	Avoid release to the environment.
P281	Use personal protective equipment as required.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.

P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	$C_{18}H_{12}$
Molecular weight	:	228.29 g/mol
CAS-No.	:	218-01-9
EC-No.	:	205-923-4
Index-No.	:	601-048-00-0

Hazardous components

Component	Classification	Concentration
Chrysene		
	Muta. 2; Carc. 1B; Aquatic Acute 1; Aquatic Chronic 1; H341, H350, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
	Remarks	Cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section), see BEI® for Polycyclic Aromatic Hydrocarbons (PAHs) Exposure by all routes should be carefully controlled to levels as low as possible. Confirmed animal carcinogen with unknown relevance to humans		
Chrysene	218-01-9	TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		1910.1002 As used in §1910.1000 (Table Z-1), coal tar pitch volatiles include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter. Asphalt (CAS 8052-42-4, and CAS 64742-93-4) is not covered under the 'coal tar pitch volatiles' standard OSHA specifically regulated carcinogen		
		TWA	0.100000 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen NIOSH considers coal tar, coal tar pitch, and creosote to be coal tar		

		products. cyclohexane-extractable fraction See Appendix C See Appendix A

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Chrysene	218-01-9	1-Hydroxypyrene (1-HP)		Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 252 - 254 °C (486 - 489 °F) - lit.
f)	Initial boiling point and boiling range	448 °C (838 °F) - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	log Pow: 5.73
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Strong oxidizing agents

10.6 Hazardous decomposition products

Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

LD50 Intraperitoneal - Mouse - > 320 mg/kg

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
Laboratory experiments have shown mutagenic effects.
In vitro tests showed mutagenic effects

Carcinogenicity

This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Possible human carcinogen

IARC:	2B - Group 2B: Possibly carcinogenic to humans (Chrysene)
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	OSHA specifically regulated carcinogen (Chrysene)

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: GC0700000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 1.90 mg/l - 2 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Chrysene)
Reportable Quantity (RQ): 100 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Chrysene)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Chrysene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Chrysene	218-01-9	1994-04-01

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date

Chrysene	218-01-9	1994-04-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Chrysene	218-01-9	1994-04-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Chrysene	218-01-9	1994-04-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Chrysene	218-01-9	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.3 Revision Date: 03/04/2015 Print Date: 05/13/2016

SAFETY DATA SHEET

Version 5.7
Revision Date 05/23/2016
Print Date 07/05/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Cyclohexane

Product Number : 34855
Brand : SIGALD
Index-No. : 601-017-00-1

CAS-No. : 110-82-7

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Skin irritation (Category 2), H315
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
Aspiration hazard (Category 1), H304
Acute aquatic toxicity (Category 1), H400

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H225 Highly flammable liquid and vapour.
H304 May be fatal if swallowed and enters airways.
H315 Causes skin irritation.
H336 May cause drowsiness or dizziness.
H400 Very toxic to aquatic life.

Precautionary statement(s)
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233 Keep container tightly closed.

P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P312	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P331	Do NOT induce vomiting.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C_6H_{12}
Molecular weight	:	84.16 g/mol
CAS-No.	:	110-82-7
EC-No.	:	203-806-2
Index-No.	:	601-017-00-1

Hazardous components

Component	Classification	Concentration
Cyclohexane		
	Flam. Liq. 2; Skin Irrit. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 1; H225, H304, H315, H336, H400	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Store under inert gas.
Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Cyclohexane	110-82-7	TWA	100.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment		
		TWA	300.000000 ppm 1,050.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	300.000000 ppm 1,050.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		
		PEL	300 ppm 1,050 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 480 min
Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 35 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 4 - 7 °C (39 - 45 °F) - lit.
f)	Initial boiling point and boiling range	80.7 °C (177.3 °F) - lit.
g)	Flash point	-18.0 °C (-0.4 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 9 %(V) Lower explosion limit: 1 %(V)
k)	Vapour pressure	225.0 hPa (168.8 mmHg) at 37.7 °C (99.9 °F) 102.7 hPa (77.0 mmHg) at 20.0 °C (68.0 °F)
l)	Vapour density	No data available
m)	Relative density	0.779 g/cm3 at 25 °C (77 °F)0.78 g/cm3 at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 3.44
p)	Auto-ignition temperature	260.0 °C (500.0 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
Hazardous decomposition products formed under fire conditions. - Carbon oxides
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 12,705 mg/kg

LC50 Inhalation - Rat - 4 h - 34,000 mg/l
(OECD Test Guideline 403)

LD50 Dermal - Rabbit - > 2,000 mg/kg

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Mild eye irritation

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
May be fatal if swallowed and enters airways.

Additional Information
RTECS: GU6300000

Central nervous system depression, Drowsiness, Irritability, Dizziness, Gastrointestinal disturbance, Lung irritation, chest pain, pulmonary edema

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	flow-through test LC50 - Pimephales promelas (fathead minnow) - 4.53 mg/l - 96 h (OECD Test Guideline 203)
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - 0.9 mg/l - 48 h (OECD Test Guideline 202)
Toxicity to algae	EC50 - Pseudokirchneriella subcapitata (green algae) - 3.4 mg/l - 72 h (OECD Test Guideline 201)

12.2 Persistence and degradability

Biodegradability Result: - Readily biodegradable

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1145 Class: 3 Packing group: II
Proper shipping name: Cyclohexane
Reportable Quantity (RQ): 1000 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 1145 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: CYCLOHEXANE
Marine pollutant:yes

IATA

UN number: 1145 Class: 3 Packing group: II
Proper shipping name: Cyclohexane

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Cyclohexane	110-82-7	2007-07-01

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Cyclohexane	110-82-7	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Cyclohexane	110-82-7	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Cyclohexane	110-82-7	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Asp. Tox.	Aspiration hazard
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H336	May cause drowsiness or dizziness.
H400	Very toxic to aquatic life.
Skin Irrit.	Skin irritation
STOT SE	Specific target organ toxicity - single exposure

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.7 Revision Date: 05/23/2016 Print Date: 07/05/2016

SAFETY DATA SHEET

Version 4.10
Revision Date 05/23/2016
Print Date 05/24/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Dimethyl phthalate

Product Number : 07-4770
Brand : Katayama OEM Partner

CAS-No. : 131-11-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute aquatic toxicity (Category 3), H402

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram none

Signal word none

Hazard statement(s)
H402 Harmful to aquatic life.

Precautionary statement(s)
P273 Avoid release to the environment.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Rapidly absorbed through skin.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula : $C_{10}H_{10}O_4$
Molecular weight : 194.18 g/mol
CAS-No. : 131-11-3
EC-No. : 205-011-6

Hazardous components

Component	Classification	Concentration
Dimethyl phthalate		
	Aquatic Acute 3; H402	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Avoid breathing vapours, mist or gas. Ensure adequate ventilation.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Combustible liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Dimethyl phthalate	131-11-3	TWA	5.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Upper Respiratory Tract irritation Eye irritation		
		TWA	5.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		PEL	5 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.2 mm
Break through time: 480 min
Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 120 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Respiratory protection not required. For nuisance exposures use type OV/AG (US) or type ABEK (EU EN 14387) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 2 °C (36 °F) - lit.
f)	Initial boiling point and boiling range	282 °C (540 °F) - lit.
g)	Flash point	146.0 °C (294.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 8.03 %(V) Lower explosion limit: 0.94 %(V)
k)	Vapour pressure	0.0020 hPa (0.0015 mmHg) at 20.0 °C (68.0 °F) 1.3 hPa (1.0 mmHg) at 100.0 °C (212.0 °F)
l)	Vapour density	No data available
m)	Relative density	1.19 g/cm3 at 25 °C (77 °F)
n)	Water solubility	slightly soluble
o)	Partition coefficient: n-octanol/water	log Pow: 1.47
p)	Auto-ignition temperature	490.0 °C (914.0 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents, acids

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 8,200 mg/kg

Inhalation: No data available

LD50 Dermal - Rabbit - > 12,000 mg/kg

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation - 24 h
(Draize Test)

Serious eye damage/eye irritation
Eyes - Rabbit
Result: No eye irritation - 72 h
(OECD Test Guideline 405)

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
Ames test
S. typhimurium
Result: negative

Rat - male
Result: negative

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

Reproductive toxicity - Rat - female - Oral
No adverse effect has been observed in chronic toxicity tests.

Developmental Toxicity - Rat - Oral
No adverse effect has been observed in chronic toxicity tests.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, Central nervous system depression, Gastrointestinal disturbance, Kidney injury may occur., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Nerves. -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	flow-through test LC50 - Pimephales promelas (fathead minnow) - 39 mg/l - 96 h LC50 - Pimephales promelas (fathead minnow) - 39 mg/l - 144 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 46.00 mg/l - 48 h
Toxicity to algae	static test EC50 - Desmodesmus subspicatus (Scenedesmus subspicatus) - 204 mg/l - 72 h

12.2 Persistence and degradability

Biodegradability	aerobic - Exposure time 11 d Result: 91 % - Readily biodegradable Remarks: No data available Result: - Readily biodegradable

12.3 Bioaccumulative potential

Bioaccumulation	Lepomis macrochirus (Bluegill) - 21 d - 0.00874 mg/l Bioconcentration factor (BCF): 57

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3082 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, liquid, n.o.s. (Dimethyl phthalate)
Reportable Quantity (RQ): 5000 lbs

Poison Inhalation Hazard: No

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Dimethyl phthalate	131-11-3	2007-07-01

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Dimethyl phthalate	131-11-3	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Dimethyl phthalate	131-11-3	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Dimethyl phthalate	131-11-3	2007-07-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
H402	Harmful to aquatic life.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	
Flammability:	1
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	1
Reactivity Hazard:	0

Further information
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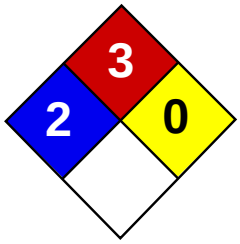
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.10 Revision Date: 05/23/2016 Print Date: 05/24/2016



Material Safety Data Sheet
Ethylbenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ethylbenzene

Catalog Codes: SLE2044

CAS#: 100-41-4

RTECS: DA0700000

TSCA: TSCA 8(b) inventory: Ethylbenzene

CI#: Not available.

Synonym: Ethyl Benzene; Ethylbenzol; Phenylethane

Chemical Name: Ethylbenzene

Chemical Formula: C8H10

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ethylbenzene	100-41-4	100

Toxicological Data on Ingredients: Ethylbenzene: ORAL (LD50): Acute: 3500 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (irritant, sensitizer). CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 432°C (809.6°F)

Flash Points:
CLOSED CUP: 15°C (59°F). (Tagliabue.) OPEN CUP: 26.667°C (80°F) (Cleveland) (CHRIS, 2001) CLOSED CUP: 12.8 C (55 F) (Bingham et al, 2001; NIOSH, 2001) CLOSED CUP: 21 C (70 F) (NFPA)

Flammable Limits: LOWER: 0.8% - 1.6%UPPER: 6.7% - 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Vapor may travel considerable distance to source of ignition and flash back. Vapors may form explosive mixtures with air. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Vapors may form explosive mixtures in air.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [United States] TWA: 435 STEL: 545 from OSHA (PEL) [United States] TWA: 435 STEL: 545 (mg/m3) from NIOSH [United States] TWA: 100 STEL: 125 (ppm) from NIOSH [United States] TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [United States] TWA: 100 STEL: 125 (ppm) [United Kingdom (UK)] TWA: 100 STEL: 125 (ppm) [Belgium] TWA: 100 STEL: 125 (ppm) [Finland] TWA: 50 (ppm) [Norway] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish. Gasoline-like. Aromatic.

Taste: Not available.

Molecular Weight: 106.16 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 136°C (276.8°F)

Melting Point: -94.9 (-138.8°F)

Critical Temperature: 617.15°C (1142.9°F)

Specific Gravity: 0.867 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.66 (Air = 1)

Volatility: 100% (v/v).

Odor Threshold: 140 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:
Easily soluble in diethyl ether. Very slightly soluble in cold water or practically insoluble in water. Soluble in all proportions in Ethyl alcohol. Soluble in Carbon tetrachloride, Benzene. Insoluble in Ammonia. Slightly soluble in Chloroform. Solubility in Water: 169 mg/l @ 25 deg. C.; 0.014 g/100 ml @ 15 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ingnition sources (flames, sparks, static), incompatible materials, light

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials. Sensitive to light.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation.

Toxicity to Animals: Acute oral toxicity (LD50): 3500 mg/kg [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals:
Lethal Dose/Conc 50% Kill: LD50 [Rabbit] - Route: Skin; Dose: 17800 ul/kg Lowest Published Lethal Dose/Conc: LDL[Rat] - Route: Inhalation (vapor); Dose: 4000 ppm/4 H

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects (teratogenic) based on animal test data. May cause cancer based on animals data. IARC evidence for carcinogenicity in animals is sufficient. IARC evidence of carcinogenicity in humans inadequate. May affect genetic material (mutagenic).

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Can cause mild skin irritation. It can be absorbed through intact skin. Eyes: Contact with vapor or liquid can cause severe eye irritation depending on concentration. It may also cause conjunctivitis. At a vapor exposure level of 85 - 200 ppm , it is mildly and transiently irritating to the eyes; 1000 ppm causes further irritation and tearing; 2000 ppm results in immediate and severe irritation and tearing; 5,000 ppm is intolerable (ACGIH, 1991; Clayton and Clayton, 1994). Standard draize test for eye irritation using 500 mg resulted in severe irritation (RTECS) Inhalation: Exposure to high concentrations can cause nasal, mucous membrane and respiratory tract irritation and can also result in chest constriction and, trouble breathing, respiratory failure, and even death. It can also affect behavior/Central Nervous System. The effective dose for CNS depression in experimental animals was 10,000 ppm (ACGIH, 1991). Symptoms of CNS depression include

headache, nausea, weakness, dizziness, vertigo, irritability, fatigue, lightheadedness, sleepiness, tremor, loss of coordination, judgement and conciousness, coma, and death. It can also cause pulmonary edema. Inhalation of 85 ppm can produce fatigue, insomnia, headache, and mild irritation of the respiratory tract (Haley & Berndt, 1987). Ingestion: Do not drink, pipet or siphon by mouth. May cause gastroinestinal/digestive tract irritation with Abdominal pain, nausea, vomiting. Ethylbenzene is a pulmonary aspiration hazard. Pulmonary aspiration of even small amounts of the liquid may cause fatal pneumonitis. It may also affect behavior/central nervous system with

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 14 mg/l 96 hours [Fish (Trout)] (static). 12.1 mg/l 96 hours [Fish (Fathead Minnow)] (flow-through)]. 150 mg/l 96 hours [Fish (Blue Gill/Sunfish)] (static). 275 mg/l 96 hours [Fish (Sheepshead Minnow)]. 42.3 mg/l 96 hours [Fish (Fathead Minnow)](soft water). 87.6mg/l 96 hours [Shrimp].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Ethylbenzene UNNA: 1175 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Ethylbenzene Illinois toxic substances disclosure to employee act: Ethylbenzene Illinois chemical safety act: Ethylbenzene New York release reporting list: Ethylbenzene Rhode Island RTK hazardous substances: Ethylbenzene Pennsylvania RTK: Ethylbenzene Minnesota: Ethylbenzene Massachusetts RTK: Ethylbenzene Massachusetts spill list: Ethylbenzene New Jersey: Ethylbenzene New Jersey spill list: Ethylbenzene Louisiana spill reporting: Ethylbenzene California Director's List of Hazardous Substances: Ethylbenzene TSCA 8(b) inventory: Ethylbenzene TSCA 4(a) proposed test rules: Ethylbenzene TSCA 8(d) H and S data reporting: Ethylbenzene: Effective Date: 6/19/87; Sunset Date: 6/19/97 SARA 313 toxic chemical notification and release reporting: Ethylbenzene

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASSE D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable. R20- Harmful by inhalation. S16- Keep away from sources of ignition - No smoking. S24/25- Avoid contact with skin and eyes. S29- Do not empty into drains.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References:
-Manufacturer's Material Safety Data Sheet. -Fire Protection Guide to Hazardous Materials, 13th ed., National Fire Protection Association (NFPA) -Registry of Toxic Effects of Chemical Substances (RTECS) -Chemical Hazard Response Information System (CHRIS) -Hazardous Substance Data Bank (HSDB) -New Jersey Hazardous Substance Fact Sheet -Ariel Global View -Reprotext System

Other Special Considerations: Not available.

Created: 10/09/2005 05:28 PM

Last Updated: 06/09/2012 12:00 PM

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SAFETY DATA SHEET

Version 5.6
Revision Date 02/28/2015
Print Date 05/25/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Fluoranthene

Product Number : F807
Brand : Aldrich

CAS-No. : 206-44-0

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H302 Harmful if swallowed.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P301 + P312 IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
P330 Rinse mouth.
P391 Collect spillage.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : Benzo[j,k]fluorene

Formula : $C_{16}H_{10}$
Molecular weight : 202.25 g/mol
CAS-No. : 206-44-0
EC-No. : 205-912-4

Hazardous components

Component	Classification	Concentration
Fluoranthene		
	Acute Tox. 4; Aquatic Acute 1; Aquatic Chronic 1; H302, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 105 - 110 °C (221 - 230 °F) - lit.
f)	Initial boiling point and boiling range	384 °C (723 °F) - lit.
g)	Flash point	198.0 °C (388.4 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 2,000 mg/kg

Inhalation: No data available

LD50 Dermal - Rabbit - 3,180 mg/kg

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
Laboratory experiments have shown mutagenic effects.

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	3 - Group 3: Not classifiable as to its carcinogenicity to humans (Fluoranthene)
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: LL4025000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.0077 mg/l - 96 h
	NOEC - Cyprinodon variegatus (sheepshead minnow) - 560 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - > 0.005 - < 0.01 mg/l - 3 d
	Immobilization EC50 - Daphnia magna (Water flea) - 0.78 mg/l - 20 h
	NOEC - Daphnia magna (Water flea) - 0.085 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Fluoranthene)
Reportable Quantity (RQ): 100 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Fluoranthene)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Fluoranthene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Fluoranthene	206-44-0	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Fluoranthene	206-44-0	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Fluoranthene	206-44-0	1993-04-24

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H302	Harmful if swallowed.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	*
Flammability:	1
Physical Hazard	0

NFPA Rating

Health hazard:	1
Fire Hazard:	1
Reactivity Hazard:	0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.6 Revision Date: 02/28/2015 Print Date: 05/25/2016

SAFETY DATA SHEET

Version 5.8
Revision Date 05/27/2016
Print Date 07/04/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Indeno[1,2,3-*cd*]pyrene

Product Number : 94377
Brand : Sigma-Aldrich

CAS-No. : 193-39-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Carcinogenicity (Category 2), H351

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H351 Suspected of causing cancer.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P281 Use personal protective equipment as required.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P405 Store locked up.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula : $C_{22}H_{12}$
Molecular weight : 276.33 g/mol
CAS-No. : 193-39-5
EC-No. : 205-893-2

Hazardous components

Component	Classification	Concentration
Indeno[1,2,3-cd]pyrene		
	Carc. 2; H351	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

No data available

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Moisture sensitive.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available

e)	Melting point/freezing point	163.6 °C (326.5 °F)
f)	Initial boiling point and boiling range	536.0 °C (996.8 °F)
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

IARC:	2B - Group 2B: Possibly carcinogenic to humans (Indeno[1,2,3-cd]pyrene)
IARC:	2B - Group 2B: Possibly carcinogenic to humans (Indeno[1,2,3-cd]pyrene)
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	Reasonably anticipated to be a human carcinogen (Indeno[1,2,3-cd]pyrene)
NTP:	Reasonably anticipated to be a human carcinogen (Indeno[1,2,3-cd]pyrene)
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Indeno[1,2,3-cd]pyrene	193-39-5	1993-04-24

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Indeno[1,2,3-cd]pyrene	193-39-5	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Indeno[1,2,3-cd]pyrene	193-39-5	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Indeno[1,2,3-cd]pyrene	193-39-5	1993-04-24

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Indeno[1,2,3-cd]pyrene	193-39-5	2007-09-28
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date

State of California to cause cancer. Indeno[1,2,3-cd]pyrene	193-39-5	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Carc.	Carcinogenicity
H351	Suspected of causing cancer.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	1
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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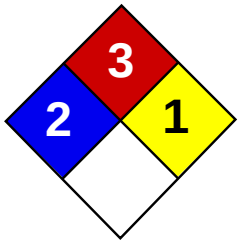
Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.8 Revision Date: 05/27/2016 Print Date: 07/04/2016



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Cumene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Cumene

Catalog Codes: SLC3052

CAS#: 98-82-8

RTECS: GR8575000

TSCA: TSCA 8(b) inventory: Cumene

CI#: Not available.

Synonym: Isopropyl benzene; Cumol; 2-Phenyl propane; (1-Methylethyl)benzene

Chemical Name: Isopropylbenzene

Chemical Formula: C6H5CH(CH3)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Cumene	98-82-8	100

Toxicological Data on Ingredients: Cumene: ORAL (LD50): Acute: 1400 mg/kg [Rat]. 12750 mg/kg [Mouse]. DERMAL (LD50): Acute: 12300 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Very hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, the nervous system, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 424°C (795.2°F)

Flash Points: CLOSED CUP: 36°C (96.8°F). OPEN CUP: 44°C (111.2°F).

Flammable Limits: LOWER: 0.9% UPPER: 6.5%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 50 CEIL: 75 (ppm) TWA: 245 CEIL: 365 (mg/m3) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 120.2 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 152.4°C (306.3°F)

Melting Point: -96°C (-140.8°F)

Critical Temperature: Not available.

Specific Gravity: 0.862 (Water = 1)

Vapor Pressure: 8 mm of Hg (@ 20°C)

Vapor Density: 4.14 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.2 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.7

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 1400 mg/kg [Rat]. Acute dermal toxicity (LD50): 12300 mg/kg [Rabbit].

Chronic Effects on Humans: The substance is toxic to lungs, the nervous system, mucous membranes.

Other Toxic Effects on Humans: Very hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Isopropylbenzene : UN1918 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Cumene Massachusetts RTK: Cumene TSCA 8(b) inventory: Cumene SARA 313 toxic chemical notification and release reporting: Cumene CERCLA: Hazardous substances.: Cumene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).

DSCL (EEC):
R10- Flammable. R22- Harmful if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 11:43 AM

Last Updated: 05/21/2013 12:00 PM

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SAFETY DATA SHEET

Version 4.7
Revision Date 12/28/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Lead

Product Number : 695912
Brand : Aldrich

CAS-No. : 7439-92-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Carcinogenicity (Category 2), H351
Reproductive toxicity (Category 2), H361
Specific target organ toxicity - repeated exposure (Category 2), H373
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H302 Harmful if swallowed.
H351 Suspected of causing cancer.
H361 Suspected of damaging fertility or the unborn child.
H373 May cause damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and

	understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Pb
Molecular weight	:	207.20 g/mol
CAS-No.	:	7439-92-1
EC-No.	:	231-100-4

Hazardous components

Component	Classification	Concentration
Lead		
	Acute Tox. 4; Carc. 2; Repr. 2; STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H302, H351, H361, H373, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Lead oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
	Remarks	See 1910.1025		
Lead	7439-92-1	TWA	0.05 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Confirmed animal carcinogen with unknown relevance to humans		
		TWA	0.05 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Hematologic effects Peripheral Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans		

		TWA	0.05 mg/m3	USA. NIOSH Recommended Exposure Limits
		See Appendix C		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Lead	7439-92-1	Lead	30µg/ 100 ml	In blood	ACGIH - Biological Exposure Indices (BEI)
	Remarks	Not critical			
		Lead	30µg/ 100 ml	In blood	ACGIH - Biological Exposure Indices (BEI)
		Not critical			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: Shot
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 327.4 °C (621.3 °F) - lit.
f)	Initial boiling point and boiling range	1,740 °C (3,164 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Strong acids

10.6 Hazardous decomposition products

Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity

Rat
Cytogenetic analysis

Carcinogenicity

Limited evidence of carcinogenicity in animal studies

IARC:	2B - Group 2B: Possibly carcinogenic to humans (Lead)
NTP:	Reasonably anticipated to be a human carcinogen (Lead)
	Reasonably anticipated to be a human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Lead)
OSHA:	1910.1025 (Lead)
	OSHA specifically regulated carcinogen (Lead)

Reproductive toxicity
Suspected human reproductive toxicant

Reproductive toxicity - Rat - Inhalation
Effects on Newborn: Biochemical and metabolic.

Reproductive toxicity - Rat - Oral
Effects on Newborn: Behavioral.

Reproductive toxicity - Mouse - Oral
Effects on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated). Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea).

Developmental Toxicity - Rat - Inhalation
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow).

Developmental Toxicity - Rat - Oral
Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow). Effects on Newborn: Growth statistics (e.g., reduced weight gain).

Developmental Toxicity - Rat - Oral
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Developmental Toxicity - Mouse - Oral
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: OF7525000

anemia

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	mortality LOEC - Oncorhynchus mykiss (rainbow trout) - 1.19 mg/l - 96.0 h
	LC50 - Micropterus dolomieui - 2.2 mg/l - 96.0 h
	mortality NOEC - Salvelinus fontinalis - 1.7 mg/l - 10.0 d
Toxicity to daphnia and other aquatic invertebrates	mortality LOEC - Daphnia (water flea) - 0.17 mg/l - 24 h
	mortality NOEC - Daphnia (water flea) - 0.099 mg/l - 24 h
Toxicity to algae	mortality EC50 - Skeletonema costatum - 7.94 mg/l - 10 d

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation: Oncorhynchus kisutch - 2 Weeks - 150 µg/l

Bioconcentration factor (BCF): 12

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Lead)
Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Lead)
Marine pollutant:yes
IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Lead)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. Lead	CAS-No. 7439-92-1	Revision Date 1989-07-10
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Lead	CAS-No. 7439-92-1	Revision Date 1989-07-10

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H302	Harmful if swallowed.
H351	Suspected of causing cancer.
H361	Suspected of damaging fertility or the unborn child.
H373	May cause damage to organs through prolonged or repeated exposure.

H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	1
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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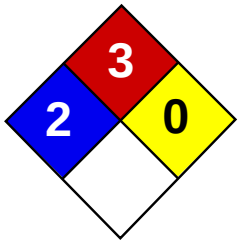
Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7 Revision Date: 12/28/2015 Print Date: 05/01/2016



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Xylenes MSDS

Section 1: Chemical Product and Company Identification

Product Name: Xylenes

Catalog Codes: SLX1075, SLX1129, SLX1042, SLX1096

CAS#: 1330-20-7

RTECS: ZE2100000

TSCA: TSCA 8(b) inventory: Xylenes

CI#: Not available.

Synonym: Xylenes; Dimethylbenzene; xylol; methyltoluene

Chemical Name: Xylenes (o-, m-, p- isomers)

Chemical Formula: C6H4(CH3)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Xylenes	1330-20-7	100

Toxicological Data on Ingredients: Xylenes: ORAL (LD50): Acute: 4300 mg/kg [Rat]. 2119 mg/kg [Mouse]. DERMAL (LD50): Acute: >1700 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 464°C (867.2°F)

Flash Points: CLOSED CUP: 24°C (75.2°F). (Tagliabue.) OPEN CUP: 37.8°C (100°F).

Flammable Limits: LOWER: 1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Vapors may travel to source of ignition and flash back.

Special Remarks on Explosion Hazards:
Vapors may form explosive mixtures with air. Containers may explode when heated. May polymerize explosively when heated. An attempt to chlorinate xylene with 1,3-Dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin) caused a violent explosion

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined

areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 (ppm) [Canada] TWA: 435 (mg/m3) [Canada] TWA: 434 STEL: 651 (mg/m3) from ACGIH (TLV) [United States] TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 138.5°C (281.3°F)

Melting Point: -47.4°C (-53.3°F)

Critical Temperature: Not available.

Specific Gravity: 0.864 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 1 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.1

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water. Miscible with absolute alcohol, ether, and many other organic liquids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles

Incompatibility with various substances: Reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Store away from acetic acid, nitric acid, chlorine, bromine, and fluorine.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2119 mg/kg [Mouse]. Acute dermal toxicity (LD50): >1700 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5000 4 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS).

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals:
Lowest Lethal Dose: LDL [Human] - Route: Oral; Dose: 50 mg/kg LCL [Man] - Route: Oral; Dose: 10000 ppm/6H

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in animal. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects (male and femael fertility (spontaneous abortion and fetotoxicity)) and birth defects based animal data.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Causes skin irritation. Can be absorbed through skin. Eyes: Causes eye irritation. Inhalation: Vapor causes respiratory tract and mucous membrane irritation. May affect central nervous system and behavior (General anesthetic/CNS depressant with effects including headache, weakness, memory loss, irritability, dizziness, giddiness, loss of coordination and judgement, respiratory depression/arrest or difficulty breathing, loss of appetite, nausea, vomiting, shivering, and possible coma and death). May also affects blood, sense organs, liver, and peripheral nerves. Ingestion: May cause gastrointestinal irritation including abdominal pain, vomiting, and nausea. May also affect liver and urinary system/ kidneys. May cause effects similar to those of acute inhalation. Chronic Potential Health Effects: Chronic inhalation may affect the urinary system (kidneys) blood (anemia), bone marrow (hyperplasia of bone marrow) brain/behavior/Central Nervous system. Chronic inhalation may alsocause mucosal bleeding. Chronic ingestion may affect the liver and metabolism (loss of appetite) and may affect urinary system (kidney damage)

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Xylenes UNNA: 1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Xylenes Illinois chemical safety act: Xylenes New York acutely hazardous substances: Xylenes Rhode Island RTK hazardous substances: Xylenes Pennsylvania RTK: Xylenes Minnesota: Xylenes Michigan critical material: Xylenes Massachusetts RTK: Xylenes Massachusetts spill list: Xylenes New Jersey: Xylenes New Jersey spill list: Xylenes Louisiana spill reporting: Xylenes California Director's List of Hazardous Substances: Xylenes TSCA 8(b) inventory: Xylenes SARA 302/304/311/312 hazardous chemicals: Xylenes SARA 313 toxic chemical notification and release reporting: Xylenes CERCLA: Hazardous substances.: Xylenes: 100 lbs. (45.36 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R10- Flammable. R21- Harmful in contact with skin. R36/38- Irritating to eyes and skin. S2- Keep out of the reach of children. S36/37- Wear suitable protective clothing and gloves. S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 12:54 PM

Last Updated: 06/09/2012 12:00 PM

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SAFETY DATA SHEET

Version 3.12
Revision Date 12/02/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Mercury

Product Number : 215457
Brand : Sigma-Aldrich
Index-No. : 080-001-00-0

CAS-No. : 7439-97-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Inhalation (Category 2), H330
Reproductive toxicity (Category 1B), H360
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H330 Fatal if inhaled.
H360 May damage fertility or the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.

P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P284	Wear respiratory protection.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Hg
Molecular weight	:	200.59 g/mol
CAS-No.	:	7439-97-6
EC-No.	:	231-106-7
Index-No.	:	080-001-00-0

Hazardous components

Component	Classification	Concentration
Mercury		
	Acute Tox. 2; Repr. 1B; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H330, H360, H372, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Mercury/mercury oxides.

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal. In some instances, a mercury spill kit may be used. Please consult with your site EHS representative to determine the most appropriate clean up method.Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Store under inert gas.
Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Mercury	7439-97-6	C	0.1 mg/m3	USA. NIOSH Recommended Exposure Limits
	Remarks	Potential for dermal absorption		

		CEIL	1.0mg/10m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		TWA	0.05 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		Skin notation		
		TWA	0.025 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen Danger of cutaneous absorption		
		TWA	0.05 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential for dermal absorption		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Mercury	7439-97-6	Mercury	0.0400 mg/g	In urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	Prior to shift (16 hours after exposure ceases)			
		Mercury	15.0000 µg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
		End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: silver, white
b)	Odour	odourless
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -38.87 °C (-37.97 °F) - lit.
f)	Initial boiling point and boiling range	356.6 °C (673.9 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	< 0.01 hPa (< 0.01 mmHg) at 20 °C (68 °F) 1 hPa (1 mmHg) at 126 °C (259 °F)
l)	Vapour density	6.93 - (Air = 1.0)
m)	Relative density	13.55 g/cm3 at 25 °C (77 °F)
n)	Water solubility	0.00006 g/l at 25 °C (77 °F)
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

Relative vapour density	6.93 - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents, Ammonia, Azides, Nitrates, Chlorates, Copper

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

LC50 Inhalation - Rat - male - 2 h - < 27 mg/m3

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	3 - Group 3: Not classifiable as to its carcinogenicity to humans (Mercury)
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
Presumed human reproductive toxicant

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: OV4550000

Mercury accumulates in almost all tissues, especially in the:, Kidney, Effects due to ingestion may include:, Nausea, Vomiting, Diarrhoea, intestinal bleeding

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	mortality LC50 - Cyprinus carpio (Carp) - 0.160 mg/l - 96 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	Carassius auratus (goldfish) - 1,789 d - 0.25 µg/l
	Bioconcentration factor (BCF): 155,986

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2809 Class: 8 (6.1) Packing group: III
Proper shipping name: A,W Mercury
Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 2809 Class: 8 (6.1) Packing group: III EMS-No: F-A, S-B
Proper shipping name: MERCURY
Marine pollutant:yes

IATA
UN number: 2809 Class: 8 (6.1) Packing group: III
Proper shipping name: Mercury

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Mercury	7439-97-6	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Mercury	7439-97-6	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Mercury	7439-97-6	2007-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Mercury	7439-97-6	2013-12-20

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H330	Fatal if inhaled.
H360	May damage fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
Repr.	Reproductive toxicity

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.12 Revision Date: 12/02/2015 Print Date: 05/01/2016

SAFETY DATA SHEET

Version 5.4
Revision Date 05/23/2016
Print Date 06/21/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Methylcyclohexane

Product Number : 66294
Brand : Sigma-Aldrich
Index-No. : 601-018-00-7

CAS-No. : 108-87-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Skin irritation (Category 2), H315
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
Aspiration hazard (Category 1), H304
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H225 Highly flammable liquid and vapour.
H304 May be fatal if swallowed and enters airways.
H315 Causes skin irritation.
H336 May cause drowsiness or dizziness.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.

P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell.
P331	Do NOT induce vomiting.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : Hexahydrotoluene

Formula : C_7H_{14}

Molecular weight : 98.19 g/mol

CAS-No. : 108-87-2

EC-No. : 203-624-3

Index-No. : 601-018-00-7

Hazardous components

Component	Classification	Concentration
Methylcyclohexane		
	Flam. Liq. 2; Skin Irrit. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 1; Aquatic Chronic 1; H225, H304, H315, H336, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Methylcyclohexane	108-87-2	TWA	400.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Upper Respiratory Tract irritation Liver damage Kidney damage		
		TWA	400.000000 ppm 1,600.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	500.000000 ppm 2,000.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		
		TWA	400 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Upper Respiratory Tract irritation Liver damage Kidney damage		
		TWA	400 ppm 1,600 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	500 ppm 2,000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		
		TWA	400 ppm 1,600 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		PEL	400 ppm 1,600 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 480 min
Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 30 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	-126.0 °C (-194.8 °F)
f)	Initial boiling point and boiling range	101.0 °C (213.8 °F)
g)	Flash point	-4.0 °C (24.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 6.7 %(V) Lower explosion limit: 1.1 %(V)
k)	Vapour pressure	110.9 hPa (83.2 mmHg) at 37.7 °C (99.9 °F) 49.3 hPa (37.0 mmHg) at 20.0 °C (68.0 °F)
l)	Vapour density	No data available
m)	Relative density	0.77 g/cm3
n)	Water solubility	slightly soluble
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	283.0 °C (541.4 °F)

q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
Eyes - Rabbit
Result: No eye irritation
(OECD Test Guideline 405)

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
Did not show mutagenic effects in animal experiments.

Chromosome aberration test in vitro
Chinese hamster lung cells
Result: negative

Ames test
Salmonella typhimurium
Result: negative

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

Reproductive toxicity - Rat - male and female - Oral

No toxicity to reproduction

Specific target organ toxicity - single exposure
May cause drowsiness or dizziness.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
May be fatal if swallowed and enters airways.

Additional Information

Repeated dose toxicity	Rat - male and female - Oral - NOAEL : 250 mg/kg
	Rat - male and female - Inhalation - NOAEL : 1.6 mg/l

RTECS: GV6125000

prolonged or repeated exposure can cause:, narcosis

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	semi-static test LC50 - Oryzias latipes - 2.07 mg/l - 96 h (OECD Test Guideline 203)
Toxicity to daphnia and other aquatic invertebrates	semi-static test EC50 - Daphnia magna (Water flea) - 0.326 mg/l - 48 h
Toxicity to algae	static test EC50 - Pseudokirchneriella subcapitata (green algae) - 0.134 mg/l - 72 h

12.2 Persistence and degradability

Biodegradability	aerobic - Exposure time 28 d Result: 0 % - Not biodegradable (OECD Test Guideline 301D)

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2296 Class: 3 Packing group: II
Proper shipping name: Methylcyclohexane
Reportable Quantity (RQ):

Poison Inhalation Hazard: No

IMDG
UN number: 2296 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: METHYLCYCLOHEXANE
Marine pollutant:yes

IATA
UN number: 2296 Class: 3 Packing group: II
Proper shipping name: Methylcyclohexane

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Methylcyclohexane	108-87-2	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Methylcyclohexane	108-87-2	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Methylcyclohexane	108-87-2	1993-04-24

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity

Asp. Tox.	Aspiration hazard
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H336	May cause drowsiness or dizziness.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
Skin Irrit.	Skin irritation

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.4 Revision Date: 05/23/2016 Print Date: 06/21/2016

SAFETY DATA SHEET

Version 5.7
Revision Date 03/02/2016
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Naphthalene

Product Number : 184500
Brand : Aldrich
Index-No. : 601-052-00-2

CAS-No. : 91-20-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable solids (Category 2), H228
Acute toxicity, Oral (Category 4), H302
Carcinogenicity (Category 2), H351
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H228 Flammable solid.
H302 Harmful if swallowed.
H351 Suspected of causing cancer.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.

P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Rinse mouth.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	$C_{10}H_8C_{10}H_8$
Molecular weight	:	128.17 g/mol
CAS-No.	:	91-20-3
EC-No.	:	202-049-5
Index-No.	:	601-052-00-2

Hazardous components

Component	Classification	Concentration
Naphthalene		
	Flam. Sol. 2; Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H228, H302, H351, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Keep in suitable, closed containers for disposal. Contain spillage, pick up with an electrically protected vacuum cleaner or by wet-brushing and transfer to a container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Flammable solid hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Naphthalene	91-20-3	TWA	10 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Hemolytic anemia Upper Respiratory Tract irritation Cataract Confirmed animal carcinogen with unknown relevance to humans		

		Danger of cutaneous absorption		
		TWA	10.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Hematologic effects Upper Respiratory Tract irritation Eye irritation Eye damage Adopted values or notations enclosed are those for which changes are proposed in the NIC See Notice of Intended Changes (NIC) Not classifiable as a human carcinogen Danger of cutaneous absorption		
		STEL	15.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Hematologic effects Upper Respiratory Tract irritation Eye irritation Eye damage Adopted values or notations enclosed are those for which changes are proposed in the NIC See Notice of Intended Changes (NIC) Not classifiable as a human carcinogen Danger of cutaneous absorption		
		TWA	10.000000 ppm 50.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		
		TWA	10.000000 ppm 50.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	15.000000 ppm 75.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	10 ppm 50 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	15 ppm 75 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	10 ppm 50 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		
		TWA	10 ppm 50 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		STEL	15 ppm 75 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Naphthalene	91-20-3	1-Naphthol + 2-Naphthol			ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift (As soon as possible after exposure ceases)			

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: flakes, granules Colour: white
b)	Odour	aromatic
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 80 - 82 °C (176 - 180 °F) - lit.
f)	Initial boiling point and boiling range	218 °C (424 °F) - lit.
g)	Flash point	80.0 °C (176.0 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available

j)	Upper/lower flammability or explosive limits	Upper explosion limit: 5.9 %(V) Lower explosion limit: 0.9 %(V)
k)	Vapour pressure	1.3 hPa (1.0 mmHg) at 53.0 °C (127.4 °F) 0.04 hPa (0.03 mmHg) at 25.0 °C (77.0 °F)
l)	Vapour density	No data available
m)	Relative density	1.085 g/cm3 at 24.7 °C (76.5 °F)
n)	Water solubility	0.0308 g/l at 25 °C (77 °F) - OECD Test Guideline 105 - slightly soluble
o)	Partition coefficient: n-octanol/water	log Pow: 3.4 at 25 °C (77 °F)
p)	Auto-ignition temperature	526.0 °C (978.8 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	1.05 mm2/s at 81.5 °C (178.7 °F) -
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

Surface tension	31.8 mN/m at 100.0 °C (212.0 °F)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 490.0 mg/kg

LC50 Inhalation - Rat - male and female - 4 h - > 0.4 mg/l
(OECD Test Guideline 403)

LD50 Dermal - Rabbit - 20,000 mg/kg

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation - 24 h

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Mild eye irritation

Respiratory or skin sensitisation
Maximisation Test - Guinea pig
Result: Does not cause skin sensitisation.
(OECD Test Guideline 406)

Germ cell mutagenicity
Ames test
S. typhimurium
Result: negative

Rat - male
Result: negative

Carcinogenicity

Carcinogenicity - Rat - male and female - inhalation (vapour)
Tumorigenic:Tumors at site or application.

IARC:	2B - Group 2B: Possibly carcinogenic to humans (Naphthalene)
NTP:	Reasonably anticipated to be a human carcinogen (Naphthalene)
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information

Repeated dose toxicity	Rat - male and female - Oral - NOAEL : 100 mg/kg - LOAEL : 400 mg/kg - OECD Test Guideline 408

RTECS: QJ0525000

Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer., Naphthalene is retinotoxic and systemic absorption of its vapors above 15ppm, may result in:, cataracts, optic neuritis, corneal injury, Eye irritation, Ingestion may provoke the following symptoms:, hemolytic anemia, hemoglobinuria, Nausea, Headache, Vomiting, Gastrointestinal disturbance, Convulsions, anemia, Kidney injury may occur., Seizures., Coma.

Heart -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	flow-through test LC50 - Pimephales promelas (fathead minnow) - 7.9 mg/l - 96 h (OECD Test Guideline 203)
Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Daphnia magna (Water flea) - 2.16 mg/l - 48 h

12.2 Persistence and degradability

Biodegradability	aerobic - Exposure time 28 d

Result: 2 % - Not readily biodegradable.

12.3 Bioaccumulative potential

Bioaccumulation Fish

Bioconcentration factor (BCF): 427 - 1,158

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1334 Class: 4.1 Packing group: III
Proper shipping name: Naphthalene, crude
Reportable Quantity (RQ): 100 lbs
Marine pollutant:yes
Poison Inhalation Hazard: No

IMDG

UN number: 1334 Class: 4.1 Packing group: III EMS-No: F-A, S-G
Proper shipping name: NAPHTHALENE, CRUDE
Marine pollutant:yes

IATA

UN number: 1334 Class: 4.1 Packing group: III
Proper shipping name: Naphthalene, crude

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Naphthalene	91-20-3	2007-07-01

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Naphthalene	91-20-3	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Naphthalene	91-20-3	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Naphthalene	91-20-3	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Naphthalene	91-20-3	1990-01-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
Flam. Sol.	Flammable solids
H228	Flammable solid.
H302	Harmful if swallowed.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	2
Physical Hazard	2

NFPA Rating

Health hazard:	2
Fire Hazard:	2
Reactivity Hazard:	2

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.7 Revision Date: 03/02/2016 Print Date: 05/01/2016

SAFETY DATA SHEET

Version 5.5
Revision Date 06/02/2016
Print Date 06/21/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : *o*-Xylene

Product Number : 95660
Brand : Sigma-Aldrich
Index-No. : 601-022-00-9

CAS-No. : 95-47-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 3), H226
Acute toxicity, Inhalation (Category 4), H332
Acute toxicity, Dermal (Category 4), H312
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Aspiration hazard (Category 1), H304
Acute aquatic toxicity (Category 3), H402
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

H226	Flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H312 + H332	Harmful in contact with skin or if inhaled
H315	Causes skin irritation.
H319	Causes serious eye irritation.

H335	May cause respiratory irritation.
H412	Harmful to aquatic life with long lasting effects.

Precautionary statement(s)

P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P331	Do NOT induce vomiting.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	:	1,2-Dimethylbenzene
Formula	:	C_8H_{10}
Molecular weight	:	106.17 g/mol
CAS-No.	:	95-47-6
EC-No.	:	202-422-2
Index-No.	:	601-022-00-9

Hazardous components

Component	Classification	Concentration
o-Xylene		
	Flam. Liq. 3; Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; Asp. Tox. 1; Aquatic Acute 3; Aquatic Chronic 3; H226, H304, H312 + H332, H315, H319, H335, H412	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
o-Xylene	95-47-6	TWA	100.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Eye & Upper Respiratory Tract irritation Central Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen		
		STEL	150.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Eye & Upper Respiratory Tract irritation Central Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen		
		TWA	100.000000 ppm 435.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	100.000000 ppm 435.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	150.000000 ppm 655.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	100.000000 ppm 435.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		
		TWA	100.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Upper Respiratory Tract irritation Eye irritation Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen		
		STEL	150.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment		

		Upper Respiratory Tract irritation Eye irritation Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen		
		TWA	100 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Upper Respiratory Tract irritation Eye irritation Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen		
		STEL	150 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Upper Respiratory Tract irritation Eye irritation Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen		
		TWA	100 ppm 435 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
o-Xylene	95-47-6	Methylhippuric acids	1,500.0000 mg/g	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift (As soon as possible after exposure ceases)			
		Methylhippuric acids	1.5g/g creatinine	Urine	ACGIH - Biological Exposure Indices (BEI)
		End of shift (As soon as possible after exposure ceases)			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Nitrile rubber

Minimum layer thickness: 0.4 mm
Break through time: 30 min
Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -26 - -23 °C (-15 - -9 °F) - lit.
f)	Initial boiling point and boiling range	143 - 145 °C (289 - 293 °F) - lit.
g)	Flash point	31.0 °C (87.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 6.7 %(V) Lower explosion limit: 0.9 %(V)
k)	Vapour pressure	21.3 hPa (16.0 mmHg) at 37.7 °C (99.9 °F)
l)	Vapour density	No data available
m)	Relative density	0.879 g/mL at 20 °C (68 °F)
n)	Water solubility	0.1705 g/l at 25 °C (77 °F) - partly soluble
o)	Partition coefficient: n-octanol/water	log Pow: 3.12 at 20 °C (68 °F)
p)	Auto-ignition temperature	464.0 °C (867.2 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available

s) Explosive properties No data available

t) Oxidizing properties No data available

9.2 Other safety information

Surface tension 29.8 mN/m at 25.0 °C (77.0 °F)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

LC50 Inhalation - Rat - male - 6 h - 18,800 mg/m3

Dermal: No data available

LD50 Intraperitoneal - Mouse - 1,364 mg/kg

Skin corrosion/irritation
Skin - Rabbit
Result: Irritating to skin. - 24 h

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
- Mouse
Result: Does not cause skin sensitisation.
(OECD Test Guideline 429)

Germ cell mutagenicity
Ames test
Salmonella typhimurium
Result: negative

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (o-Xylene)

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
May be fatal if swallowed and enters airways.

Additional Information
RTECS: ZE2450000

narcosis, Lung irritation, chest pain, pulmonary edema, Central nervous system depression, Dermatitis, Gastrointestinal disturbance, Liver injury may occur., Kidney injury may occur., Blood disorders

Nerves. -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Lepomis macrochirus (Bluegill) - 16.10 mg/l - 96 h

12.2 Persistence and degradability

Biodegradability	aerobic - Exposure time 28 d Result: 69.67 % - Not readily biodegradable. (OECD Test Guideline 301F) Remarks: The 10 day time window criterion is not fulfilled.

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Contact a licensed professional waste disposal service to dispose of this material. Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1307 Class: 3 Packing group: III
Proper shipping name: Xylenes
Reportable Quantity (RQ): 100 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1307 Class: 3 Packing group: III EMS-No: F-E, S-D
Proper shipping name: XYLENES

IATA
UN number: 1307 Class: 3 Packing group: III
Proper shipping name: Xylenes

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
o-Xylene	95-47-6	2007-07-01

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
o-Xylene	95-47-6	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
o-Xylene	95-47-6	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
o-Xylene	95-47-6	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Asp. Tox.	Aspiration hazard
Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquids
H226	Flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H312	Harmful in contact with skin.

H312 + H332	Harmful in contact with skin or if inhaled
H315	Causes skin irritation.
H319	Causes serious eye irritation.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.5 Revision Date: 06/02/2016 Print Date: 06/21/2016

SAFETY DATA SHEET

Version 5.4
Revision Date 03/02/2015
Print Date 06/20/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Phenanthrene

Product Number : P11409
Brand : Aldrich

CAS-No. : 85-01-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)
H302 Harmful if swallowed.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.

P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P312	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312	Call a POISON CENTER or doctor/ physician if you feel unwell.
P321	Specific treatment (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Photosensitizer.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	$C_{14}H_{10}$
Molecular weight	:	178.23 g/mol
CAS-No.	:	85-01-8
EC-No.	:	201-581-5

Hazardous components

Component	Classification	Concentration
Phenanthrene		
	Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 1; H302, H315, H319, H335, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.Normal measures for preventive fire protection.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Handle and store under inert gas.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Phenanthrene	85-01-8	TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Remarks	1910.1002 As used in §1910.1000 (Table Z-1), coal tar pitch volatiles include		

		the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter. Asphalt (CAS 8052-42-4, and CAS 64742-93-4) is not covered under the 'coal tar pitch volatiles' standard OSHA specifically regulated carcinogen		
		TWA	0.100000 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen NIOSH considers coal tar, coal tar pitch, and creosote to be coal tar products. cyclohexane-extractable fraction See Appendix C See Appendix A		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Phenanthrene	85-01-8	1-Hydroxypyrene (1-HP)		Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 98 - 100 °C (208 - 212 °F)
f)	Initial boiling point and boiling range	340 °C (644 °F)
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	1.063 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 4.57
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Mouse - 700.0 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
Causes photosensitivity. Exposure to light can result in allergic reactions resulting in dermatologic lesions, which can vary from sunburnlike responses to edematous, vesiculated lesions, or bullae

Germ cell mutagenicity
No data available

Carcinogenicity

IARC:	3 - Group 3: Not classifiable as to its carcinogenicity to humans (Phenanthrene)
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 3.2 mg/l - 96.0 h
	LC100 - other fish - 1.5 mg/l - 1.0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.86 mg/l - 24 h
	EC50 - Daphnia magna (Water flea) - 0.38 mg/l - 48 h
Toxicity to algae	EC50 - Chlorella vulgaris (Fresh water algae) - 1.20 mg/l - 3 h

12.2 Persistence and degradability

Biodegradability Result: 55 - 95 % - Partially biodegradable.

12.3 Bioaccumulative potential

Bioaccumulation Pimephales promelas (fathead minnow) - 28 d
- 0.00255 mg/l

Bioconcentration factor (BCF): 5,100

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Phenanthrene)
Reportable Quantity (RQ): 5000 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Phenanthrene)
Marine pollutant:yes

IATA

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Phenanthrene)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Phenanthrene	85-01-8	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Phenanthrene	85-01-8	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Phenanthrene	85-01-8	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Phenanthrene	85-01-8	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Phenanthrene	85-01-8	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Eye Irrit.	Eye irritation
H302	Harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H400	Very toxic to aquatic life.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling

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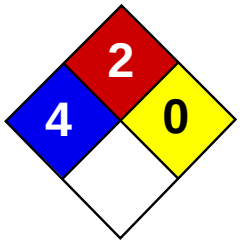
Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.4 Revision Date: 03/02/2015 Print Date: 06/20/2016



Material Safety Data Sheet
Phenol MSDS

Section 1: Chemical Product and Company Identification

Product Name: Phenol

Catalog Codes: SLP4453, SLP5251

CAS#: 108-95-2

RTECS: SJ3325000

TSCA: TSCA 8(b) inventory: Phenol

CI#: Not available.

Synonym: Monohydroxybenzene; Benzenol; Phenyl hyroxide; Phenylic acid

Chemical Name: Carbolic Acid

Chemical Formula: C6H5OH

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Phenol	108-95-2	100

Toxicological Data on Ingredients: Phenol: ORAL (LD50): Acute: 317 mg/kg [Rat]. 270 mg/kg [Mouse]. DERMAL (LD50): Acute: 630 mg/kg [Rabbit]. 669 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (sensitizer, permeator). The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated

exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 715°C (1319°F)

Flash Points: CLOSED CUP: 79°C (174.2°F). OPEN CUP: 85°C (185°F).

Flammable Limits: LOWER: 1.7% UPPER: 8.6%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Phenol + nitrides results in heat and flammable gas generation. Phenol + mineral oxdizing acids results in fire. Phenol + calcium hypochlorite is an exothermic reaction producing toxic fumes which may ignite.

Special Remarks on Explosion Hazards:
Phenol + sodium nitrite causes explosion on heating. Peroxydisulfuric acid + phenol causes explosion.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Corrosive solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Air Sensitive. Sensitive to light. Store in light-resistant containers. Moisture sensitive. Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 5 (ppm) from ACGIH (TLV) [United States] SKIN TWA: 19 (mg/m3) from ACGIH (TLV) [United States] SKIN TWA: 5 from NIOSH [United States] TWA: 19 (mg/m3) from NIOSH [United States] TWA: 5 (ppm) from OSHA (PEL) [United States] TWA: 19 (mg/m3) from OSHA (PEL) [United States] TWA: 5 (ppm) [Canada] TWA: 19 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor:
Distinct, aromatic, somewhat sickening sweet and acrid

Taste: Burning.

Molecular Weight: 94.11 g/mole

Color: Colorless to light pink

pH (1% soln/water): Not available.

Boiling Point: 182°C (359.6°F)

Melting Point: 42°C (107.6°F)

Critical Temperature: 694.2 (1281.6°F)

Specific Gravity: 1.057 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 3.24 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.048 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 1.5

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:
Easily soluble in methanol, diethyl ether. Soluble in cold water, acetone. Solubility in water: 1g/15 ml water. Soluble in benzene. Very soluble in alcohol, chloroform, glycerol, petroleum, carbon disulfide, volatile and fixed oils, aqueous alkali hydroxides, carbon tetrachloride, acetic acid, liquid sulfur dioxide. Almost insoluble in petroleum ether. Miscible in acetone. Sparingly soluble in mineral oil.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks), light, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity:
Extremely corrosive in presence of copper. Slightly corrosive in presence of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass, of aluminum.

Special Remarks on Reactivity:
Air and light sensitive. Prone to redden on exposure to light and air. Incompatible with aluminum chloride, peroxydisulfuirc acid, acetaldehyde, sodium nitrite, boron trifluoride diethyl ether + 1,3-butadiene, isocyanates, nitrides, mineral oxidizing acids, calcium hypochlorite, halogens, formaldehyde, metals and alloys, lead, zinc, magnesium and their alloys, plastics, rubber, coatings, sodium nitrate + trifluoroacetic acid. Phenol + isocyanates results in heat generation, and violent polymerization. Phenol + 1,3-butadiene and boron trifluoride diethyl ether complex results in intense exothermic reaction. Phenol + acetaldehyde resultes in violent condensation.

Special Remarks on Corrosivity:
Minor corrosive effect on bronze. Severe corrosive effect on brass.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 270 mg/kg [Mouse]. Acute dermal toxicity (LD50): 630 mg/kg [Rabbit].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, central nervous system (CNS).

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (corrosive, irritant), of ingestion, . Hazardous in case of skin contact (sensitizer, permeator), of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose: LDL [Human] - Route: Oral; Dose: 140 mg/kg LDL [Infant] - Route: Oral; Dose: 10,000 mg/kg

Special Remarks on Chronic Effects on Humans:
Animal: passes through the placental barrier. May cause adverse reproductive effects and birth defects (teratogenic) Embryotoxic and/or foetotoxic in animal. May affect genetic material (mutagenic).

Special Remarks on other Toxic Effects on Humans:

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 125 mg/l 24 hours [Fish (Goldfish)]. >50 mg/l 1 hours [Fish (Fathead minnow)]. >50 mg/l 24 hours [Fish (Fathead minnow)]. >33 mg/l 72 hours [Fish (Fathead minnow)]. >33 ppm 96 hours [Fish (Fathead minnow)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Phenol, solid UNNA: 1671 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Phenol Illinois toxic substances disclosure to employee act: Phenol Illinois chemical safety act: Phenol New York release reporting list: Phenol Rhode Island RTK hazardous substances: Phenol Pennsylvania RTK: Phenol Minnesota: Phenol Massachusetts RTK: Phenol Massachusetts spill list: Phenol New Jersey: Phenol New Jersey spill list: Phenol Louisiana RTK reporting list: Phenol Louisiana spill reporting: Phenol TSCA 8(b) inventory: Phenol TSCA 4(a) proposed test rules: Phenol TSCA 8(a) IUR: Phenol TSCA 8(d) H and S data reporting: Phenol: effective: 6/1/87; sunset:

6/01/97 SARA 302/304/311/312 extremely hazardous substances: Phenol SARA 313 toxic chemical notification and release reporting: Phenol CERCLA: Hazardous substances.: Phenol: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive solid.

DSCL (EEC):
R24/25- Toxic in contact with skin and if swallowed. R34- Causes burns. R40- Possible risks of irreversible effects. R43- May cause sensitization by skin contact. R52- Harmful to aquatic organisms. S1/2- Keep locked up and out of the reach of children. S24- Avoid contact with skin. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S28- After contact with skin, wash immediately with plenty of water S37/39- Wear suitable gloves and eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label. S56- Dispose of this material and its container at hazardous or special waste collection point.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 2

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 4

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 11:17 AM

Last Updated: 05/21/2013 12:00 PM

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Monsanto
Material Safety Data

POLYCHLORINATED BIPHENYLS (PCBs)

Emergency Phone No.
(Call Collect)
314-694-1000

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: POLYCHLORINATED BIPHENYLS (PCBs)
Aroclor® Series 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, 1268
Therminol® FR Series

MSDS Number: M00018515 Date: 12/95

Chemical Family:	Chlorinated Hydrocarbons
Chemical Name:	Polychlorinated biphenyls
Synonyms:	PCBs, Chlorodiphenyls, Chlorinated biphenyls

Trade Names/Common Names:

PYRANOL® and INERTEEN® are trade names for commonly used dielectric fluids that may have contained varying amounts of PCBs as well as other components including chlorinated benzenes.

ASKAREL is the generic name for a broad class of fire resistant synthetic chlorinated hydrocarbons and mixtures used as dielectric fluids that commonly contained about 30 - 70% PCBs. Some ASKAREL fluids contained 99% or greater PCBs and some contained no PCBs.

PYDRAUL® is the trade name for hydraulic fluids that, prior to 1972, may have contained varying amounts of PCBs and other components including phosphate esters.

The product names/trade names are representative of several commonly used Monsanto products (or products formulated with Monsanto products). Other trademarked PCB products were marketed by Monsanto and other manufacturers. PCBs were also manufactured and sold by several European and Japanese companies. Contact the manufacturer of the trademarked product, if not in this listing, to determine if the formulation contained PCBs.

In 1972, Monsanto restricted sales of PCBs to applications involving only closed electrical systems, (transformers and capacitors). In 1977, all manufacturing and sales were voluntarily terminated. In 1979, EPA restricted the manufacture, processing, use, and distribution of PCBs to specifically exempted and authorized activities.

MONSANTO COMPANY, 800 N. LINDBERGH BLVD., ST. LOUIS, MO 63167

FOR CHEMICAL EMERGENCY, SPILL, LEAK, FIRE, EXPOSURE, OR ACCIDENT
Call CHEMTREC - Day or Night - 1-800-424-9300 Toll free in the continental U.S., Hawaii, Puerto Rico, Canada, Alaska, or Virgin Islands. For calls originating elsewhere: 202-483-7616 (collect calls accepted)

For additional nonemergency information, call: 314-694-3344.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemically, commercial PCBs are defined as a series of technical mixtures, consisting of many isomers and compounds that vary from mobile, oily liquids to white crystalline solids and hard noncrystalline resins. Technical products vary in composition, in the degree of chlorination, and possibly according to batch.

The mixtures generally used contain an average of 3 atoms of chlorine per molecule (42% chlorine) to 5 atoms of chlorine per module (54% chlorine). They were used as components of dielectric fluids in transformers and capacitors. Prior to 1972, PCB applications included heat transfer media, hydraulic, and other industrial fluids, plasticizers, carbonless copy paper, paints, inks, and adhesives.

Component	CAS No.
chlorinated biphenyl	1336-36-3
Aroclor 1016	12674-11-2
Aroclor 1221	11104-28-2
Aroclor 1232	11141-16-5
Aroclor 1242	53469-21-9
Aroclor 1248	12672-29-6
Aroclor 1254	11097-69-1
Aroclor 1260	11096-82-5
Aroclor 1262	37324-23-5
Aroclor 1268	11100-14-4

There are also CAS Numbers for individual PCB congeners and for mixtures of Aroclor® products.

PCBs are identified as hazardous chemicals under criteria of the OSHA Hazard Communication Standard (29 CFR Part 1910.1200). PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1987)-Group 2A and in the National Toxicology Program (NTP) Annual Report on Carcinogens (Seventh).

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Appearance and Odor: PCB mixtures range in form and color from clear to amber liquids to white crystalline solids. They have a mild, distinctive odor and are not volatile at room temperature. Refer to Section 9 for details.

WARNING!
CAUSES EYE IRRITATION
MAY CAUSE SKIN IRRITATION

PROCESSING AT ELEVATED TEMPERATURES MAY RELEASE VAPORS OR FUMES WHICH MAY CAUSE RESPIRATORY TRACT IRRITATION

POTENTIAL HEALTH EFFECTS

Likely Routes of Exposure: Skin contact and inhalation of heated vapors

Eye Contact: Causes moderate irritation based on worker experience.

Skin Contact: Prolonged or repeated contact may result in redness, dry skin and defatting based on human experience. A potential exists for developing chloracne. PCBs can be absorbed through intact skin.

Inhalation: Due to the low volatility of PCBs, exposure to this material in ambient conditions is not expected to produce adverse health effects. However, at elevated processing temperatures, PCBs may produce a vapor that may cause respiratory tract irritation if inhaled based on human experience.

Ingestion: No more than slightly toxic based on acute animal toxicity studies. Coughing, choking and shortness of breath may occur if liquid material is accidentally drawn into the lungs during swallowing or vomiting.

Other: Numerous epidemiological studies of humans, both occupationally exposed and nonworker environmentally exposed populations, have not demonstrated any causal relationship between PCB exposure and chronic human illnesses such as cancer or neurological or cardiovascular effects. PCBs at high dosage can cause skin symptoms; however, these subside upon removal of the exposure source.

Refer to Section 11 for toxicological information.

4. FIRST AID MEASURES

IF IN EYES, immediately flush with plenty of water for at least 15 minutes. If easy to do, remove any contact lenses. Get medical attention. Remove material from skin and clothing.

IF ON SKIN, immediately flush the area with plenty of water. Wash skin gently with soap as soon as it is available. Get medical attention if irritation persists.

IF INHALED, remove person to fresh air. If breathing is difficult, get medical attention.

IF SWALLOWED, do NOT induce vomiting. Rinse mouth with water. Get medical attention. Contact a Poison Control Center. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

NOTE TO PHYSICIANS: Hot PCBs may cause thermal burn. If electrical equipment arcs between conductors, PCBs or other chlorinated hydrocarbon dielectric fluids may decompose to produce hydrochloric acid (HCl), a respiratory irritant. If large amounts are swallowed, gastric lavage may be considered.

5. FIRE FIGHTING MEASURES

Flash Point: 284 degrees F (140 degrees C) or higher depending on the chlorination level of the Aroclor product

Fire Point: 349 degrees F (176 degrees C) or higher depending on the chlorination level of the Aroclor product

NOTE: Refer to Section 9 for individual flash points and fire points.

Extinguishing Media: Extinguish fire using agent suitable for surrounding fire. Use dry chemical, foam, carbon dioxide or water spray. Water may be ineffective. Use water spray to keep fire-exposed containers or transformer cool.

PCBs are fire-resistant compounds. They may decompose to form CO, CO2, HCl, phenolics, aldehydes, and other toxic combustion products under severe conditions such as exposure to flame or hot surfaces.

Dielectric fluids having PCBs and chlorinated benzenes as components have been reported to produce polychlorinated dibenzo-p-dioxins (PCDDs) and furans (PCDFs) during fire situations involving electrical equipment. At temperatures in the range of 600-650 degrees C in the presence of excess oxygen, PCBs may form polychlorinated dibenzofurans (PCDFs). Laboratory studies under similar conditions have demonstrated that PCBs do not produce polychlorinated dibenzo-p-dioxins (PCDDs).

Federal regulations require all PCB transformers to be registered with fire response personnel.

If a PCB transformer is involved in a fire-related incident, the owner of the transformer may be required to report the incident. Consult and follow appropriate federal, state and local regulations.

Fire Fighting Equipment: Fire fighters and others exposed to products of combustion should wear self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

6. ACCIDENTAL RELEASE MEASURES

Cleanup and disposal of liquid PCBs and other PCB items are strictly regulated by the federal government. The regulations are found at 40 CFR Part 761. Consult these regulations as well as applicable state and local regulations prior to any cleanup or disposal of PCBs, PCB items, or PCB contaminated items.

If PCBs leak or are spilled, the following steps should be taken immediately:

All nonessential personnel should leave the leak or spill area.

The area should be adequately ventilated to prevent the accumulation of vapors.

The spill/leak should be contained. Loss to sewer systems, navigable waterways, and streams should be prevented. Spills/leaks should be removed promptly by means of absorptive material, such as sawdust, vermiculite, dry sand, clay, dirt or other similar materials, or trapped and removed by pumping or other suitable means (traps, drip-pans, trays, etc.).

Personnel entering the spill or leak area should be furnished with appropriate personal protective equipment and clothing as needed. Refer to Section 8 for personal protection equipment and clothing.

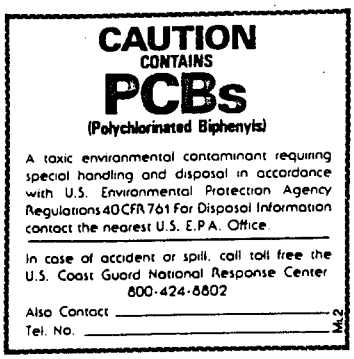
Personnel trained in emergency procedures and protected against attendant hazards should shut off sources of PCBs, clean up spills, control and repair leaks, and fight fires in PCB areas.

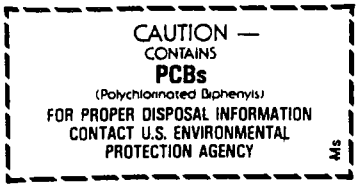
Refer to Section 13 for disposal information and Sections 14 and 15 for information regarding reportable quantity, and Section 7 for marking information.

7. HANDLING AND STORAGE

Care should be taken to prevent entry into the environment through spills, leakage, use vaporization, or disposal of liquid or containers. Avoid prolonged breathing of vapors or mists. Avoid contact with eyes or prolonged contact with skin. If skin contact occurs, remove by washing with soap and water. Following eye contact, flush with water. In case of spillage onto clothing, the clothing should be removed as soon as practical, skin washed, and clothing laundered. Comply with all federal, state, and local regulations.

Federal regulations under the Toxic Substances Control Act require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be marked (check regulations, 40 CFR 761, for details).





Storage: The storage of PCB items or equipment (those containing 50 ppm or greater PCBs) and PCB waste is strictly regulated by 40 CFR Part 761. The storage time is limited, the storage area must meet physical requirements, and the area must be labeled.

Avoid contact with eyes.
Wash thoroughly after handling.
Avoid breathing processing fumes or vapors.
Process using adequate ventilation.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection: Wear chemical splash goggles and have eye baths available where there is significant potential for eye contact.

Skin Protection: Wear appropriate protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine the appropriate type glove for a given application. Wear chemical goggles, face shield, and chemical resistant clothing such as a rubber apron when splashing is likely. Wash immediately if skin is contacted. Remove contaminated clothing promptly and launder before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling.

ATTENTION! Repeated or prolonged skin contact may cause chloracne in some people.

Respiratory Protection: Avoid breathing vapor, mist, or dust. Use NIOSH/MSHA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended when airborne exposure limits are exceeded and, if used, replaces the need for face shield and/or chemical splash goggles. Consult respirator manufacturer to determine the type of equipment for a given application. The respirator use limitations specified by NIOSH/MSHA or the manufacturer must be observed. High airborne concentrations may require use of self-contained breathing apparatus or supplied air respirator. Respiratory protection programs must be in compliance with 29 CFR Part 1910.134.

ATTENTION! Repeated or prolonged inhalation may cause chloracne in some people.

Ventilation: Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of vapor or mist, such as open process equipment.

Airborne Exposure Limits:

Product: Chlorodiphenyl (42% chlorine)

OSHA PEL: 1 mg/m^3 8-hour time-weighted average - Skin*
ACGIH TLV: 1 mg/m^3 8-hour time-weighted average - Skin*

Product: Chlorodiphenyl (54% chlorine)

OSHA PEL: 0.5 mg/m^3 8-hour time-weighted average - Skin*
ACGIH TLV: 0.5 mg/m^3 8-hour time-weighted average - Skin*

*For Skin notation see Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Government Industrial Hygienists, 1995-1996.

9. PHYSICAL AND CHEMICAL PROPERTIES

PROPERTIES OF SELECTED AROCLORS*							
PROPERTY	**1016**	**1221**	**1232**	**1242**	**1248**	**1254**	**1260**
Color (APHA)	40	100	100	100	100	100	150
Physical state	mobile oil	mobile oil	mobile oil	mobile oil	mobile oil	viscous liquid	sticky resin
Stability	inert	inert	inert	inert	inert	inert	inert
Density (lb/gal 25°C)	11.40	9.85	10.55	11.50	12.04	12.82	13.50
Specific gravity x/15.5°C	1.36-1.37 x-25°	1.18-1.19 x-25°	1.27-1.28 x-25°	1.30-1.39 x-25°	1.40-1.41 x-65°	1.49-1.50 x-65°	1.55-1.56 x-90°
Distillation range (°C)	323-356	275-320	290-325	325-366	340-375	365-390	385-420
Acidity mg KOH/g, maximum	.010	.014	.014	.015	.010	.010	.014
Fire point (°C)	none to boiling point	176	238	none to boiling point	none to boiling point	none to boiling point	none to boiling point
Flash point (°C)	170	141-150	152-154	176-180	193-196	none	none
Vapor pressure (mm Hg @ 100°F)	NA	NA	0.005	0.001	0.00037	0.00006	NA
Viscosity (Saybolt Univ. Sec. @ 100°F) (centistokes)	71-81 13-16	38-41 3.6-4.6	44-51 5.5-7.7	82-92 16-19	185-240 42-52	1800-2500 390-540	— —

*NA—*Not Available*

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

10. STABILITY AND REACTIVITY

Stability: PCBs are very stable, fire-resistant compounds.
Materials to Avoid: None
Hazardous Decomposition
Products: PCBs may decompose to form CO, CO_2, HCl, phenolics, aldehydes, and other toxic combustion products under severe conditions such as exposure to flame or hot surface.
Hazardous Polymerization: Does not occur.

11. TOXICOLOGICAL INFORMATION

Data from laboratory studies conducted by Monsanto and from the available scientific literature are summarized below.
Single exposure (acute) studies indicate:
Oral - Slightly Toxic (Rat LD50 - 8.65 g/kg for 42% chlorinated; 11.9 g/kg for 54% chlorinated)

The liquid products and their vapors are moderately irritating to eye tissues. Animal experiments of varying duration and at different air concentrations show that for similar exposure conditions, the 54% chlorinated material produces more liver injury than the 42% chlorinated material.

There are literature reports that PCBs can impair reproductive functions in monkeys. The National Cancer Institute (NCI) performed a study in 1977 using Aroclor 1254 with both sexes of rats. NCI stated that the PCB, Aroclor 1254, was not carcinogenic under the conditions of their bioassay. There is sufficient evidence in the scientific literature to conclude that Aroclor 1260 can cause liver cancer when fed to rodents at high doses. Similar experiments with less chlorinated PCB products have produced negative or equivocal results.

The consistent finding in animal studies is that PCBs produce liver injury following prolonged and repeated exposure by any route, if the exposure is of sufficient degree and duration. Liver injury is produced first, and by exposures that are less than those reported to cause cancer in rodents. Therefore, exposure by all routes should be kept sufficiently low to prevent liver injury.

Numerous epidemiological studies of humans, both occupationally exposed and nonworker environmentally exposed population, have not demonstrated any causal relationship between PCB exposure and chronic human illnesses such as cancer or neurological or cardiovascular effects. PCBs at high dosage can cause skin symptoms; however, these subside upon removal of the exposure source.

PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1987)-Group 2A and in the National Toxicology Program (NTP) Seventh Annual Report on Carcinogens.

12. ECOLOGICAL INFORMATION

Care should be taken to prevent entry of PCBs into the environment through spills, leakage, use, vaporization or disposal of liquid or solids. PCBs can accumulate in the environment and can adversely affect some animals and aquatic life. In general, PCBs have low solubility in water, are strongly bound to soils and sediments, and are slowly degraded by natural processes in the environment.

13. DISPOSAL CONSIDERATIONS

The disposal of PCB items or equipment (those containing 50 ppm or greater PCBs) and PCB wastes is strictly regulated by 40 CFR Part 761. For example, all wastes and residues containing PCBs (wiping cloths, absorbent material, used disposable protective gloves and clothing, etc.) should be collected, placed in proper containers, marked and disposed of in the manner prescribed by EPA regulations (40 CFR Part 761) and applicable state and local regulations.

14. TRANSPORT INFORMATION

The data provided in this section are for information only. Please apply the appropriate regulations to properly classify a shipment for transportation.

DOT Classification:	IF WEIGHT OF PCBs TO BE SHIPPED IS OVER ONE POUND, THE FOLLOWING CLASSIFICATION AND LABEL APPLY.	
DOT Label:	LIQUID:	Environmentally Hazardous Substance, liquid, n.o.s. (Contains PCB), 9, UN 3082, III
	SOLID:	Environmentally Hazardous Substance, solid, n.o.s. (Contains PCB), 9, UN 3077, III
DOT Label:	Class: 9	
DOT Reportable Quantity:	One Pound	
IMO Classification:	Polychlorinated Biphenyls, IMO Class 9, UN 2315, II IMO Page 9034, EMS 6.1-02	
IATA/ICAO Classification:	Polychlorinated Biphenyls, 9, UN2315, II	

15. REGULATORY INFORMATION

For regulatory purposes, under the Toxic Substances Control Act, the term "PCBs" refers to a chemical substance limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contain such a substance (40 CFR Part 761).

TSCA Inventory: not listed.

Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370): Immediate, Delayed.
SARA Section 313 Toxic Chemical(s): Listed-1993 (De Minimis concentration 0.1%.)

Reportable Quantity (RQ) under DOT (49 CFR) and CERCLA Regulations: 1 lb. (polychlorinated biphenyls) PCBs.

Release of more than 1 (one) pound of PCBs to the environment requires notification to the National Response Center (800-424-8802 or 202-426-2675).

Various state and local regulations may require immediate reporting of PCB spills and may also define spill cleanup levels. Consult your attorney or appropriate regulatory officials for information relating to spill reporting and spill cleanup.

16. OTHER INFORMATION

Reason for revision: Conversion to the 16 section format. Supersedes MSDS dated 10/88.

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Inerteen® is a registered trademark of Westinghouse Electric Corporation

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SAFETY DATA SHEET

Version 4.8
Revision Date 08/11/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Pyrene

Product Number : 571245
Brand : Aldrich

CAS-No. : 129-00-0

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Germ cell mutagenicity (Category 2), H341
Specific target organ toxicity - repeated exposure (Category 1), Blood, H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H341 Suspected of causing genetic defects.
H372 Causes damage to organs (Blood) through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.

P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Rapidly absorbed through skin.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : Benzo[def]phenanthrene

Formula : $C_{16}H_{10}$

Molecular weight : 202.25 g/mol

CAS-No. : 129-00-0

EC-No. : 204-927-3

Hazardous components

Component	Classification	Concentration
Pyrene		
	Muta. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H341, H372, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Pyrene	129-00-0	TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Remarks	1910.1002 As used in §1910.1000 (Table Z-1), coal tar pitch volatiles include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter. Asphalt (CAS 8052-42-4, and CAS 64742-93-4) is not covered under the 'coal tar pitch volatiles' standard OSHA specifically regulated carcinogen		
		TWA	0.100000 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen		

		NIOSH considers coal tar, coal tar pitch, and creosote to be coal tar products. cyclohexane-extractable fraction See Appendix C See Appendix A

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Pyrene	129-00-0	1-Hydroxypyrene (1-HP)		Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 480 min
Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 30 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: yellow
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 145 - 148 °C (293 - 298 °F) - lit.
f)	Initial boiling point and boiling range	390.0 - 395.0 °C (734.0 - 743.0 °F)
g)	Flash point	> 200.0 °C (> 392.0 °F)
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	1.21 g/cm3
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 4.88
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

Bulk density	650 kg/m3

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Risk of dust explosion.

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 2,700 mg/kg
Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Conjunctive irritation. Behavioral:Excitement. Behavioral:Muscle contraction or spasticity.

LC50 Inhalation - Rat - 170.0 mg/m3
Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Conjunctive irritation. Behavioral:Excitement. Behavioral:Muscle contraction or spasticity.

Dermal: No data available

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Mild skin irritation - 24 h

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Mild eye irritation

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
Laboratory experiments have shown mutagenic effects. In vitro tests showed mutagenic effects

Ames test
Result: positive

Mutation in mammalian somatic cells.
mouse lymphoma cells
Result: positive

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	3 - Group 3: Not classifiable as to its carcinogenicity to humans (Pyrene)
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	OSHA specifically regulated carcinogen (Pyrene)

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Causes damage to organs through prolonged or repeated exposure. - Blood

Aspiration hazard
No data available

Additional Information
RTECS: UR2450000

Inhalation studies in animals have caused:, Liver toxicity, pulmonary pathologies, intragastric pathologies, neutropenia, leukopenia, anemia, Contact with skin can cause:, hyperemia, weight loss, hematopoietic changes, Dermatitis, Chronic effects, leukocytosis

Kidney -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - > 2 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.002 - 0.003 mg/l - 48 h

12.2 Persistence and degradability

12.3 Bioaccumulative potential

Bioaccumulation other fish - 48 h
- 0.056 mg/l

Bioconcentration factor (BCF): 4,810

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

Avoid release to the environment.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Pyrene)
Reportable Quantity (RQ): 5000 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Pyrene)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Pyrene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
The following components are subject to reporting levels established by SARA Title III, Section 302:

	CAS-No.	Revision Date
Pyrene	129-00-0	2008-11-03

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Pyrene	129-00-0	2008-11-03

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Pyrene	129-00-0	2008-11-03

New Jersey Right To Know Components

	CAS-No.	Revision Date
Pyrene	129-00-0	2008-11-03

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Pyrene	129-00-0	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H341	Suspected of causing genetic defects.
H372	Causes damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
Muta.	Germ cell mutagenicity

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the

product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.8 Revision Date: 08/11/2015 Print Date: 05/01/2016

SAFETY DATA SHEET

Version 4.7
Revision Date 11/13/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Selenium

Product Number : 209651
Brand : Aldrich
Index-No. : 034-001-00-2

CAS-No. : 7782-49-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 3), H301
Acute toxicity, Inhalation (Category 3), H331
Specific target organ toxicity - repeated exposure (Category 2), H373
Chronic aquatic toxicity (Category 4), H413

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H301 + H331 Toxic if swallowed or if inhaled
H373 May cause damage to organs through prolonged or repeated exposure.
H413 May cause long lasting harmful effects to aquatic life.

Precautionary statement(s)
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P273 Avoid release to the environment.

P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician. Rinse mouth.
P304 + P340 + P311	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician.
P314	Get medical advice/ attention if you feel unwell.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Se
Molecular weight	:	78.96 g/mol
CAS-No.	:	7782-49-2
EC-No.	:	231-957-4
Index-No.	:	034-001-00-2

Hazardous components

Component	Classification	Concentration
Selenium		
	Acute Tox. 3; STOT RE 2; Aquatic Chronic 4; H301 + H331, H373, H413	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Selenium/selenium oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Store under inert gas. Keep in a dry place.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Selenium	7782-49-2	TWA	0.2 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Eye & Upper Respiratory Tract irritation		
		TWA	0.200000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Eye & Upper Respiratory Tract irritation		

		TWA	0.200000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.200000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	0.2 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.2 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Upper Respiratory Tract irritation Eye irritation		

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N99 (US) or type P2 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: light grey
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 217 °C (423 °F) - lit.
f)	Initial boiling point and boiling range	684.9 °C (1,264.8 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	4.81 g/cm3 at 25 °C (77 °F)
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	log Pow: 5
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Strong oxidizing agents, Do not store near acids., Amides, Carbides, Metals, Nickel, Nitric acid, Nitrogen trichloride, Oxygen, Potassium, Zinc

10.6 Hazardous decomposition products

Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 6,700 mg/kg
Remarks: Behavioral:Somnolence (general depressed activity). Lungs, Thorax, or Respiration:Dyspnea. Nutritional and Gross Metabolic:Changes in:Other changes.

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

Carcinogenicity - Mouse - Oral
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Skin and Appendages: Other: Tumors.

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	3 - Group 3: Not classifiable as to its carcinogenicity to humans (Selenium)
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Developmental Toxicity - Mouse - Oral
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: VS7700000

anemia, Vomiting, Diarrhoea, Cough, Difficulty in breathing, Acute selenium poisoning produces central nervous system effects, which include nervousness, convulsions, and drowsiness. Other signs of intoxication can include skin

eruptions, lassitude, gastrointestinal distress, teeth that are discolored or decayed, odorous ("garlic") breath, and partial loss of hair and nails. Chronic exposure by inhalation can produce symptoms that include pallor, coating of the tongue, anemia, irritation of the mucosa, lumbar pain, liver and spleen damage, as well as any of the other previously mentioned symptoms. Chronic contact with selenium compounds may cause garlic odor of breath and sweat, dermatitis, and moderate emotional instability., Dermatitis, garlic-like breath odor, pallor, nervousness, depression

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	mortality NOEC - Cyprinodon variegatus (sheepshead minnow) - 2 mg/l - 96.0 h
	mortality LOEC - Oncorhynchus mykiss (rainbow trout) - 7.8 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	LC50 - Daphnia magna (Water flea) - 0.43 mg/l - 48 h
Toxicity to algae	EC50 - Pseudokirchneriella subcapitata - 99 mg/l - 72 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation: Lepomis macrochirus - 60 d - 640 µg/l

Bioconcentration factor (BCF): 7.7

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3288 Class: 6.1 Packing group: III
Proper shipping name: Toxic solid, inorganic, n.o.s. (Selenium)
Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3288 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, INORGANIC, N.O.S. (Selenium)
Marine pollutant:yes

IATA

UN number: 3288 Class: 6.1 Packing group: III
Proper shipping name: Toxic solid, inorganic, n.o.s. (Selenium)

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Selenium	7782-49-2	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Selenium	7782-49-2	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Selenium	7782-49-2	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Selenium	7782-49-2	2007-07-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Chronic	Chronic aquatic toxicity
H301	Toxic if swallowed.
H301 + H331	Toxic if swallowed or if inhaled
H331	Toxic if inhaled.
H373	May cause damage to organs through prolonged or repeated exposure.
H413	May cause long lasting harmful effects to aquatic life.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information
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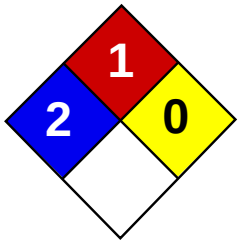
Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7 Revision Date: 11/13/2015 Print Date: 05/01/2016



Material Safety Data Sheet
Silver MSDS

Section 1: Chemical Product and Company Identification

Product Name: Silver

Catalog Codes: SLS4222, SLS2005, SLS3427, SLS1210, SLS2632, SLS4054, SLS1837

CAS#: 7440-22-4

RTECS: VW3500000

TSCA: TSCA 8(b) inventory: Silver

CI#: Not applicable.

Synonym:

Chemical Formula: Ag

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Silver	7440-22-4	100

Toxicological Data on Ingredients: Silver: ORAL (LD50): Acute: 100 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of ingestion, of inhalation. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact: No known effect on skin contact, rinse with water for a few minutes.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Avoid contact with eyes In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Splash goggles. Lab coat.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 (mg/m3) from OSHA (PEL) TWA: 0.01 (mg/m3) from OSHA NIOSH Australia: TWA: 0.1 (mg/m3)Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Solid metallic powder. Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 107.87 g/mole

Color: Not available.

pH (1% soln/water): Not applicable.

Boiling Point: 2212°C (4013.6°F)

Melting Point: 961°C (1761.8°F)

Critical Temperature: Not available.

Specific Gravity: 10.4 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Is not dispersed in cold water, hot water.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 100 mg/kg [Mouse].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Very hazardous in case of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:

Identification:

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Rhode Island RTK hazardous substances: Silver Pennsylvania RTK: Silver Minnesota: Silver Massachusetts RTK: Silver New Jersey: Silver TSCA 8(b) inventory: Silver TSCA 8(a) PAIR: Silver TSCA 8(d) H and S data reporting: Silver SARA 313 toxic chemical notification and release reporting: Silver: 1% CERCLA: Hazardous substances.: Silver: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC): R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Not applicable. Lab coat. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:26 PM

Last Updated: 05/21/2013 12:00 PM

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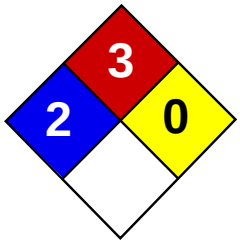

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Toluene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Toluene

Catalog Codes: SLT2857, SLT3277

CAS#: 108-88-3

RTECS: XS5250000

TSCA: TSCA 8(b) inventory: Toluene

CI#: Not available.

Synonym: Toluol, Tolu-Sol; Methylbenzene; Methacide; Phenylmethane; Methylbenzol

Chemical Name: Toluene

Chemical Formula: C6-H5-CH3 or C7-H8

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Toluene	108-88-3	100

Toxicological Data on Ingredients: Toluene: ORAL (LD50): Acute: 636 mg/kg [Rat]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit]. VAPOR (LC50): Acute: 49000 mg/m 4 hours [Rat]. 440 ppm 24 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, the nervous system, liver, brain, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: CLOSED CUP: 4.4444°C (40°F). (Setaflash) OPEN CUP: 16°C (60.8°F).

Flammable Limits: LOWER: 1.1% UPPER: 7.1%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:
Toluene forms explosive reaction with 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione; dinitrogen tetraoxide; concentrated nitric acid, sulfuric acid + nitric acid; N2O4; AgClO4; BrF3; Uranium hexafluoride; sulfur dichloride. Also forms an explosive mixture with tetranitromethane.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Toxic flammable liquid, insoluble or very slightly soluble in water. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 200 STEL: 500 CEIL: 300 (ppm) from OSHA (PEL) [United States] TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN TWA: 100 STEL: 150 from NIOSH [United States] TWA: 375 STEL: 560 (mg/m3) from NIOSH [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweet, pungent, Benzene-like.

Taste: Not available.

Molecular Weight: 92.14 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 110.6°C (231.1°F)

Melting Point: -95°C (-139°F)

Critical Temperature: 318.6°C (605.5°F)

Specific Gravity: 0.8636 (Water = 1)

Vapor Pressure: 3.8 kPa (@ 25°C)

Vapor Density: 3.1 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.6 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.7

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Soluble in diethyl ether, acetone. Practically insoluble in cold water. Soluble in ethanol, benzene, chloroform, glacial acetic acid, carbon disulfide. Solubility in water: 0.561 g/l @ 25 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong oxidizers, silver perchlorate, sodium difluoride, Tetranitromethane, Uranium Hexafluoride. Frozen Bromine Trifluoride reacts violently with Toluene at -80 deg. C. Reacts chemically with nitrogen oxides, or halogens to form nitrotoluene, nitrobenzene, and nitrophenol and halogenated products, respectively.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 636 mg/kg [Rat]. Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 440 24 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose: LDL [Human] - Route: Oral; Dose: 50 mg/kg LCL [Rabbit] - Route: Inhalation; Dose: 55000 ppm/40min

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in human. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes mild to moderate skin irritation. It can be absorbed to some extent through the skin. Eyes: Cauess mild to moderate eye irritation with a burning sensation. Splash contact with eyes also causes conjunctivitis, blepharospasm, corneal edema, corneal abraisons. This usually resolves in 2 days. Inhalation: Inhalation of vapor may cause respiratory tract irritation causing coughing and wheezing, and nasal discharge. Inhalation of high concentrations may affect behavior and cause central nervous system effects characterized by nausea, headache, dizziness, tremors, restlessness, lightheadedness, exhilaration, memory loss, insomnia, impaired reaction time, drowsiness, ataxia, hallucinations, somnolence, muscle contraction or spasticity, unconsciousness and coma. Inhalation of high concentration of vapor may also affect the cardiovascular system (rapid heart beat, heart palpitations, increased or decreased blood pressure, dysrhythmia,), respiration (acute pulmonary edema, respiratory depression, apnea, asphyxia), cause vision disturbances and dilated pupils, and cause loss of appetite. Ingestion: Aspiration hazard. Aspiration of Toluene into the lungs may cause chemical pneumonitis. May cause irritation of the digestive tract with nausea, vomiting, pain. May have effects similar to that of acute inhalation. Chronic Potential Health Effects: Inhalation and Ingestion: Prolonged or repeated exposure via inhalation may cause central nervous system and cardiovascular symptoms similar to that of acute inhalation and ingestion as well liver damage/failure, kidney damage/failure (with hematuria, proteinuria, oliguria, renal tubular acidosis), brain damage, weight loss, blood (pigmented or nucleated red blood cells, changes in white blood cell count), bone marrow changes, electrolyte imbalances (Hypokalemia, Hypophostatemia), severe, muscle weakness and Rhabdomyolysis. Skin: Repeated or prolonged skin contact may cause defatting dermatitis.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 313 mg/l 48 hours [Daphnia (daphnia)]. 17 mg/l 24 hours [Fish (Blue Gill)]. 13 mg/l 96 hours [Fish (Blue Gill)]. 56 mg/l 24 hours [Fish (Fathead minnow)]. 34 mg/l 96 hours [Fish (Fathead minnow)]. 56.8 ppm any hours [Fish (Goldfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Toluene UNNA: 1294 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Toluene California prop. 65 (no significant risk level): Toluene: 7 mg/day (value) California prop. 65 (acceptable daily intake level): Toluene: 7 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Toluene Connecticut hazardous material survey.: Toluene Illinois

toxic substances disclosure to employee act: Toluene Illinois chemical safety act: Toluene New York release reporting list: Toluene Rhode Island RTK hazardous substances: Toluene Pennsylvania RTK: Toluene Florida: Toluene Minnesota: Toluene Michigan critical material: Toluene Massachusetts RTK: Toluene Massachusetts spill list: Toluene New Jersey: Toluene New Jersey spill list: Toluene Louisiana spill reporting: Toluene California Director's List of Hazardous Substances.: Toluene TSCA 8(b) inventory: Toluene TSCA 8(d) H and S data reporting: Toluene: Effective date: 10/04/82; Sunset Date: 10/0/92 SARA 313 toxic chemical notification and release reporting: Toluene CERCLA: Hazardous substances.: Toluene: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable. R20- Harmful by inhalation. S16- Keep away from sources of ignition - No smoking. S25- Avoid contact with eyes. S29- Do not empty into drains. S33- Take precautionary measures against static discharges.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:30 PM

Last Updated: 06/09/2012 12:00 PM

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Safety Data Sheet

acc. to OSHA HCS (29CFR 1910.1200) and WHMIS 2015 Regulations

Printing date: July 25, 2018 Revision: June 25, 2018

1 Identification

· **Product identifier**

· **Trade name: Buffer Solution pH 4.00**
· **Product code:** ACABU5004-Q

· **Recommended use and restriction on use**
· **Recommended use:** Industrial uses.
· **Restrictions on use:** No relevant information available.

· **Details of the supplier of the Safety Data Sheet**
· **Manufacturer/Supplier:**
AquaPhoenix Scientific, Inc.
860 Gitts Run Road
Hanover, PA 17331
Phone: (717)632-1291
Toll-Free: (866)632-1291
info@aquaphoenixsci.com
· **Distributor:**
AccentPDIR
2564 Industry Lane
Norristown
PA 19403
(610) 630-7640

· **Emergency telephone number:**
ChemTel Inc.
(800)255-3924 (North America)
+1 (813)248-0585 (International)

2 Hazard(s) identification

· **Classification of the substance or mixture**
The product is not classified as hazardous according to the Globally Harmonized System (GHS).

· **Label elements**
The product is not classified as hazardous according to OSHA GHS regulations within the United States.
· **GHS label elements** This product does not have a classification according to the GHS regulation.
· **Hazard pictograms:** Not regulated.
· **Signal word:** Not regulated.
· **Hazard statements:** Not regulated.

· **Other hazards** There are no other hazards not otherwise classified that have been identified.

3 Composition/information on ingredients

· **Chemical characterization: Mixtures**

· **Components:**		
7732-18-5	Water	>80%
877-24-7	potassium hydrogen phthalate	<10%
110-44-1	hexa-2,4-dienoic acid Skin Irrit. 2, H315; Eye Irrit. 2A, H319; STOT SE 3, H335	<1%

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6625-46-3	2,7-Naphthalenedisulfonic acid, 5-(acetylamino)-4-hydroxy-3-[(2-methoxyphenyl)azo]-, disodium salt	<1%

· **Additional information:**
For the wording of the listed Hazard Statements, refer to section 16.
For the listed ingredient(s), the identity and/or exact percentage(s) are being withheld as a trade secret.

4 First-aid measures

· **Description of first aid measures**
· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:**
Rinse with warm water.
If skin irritation is experienced, consult a doctor.
· **After eye contact:**
Remove contact lenses if worn, if possible.
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:**
Rinse out mouth and then drink plenty of water.
Do not induce vomiting; immediately call for medical help.
· **Most important symptoms and effects, both acute and delayed:**
Nausea in case of ingestion.
Gastric or intestinal disorders when ingested.
· **Indication of any immediate medical attention and special treatment needed:**
No relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
The product is not flammable.
Use fire fighting measures that suit the environment.
· **For safety reasons unsuitable extinguishing agents:** None.
· **Special hazards arising from the substance or mixture**
Formation of toxic gases is possible during heating or in case of fire.
· **Advice for firefighters**
· **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Ensure adequate ventilation.
Use personal protective equipment as required.
· **Environmental precautions** Avoid release to the environment.
· **Methods and material for containment and cleaning up**

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Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Send for recovery or disposal in suitable receptacles.

· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

· **Handling**
· **Precautions for safe handling:**
Avoid splashes or spray in enclosed areas.
Use only in well ventilated areas.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Requirements to be met by storerooms and receptacles:**
Use only receptacles specifically permitted for this substance/product.
Unsuitable material for receptacle: aluminium.
Store in cool, dry conditions in well sealed receptacles.
· **Information about storage in one common storage facility:**
Store away from foodstuffs.
Store away from metals.
Store away from oxidizing agents.
Do not store together with alkalis (caustic solutions).
· **Specific end use(s)** No relevant information available.

8 Exposure controls/personal protection

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:**
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

· **Exposure controls**
· **General protective and hygienic measures:**
The usual precautionary measures for handling chemicals should be followed.
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
Avoid breathing mist, vapors, or spray.
· **Engineering controls:** Provide adequate ventilation.
· **Breathing equipment:**
Not required under normal conditions of use.
For spills, respiratory protection may be advisable.
· **Protection of hands:**

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Protective gloves

· **Eye protection:**

Safety glasses

Follow relevant national guidelines concerning the use of protective eyewear.

· **Body protection:** Protection may be required for spills.

· **Limitation and supervision of exposure into the environment**
No relevant information available.

· **Risk management measures** No relevant information available.

9 Physical and chemical properties

· **Information on basic physical and chemical properties**

· **Appearance:**	
Form:	Liquid
Color:	Red
· **Odor:**	Odorless
· **Odor threshold:**	Not determined.
· **pH-value at 20 °C (68 °F):**	4.00
· **Melting point/Melting range:**	Not determined.
· **Boiling point/Boiling range:**	100-101 °C (212-213.8 °F)
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Not applicable.
· **Auto-ignition temperature:**	Not determined.
· **Decomposition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits**	
Lower:	Not determined.
Upper:	Not determined.
· **Oxidizing properties:**	Non-oxidizing.
· **Vapor pressure at 20 °C (68 °F):**	23 hPa (17.3 mm Hg)
· **Density:**	
Relative density:	Not determined.
Vapor density:	Not determined.
Evaporation rate:	Not determined.
· **Solubility in / Miscibility with**	
Water:	Soluble.

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· **Partition coefficient (n-octanol/water):** Not determined.

· **Viscosity**

Dynamic: Not determined.

Kinematic: Not determined.

· **Other information** No relevant information available.

10 Stability and reactivity

· **Reactivity:** No relevant information available.
· **Chemical stability:**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used and stored according to specifications.
· **Possibility of hazardous reactions**
Toxic fumes may be released if heated above the decomposition point.
Reacts with alkali (lyes).
· **Conditions to avoid** Store away from oxidizing agents.
· **Incompatible materials** No relevant information available.
· **Hazardous decomposition products** Carbon monoxide and carbon dioxide

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:** Based on available data, the classification criteria are not met.
· **LD/LC50 values that are relevant for classification:** None.
· **Primary irritant effect:**
· **On the skin:** Based on available data, the classification criteria are not met.
· **On the eye:** Based on available data, the classification criteria are not met.
· **Sensitization:** No sensitizing effects known.

· **IARC (International Agency for Research on Cancer):**
None of the ingredients are listed.

· **NTP (National Toxicology Program):**
None of the ingredients are listed.

· **OSHA-Ca (Occupational Safety & Health Administration):**
None of the ingredients are listed.

· **Probable route(s) of exposure:**
Ingestion.
Inhalation.
Eye contact.
Skin contact.
· **Germ cell mutagenicity:** Based on available data, the classification criteria are not met.
· **Carcinogenicity:** Based on available data, the classification criteria are not met.
· **Reproductive toxicity:** Based on available data, the classification criteria are not met.
· **STOT-single exposure:** Based on available data, the classification criteria are not met.
· **STOT-repeated exposure:** Based on available data, the classification criteria are not met.

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· **Aspiration hazard:** Based on available data, the classification criteria are not met.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity** No relevant information available.
· **Persistence and degradability** No relevant information available.
· **Bioaccumulative potential:** No relevant information available.
· **Mobility in soil:** No relevant information available.
· **Additional ecological information**
· **General notes:**
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.
The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all relevant local, state and federal laws and regulations regarding treatment, storage and disposal for hazardous and nonhazardous wastes.

· **Uncleaned packagings**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number**	
· **DOT, ADR, IMDG, IATA**	Not regulated.
· **UN proper shipping name**	
· **DOT, ADR, IMDG, IATA**	Not regulated.
· **Transport hazard class(es)**	
· **DOT, ADR, IMDG, IATA**	
· **Class**	Not regulated.
· **Packing group**	
· **DOT, ADR, IMDG, IATA**	Not regulated.
· **Environmental hazards**	

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· **Marine pollutant:**	No
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**

· **United States (USA)**

· **SARA**

· **Section 302 (extremely hazardous substances):**

None of the ingredients are listed.

· **Section 355 (extremely hazardous substances):**

None of the ingredients are listed.

· **Section 313 (Specific toxic chemical listings):**

None of the ingredients are listed.

· **TSCA (Toxic Substances Control Act)**

All ingredients are listed.

· **Proposition 65 (California)**

· **Chemicals known to cause cancer:**

None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity for females:**

None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity for males:**

None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity:**

None of the ingredients are listed.

· **EPA (Environmental Protection Agency):**

None of the ingredients are listed.

· **IARC (International Agency for Research on Cancer):**

None of the ingredients are listed.

· **Canadian Domestic Substances List (DSL) (Substances not listed.):**

All ingredients are listed.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

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· **Abbreviations and acronyms:**
ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
CAS: Chemical Abstracts Service (division of the American Chemical Society)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistant, Bio-accumulable, Toxic
vPvB: very Persistent and very Bioaccumulative
OSHA: Occupational Safety & Health Administration
Skin Irrit. 2: Skin corrosion/irritation – Category 2
Eye Irrit. 2A: Serious eye damage/eye irritation – Category 2A
STOT SE 3: Specific target organ toxicity (single exposure) – Category 3

· **Sources**
Website, European Chemicals Agency (echa.europa.eu)
Website, US EPA Substance Registry Services (ofmpub.epa.gov/sor internet/registry/substreg/home/overview/home.do)
Website, Chemical Abstracts Registry, American Chemical Society (www.cas.org)
Patty's Industrial Hygiene, 6th ed., Rose, Vernon, ed. ISBN: 978-0-470-07488-6
Casarett and Doull's Toxicology: The Basic Science of Poisons, 8th Ed., Klaasen, Curtis D., ed., ISBN: 978-0-07-176923-5.
Safety Data Sheets, Individual Manufacturers

SDS Prepared by:
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Website: www.chemtelinc.com

Safety Data Sheet

acc. to OSHA HCS (29CFR 1910.1200) and WHMIS 2015 Regulations

Printing date: July 25, 2018 Revision: June 25, 2018

1 Identification

· **Product identifier**

· **Trade name: Buffer Solution pH 7.00**
· **Product code:** ACABU5007-Q

· **Recommended use and restriction on use**
· **Recommended use:**
Laboratory chemicals
Industrial uses.
· **Restrictions on use:** No relevant information available.

· **Details of the supplier of the Safety Data Sheet**
· **Manufacturer/Supplier:**
AquaPhoenix Scientific, Inc.
860 Gitts Run Road
Hanover, PA 17331
Phone: (717)632-1291
Toll-Free: (866)632-1291
info@aquaphoenixsci.com
· **Distributor:**
AccentPDIR
2564 Industry Lane
Norristown
PA 19403
(610) 630-7640

· **Emergency telephone number:**
ChemTel Inc.
(800)255-3924 (North America)
+1 (813)248-0585 (International)

2 Hazard(s) identification

· **Classification of the substance or mixture**
The product is not classified as hazardous according to the Globally Harmonized System (GHS).

· **Label elements**
The product is not classified as hazardous according to OSHA GHS regulations within the United States.
· **GHS label elements** This product does not have a classification according to the GHS regulation.
· **Hazard pictograms:** Not regulated.
· **Signal word:** Not regulated.
· **Hazard statements:** Not regulated.

· **Other hazards** There are no other hazards not otherwise classified that have been identified.

3 Composition/information on ingredients

· **Chemical characterization: Mixtures**

· **Components:**		
7732-18-5	Water	>99%
1310-73-2	Sodium hydroxide	<0.25%

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	Met. Corr.1, H290; Skin Corr. 1A, H314; Eye Dam. 1, H318	
6359-83-7	Disodium 2-[[4,5-dihydro-3-methyl-5-oxo-1-(4-sulphonatophenyl)-1H-pyrazol-4-yl]azo]benzoate	<0.25%
52-51-7	bronopol (INN) Acute Tox. 3, H331 Eye Dam. 1, H318 Acute Tox. 4, H302; Acute Tox. 4, H312; Skin Irrit. 2, H315; STOT SE 3, H335	<0.25%

· **Additional information:**
For the wording of the listed Hazard Statements, refer to section 16.
For the listed ingredient(s), the identity and/or exact percentage(s) are being withheld as a trade secret.

4 First-aid measures

· **Description of first aid measures**
· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:**
Rinse with warm water.
If skin irritation is experienced, consult a doctor.
· **After eye contact:**
Remove contact lenses if worn, if possible.
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:**
Rinse out mouth and then drink plenty of water.
Do not induce vomiting; immediately call for medical help.
· **Most important symptoms and effects, both acute and delayed:**
Nausea in case of ingestion.
Gastric or intestinal disorders when ingested.
· **Indication of any immediate medical attention and special treatment needed:**
No relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
The product is not flammable.
Use fire fighting measures that suit the environment.
· **For safety reasons unsuitable extinguishing agents:** None.
· **Special hazards arising from the substance or mixture**
Formation of toxic gases is possible during heating or in case of fire.
· **Advice for firefighters**
· **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.

6 Accidental release measures

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· **Personal precautions, protective equipment and emergency procedures**
Ensure adequate ventilation.
Use personal protective equipment as required.

· **Environmental precautions**
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.

· **Methods and material for containment and cleaning up**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Send for recovery or disposal in suitable receptacles.

· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

· **Handling**

· **Precautions for safe handling:**
Avoid splashes or spray in enclosed areas.
Use only in well ventilated areas.

· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**

· **Requirements to be met by storerooms and receptacles:**
Use only receptacles specifically permitted for this substance/product.
Store in cool, dry conditions in well sealed receptacles.

· **Information about storage in one common storage facility:** Store away from foodstuffs.

· **Specific end use(s)** No relevant information available.

8 Exposure controls/personal protection

· **Control parameters**

· **Components with limit values that require monitoring at the workplace:**	
1310-73-2 Sodium hydroxide	
PEL (USA)	Long-term value: 2 mg/m³
REL (USA)	Ceiling limit value: 2 mg/m³
TLV (USA)	Ceiling limit value: 2 mg/m³
EL (Canada)	Ceiling limit value: 2 mg/m³
EV (Canada)	Ceiling limit value: 2 mg/m³
LMPE (Mexico)	Ceiling limit value: 2 mg/m³

· **Exposure controls**

· **General protective and hygienic measures:**
The usual precautionary measures for handling chemicals should be followed.
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.

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Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
Avoid breathing mist, vapors, or spray.
· **Engineering controls:** Provide adequate ventilation.
· **Breathing equipment:**
Not required under normal conditions of use.
For spills, respiratory protection may be advisable.
· **Protection of hands:** Gloves are advised for repeated or prolonged contact.
· **Eye protection:**

Safety glasses

Follow relevant national guidelines concerning the use of protective eyewear.
· **Body protection:** Protection may be required for spills.
· **Limitation and supervision of exposure into the environment**
No relevant information available.
· **Risk management measures** No relevant information available.

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **Appearance:**	
Form:	Liquid
Color:	Red
· **Odor:**	Odorless
· **Odor threshold:**	Not determined.
· **pH-value at 20 °C (68 °F):**	7.00
· **Melting point/Melting range:**	Not determined.
· **Boiling point/Boiling range:**	100-101 °C (212-213.8 °F)
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Not applicable.
· **Auto-ignition temperature:**	Not determined.
· **Decomposition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits**	
Lower:	Not determined.
Upper:	Not determined.
· **Oxidizing properties:**	Non-oxidizing.
· **Vapor pressure at 20 °C (68 °F):**	23 hPa (17.3 mm Hg)
· **Density:**	
Relative density:	Not determined.
Vapor density:	Not determined.

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Evaporation rate:	Not determined.
· **Solubility in / Miscibility with Water:**	Soluble.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity**	
Dynamic:	Not determined.
Kinematic:	Not determined.
· **Other information**	No relevant information available.

10 Stability and reactivity

· **Reactivity:** No relevant information available.
· **Chemical stability:**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used and stored according to specifications.
· **Possibility of hazardous reactions**
Toxic fumes may be released if heated above the decomposition point.
· **Conditions to avoid** No relevant information available.
· **Incompatible materials** No relevant information available.
· **Hazardous decomposition products** Carbon monoxide and carbon dioxide

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:** Based on available data, the classification criteria are not met.
· **LD/LC50 values that are relevant for classification:** None.
· **Primary irritant effect:**
· **On the skin:** Based on available data, the classification criteria are not met.
· **On the eye:** Based on available data, the classification criteria are not met.
· **Sensitization:** No sensitizing effects known.

· **IARC (International Agency for Research on Cancer):**
None of the ingredients are listed.

· **NTP (National Toxicology Program):**
None of the ingredients are listed.

· **OSHA-Ca (Occupational Safety & Health Administration):**
None of the ingredients are listed.

· **Probable route(s) of exposure:**
Ingestion.
Inhalation.
Eye contact.
Skin contact.
· **Germ cell mutagenicity:** Based on available data, the classification criteria are not met.
· **Carcinogenicity:** Based on available data, the classification criteria are not met.

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· **Reproductive toxicity:** Based on available data, the classification criteria are not met.
· **STOT-single exposure:** Based on available data, the classification criteria are not met.
· **STOT-repeated exposure:** Based on available data, the classification criteria are not met.
· **Aspiration hazard:** Based on available data, the classification criteria are not met.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity** No relevant information available.
· **Persistence and degradability** No relevant information available.
· **Bioaccumulative potential:** No relevant information available.
· **Mobility in soil:** No relevant information available.
· **Additional ecological information**
· **General notes:**
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.
The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all relevant local, state and federal laws and regulations regarding treatment, storage and disposal for hazardous and nonhazardous wastes.

· **Uncleaned packagings**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number**	
· **DOT, ADR, IMDG, IATA**	Not regulated.
· **UN proper shipping name**	
· **DOT, ADR, IMDG, IATA**	Not regulated.
· **Transport hazard class(es)**	
· **DOT, ADR, IMDG, IATA**	
· **Class**	Not regulated.

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· **Packing group**	
· **DOT, ADR, IMDG, IATA**	Not regulated.
· **Environmental hazards**	
· **Marine pollutant:**	No
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**

· **United States (USA)**

· **SARA**

· **Section 302 (extremely hazardous substances):**

None of the ingredients are listed.

· **Section 355 (extremely hazardous substances):**

None of the ingredients are listed.

· **Section 313 (Specific toxic chemical listings):**

None of the ingredients are listed.

· **TSCA (Toxic Substances Control Act)**

All ingredients are listed.

· **Proposition 65 (California)**

· **Chemicals known to cause cancer:**

None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity for females:**

None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity for males:**

None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity:**

None of the ingredients are listed.

· **EPA (Environmental Protection Agency):**

None of the ingredients are listed.

· **IARC (International Agency for Research on Cancer):**

None of the ingredients are listed.

· **Canadian Domestic Substances List (DSL) (Substances not listed.):**

All ingredients are listed.

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16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Abbreviations and acronyms:**
ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
CAS: Chemical Abstracts Service (division of the American Chemical Society)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistant, Bio-accumulable, Toxic
vPvB: very Persistent and very Bioaccumulative
OSHA: Occupational Safety & Health Administration
Met. Corr.1: Corrosive to metals – Category 1
Acute Tox. 4: Acute toxicity – Category 4
Acute Tox. 3: Acute toxicity – Category 3
Skin Corr. 1A: Skin corrosion/irritation – Category 1A
Skin Irrit. 2: Skin corrosion/irritation – Category 2
Eye Dam. 1: Serious eye damage/eye irritation – Category 1
STOT SE 3: Specific target organ toxicity (single exposure) – Category 3

· **Sources**
Website, European Chemicals Agency (echa.europa.eu)
Website, US EPA Substance Registry Services (ofmpub.epa.gov/sor internet/registry/substreg/home/overview/home.do)
Website, Chemical Abstracts Registry, American Chemical Society (www.cas.org)
Patty's Industrial Hygiene, 6th ed., Rose, Vernon, ed. ISBN: 978-0-470-07488-6
Casarett and Doull's Toxicology: The Basic Science of Poisons, 8th Ed., Klaasen, Curtis D., ed., ISBN: 978-0-07-176923-5.
Safety Data Sheets, Individual Manufacturers

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Website: www.chemtelinc.com

Safety Data Sheet

acc. to OSHA HCS (29CFR 1910.1200) and WHMIS 2015 Regulations

Printing date: July 25, 2018 Revision: June 25, 2018

1 Identification

· **Product identifier**

· **Trade name: Buffer Solution pH 10.00**
· **Product code:** ACABU5010-Q

· **Recommended use and restriction on use**
· **Recommended use:** Industrial uses.
· **Restrictions on use:** No relevant information available.

· **Details of the supplier of the Safety Data Sheet**
· **Manufacturer/Supplier:**
AquaPhoenix Scientific, Inc.
860 Gitts Run Road
Hanover, PA 17331
Phone: (717)632-1291
Toll-Free: (866)632-1291
info@aquaphoenixsci.com
· **Distributor:**
AccentPDIR
2564 Industry Lane
Norristown
PA 19403
(610) 630-7640

· **Emergency telephone number:**
ChemTel Inc.
(800)255-3924 (North America)
+1 (813)248-0585 (International)

2 Hazard(s) identification

· **Classification of the substance or mixture**
The product is not classified as hazardous according to the Globally Harmonized System (GHS).

· **Label elements**
The product is not classified as hazardous according to OSHA GHS regulations within the United States.
· **GHS label elements** This product does not have a classification according to the GHS regulation.
· **Hazard pictograms:** Not regulated.
· **Signal word:** Not regulated.
· **Hazard statements:** Not regulated.

· **Other hazards** There are no other hazards not otherwise classified that have been identified.

3 Composition/information on ingredients

· **Chemical characterization: Mixtures**

· **Components:**		
7732-18-5	Water	>70%
497-19-8	Sodium carbonate	<10%
	Eye Irrit. 2A, H319	
144-55-8	sodium hydrogencarbonate	<10%

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34722-90-2	Sodium α-(3-bromo-5-isopropyl-4-oxo-2-methyl-2,5-cyclohexadienylidene)-2-(3-bromo-4-hydroxy-5-isopropyl-2-methylphenyl)toluenesulphonate	<10%

· **Additional information:** For the wording of the listed Hazard Statements, refer to section 16.

4 First-aid measures

· **Description of first aid measures**
· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:**
Rinse with warm water.
If skin irritation is experienced, consult a doctor.
· **After eye contact:**
Remove contact lenses if worn, if possible.
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:**
Rinse out mouth and then drink plenty of water.
Do not induce vomiting; immediately call for medical help.
· **Most important symptoms and effects, both acute and delayed:**
Nausea in case of ingestion.
Gastric or intestinal disorders when ingested.
Slight irritant effect on eyes.
· **Indication of any immediate medical attention and special treatment needed:**
No relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:**
The product is not flammable.
Use fire fighting measures that suit the environment.
· **For safety reasons unsuitable extinguishing agents:** None.
· **Special hazards arising from the substance or mixture**
Formation of toxic gases is possible during heating or in case of fire.
· **Advice for firefighters**
· **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Ensure adequate ventilation.
Use personal protective equipment as required.
· **Environmental precautions**
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
· **Methods and material for containment and cleaning up**

(Cont'd. on page 3)

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Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Send for recovery or disposal in suitable receptacles.

· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

· **Handling**
· **Precautions for safe handling:**
Avoid splashes or spray in enclosed areas.
Use only in well ventilated areas.
Avoid breathing mist, vapors, or spray.
Avoid contact with the eyes and skin.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Requirements to be met by storerooms and receptacles:**
Use only receptacles specifically permitted for this substance/product.
Unsuitable material for receptacle: aluminium.
Store in cool, dry conditions in well sealed receptacles.
· **Information about storage in one common storage facility:**
Store away from foodstuffs.
Store away from metals.
· **Specific end use(s)** No relevant information available.

8 Exposure controls/personal protection

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:**
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

· **Exposure controls**
· **General protective and hygienic measures:**
The usual precautionary measures for handling chemicals should be followed.
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
Avoid breathing mist, vapors, or spray.
· **Engineering controls:** Provide adequate ventilation.
· **Breathing equipment:**
Not required under normal conditions of use.
For spills, respiratory protection may be advisable.
· **Protection of hands:**

(Cont'd. on page 4)

Safety Data Sheet

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Protective gloves

· **Eye protection:**

Safety glasses

Follow relevant national guidelines concerning the use of protective eyewear.

· **Body protection:** Protection may be required for spills.

· **Limitation and supervision of exposure into the environment**
No relevant information available.

· **Risk management measures** No relevant information available.

9 Physical and chemical properties

· **Information on basic physical and chemical properties**

· **Appearance:**	
Form:	Liquid
Color:	Blue
· **Odor:**	Odorless
· **Odor threshold:**	Not determined.
· **pH-value at 20 °C (68 °F):**	10.00
· **Melting point/Melting range:**	Not determined.
· **Boiling point/Boiling range:**	100-101 °C (212-213.8 °F)
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Not applicable.
· **Auto-ignition temperature:**	Not determined.
· **Decomposition temperature:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits**	
Lower:	Not determined.
Upper:	Not determined.
· **Oxidizing properties:**	Non-oxidizing.
· **Vapor pressure at 20 °C (68 °F):**	23 hPa (17.3 mm Hg)
· **Density:**	
Relative density:	Not determined.
Vapor density:	Not determined.
Evaporation rate:	Not determined.
· **Solubility in / Miscibility with**	
Water:	Soluble.

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· **Partition coefficient (n-octanol/water):** Not determined.

· **Viscosity**

Dynamic: Not determined.

Kinematic: Not determined.

· **Other information** No relevant information available.

10 Stability and reactivity

· **Reactivity:** No relevant information available.
· **Chemical stability:**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used and stored according to specifications.
· **Possibility of hazardous reactions**
Toxic fumes may be released if heated above the decomposition point.
Reacts with strong acids.
· **Conditions to avoid** Avoid acids.
· **Incompatible materials** Strong acids
· **Hazardous decomposition products**
Carbon monoxide and carbon dioxide
Sulfur oxides (SOx)

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:** Based on available data, the classification criteria are not met.
· **LD/LC50 values that are relevant for classification:** None.
· **Primary irritant effect:**
· **On the skin:** Based on available data, the classification criteria are not met.
· **On the eye:** Based on available data, the classification criteria are not met.
· **Sensitization:** No sensitizing effects known.

· **IARC (International Agency for Research on Cancer):**
None of the ingredients are listed.

· **NTP (National Toxicology Program):**
None of the ingredients are listed.

· **OSHA-Ca (Occupational Safety & Health Administration):**
None of the ingredients are listed.

· **Probable route(s) of exposure:**
Ingestion.
Inhalation.
Eye contact.
Skin contact.
· **Germ cell mutagenicity:** Based on available data, the classification criteria are not met.
· **Carcinogenicity:** Based on available data, the classification criteria are not met.
· **Reproductive toxicity:** Based on available data, the classification criteria are not met.

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· **STOT-single exposure:** Based on available data, the classification criteria are not met.
· **STOT-repeated exposure:** Based on available data, the classification criteria are not met.
· **Aspiration hazard:** Based on available data, the classification criteria are not met.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity** No relevant information available.
· **Persistence and degradability** No relevant information available.
· **Bioaccumulative potential:** No relevant information available.
· **Mobility in soil:** No relevant information available.
· **Additional ecological information**
· **General notes:**
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.
The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all relevant local, state and federal laws and regulations regarding treatment, storage and disposal for hazardous and nonhazardous wastes.

· **Uncleaned packagings**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number**	
· **DOT, ADR, IMDG, IATA**	Not regulated.
· **UN proper shipping name**	
· **DOT, ADR, IMDG, IATA**	Not regulated.
· **Transport hazard class(es)**	
· **DOT, ADR, IMDG, IATA**	
· **Class**	Not regulated.
· **Packing group**	

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Safety Data Sheet

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· **DOT, ADR, IMDG, IATA**	Not regulated.
· **Environmental hazards**	
· **Marine pollutant:**	No
· **Special precautions for user**	Not applicable.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**

· **United States (USA)**

· **SARA**

· **Section 302 (extremely hazardous substances):**

None of the ingredients are listed.

· **Section 355 (extremely hazardous substances):**

None of the ingredients are listed.

· **Section 313 (Specific toxic chemical listings):**

None of the ingredients are listed.

· **TSCA (Toxic Substances Control Act)**

All ingredients are listed.

· **Proposition 65 (California)**

· **Chemicals known to cause cancer:**

None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity for females:**

None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity for males:**

None of the ingredients are listed.

· **Chemicals known to cause developmental toxicity:**

None of the ingredients are listed.

· **EPA (Environmental Protection Agency):**

None of the ingredients are listed.

· **IARC (International Agency for Research on Cancer):**

None of the ingredients are listed.

· **Canadian Domestic Substances List (DSL) (Substances not listed.):**

All ingredients are listed.

16 Other information

(Cont'd. on page 8)

Safety Data Sheet

acc. to OSHA HCS (29CFR 1910.1200) and WHMIS 2015 Regulations

Printing date: July 25, 2018 Revision: June 25, 2018

Trade name: Buffer Solution pH 10.00

(Cont'd. of page 7)

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Abbreviations and acronyms:**
ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
CAS: Chemical Abstracts Service (division of the American Chemical Society)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistant, Bio-accumulable, Toxic
vPvB: very Persistent and very Bioaccumulative
OSHA: Occupational Safety & Health Administration
Eye Irrit. 2A: Serious eye damage/eye irritation – Category 2A

· **Sources**
Website, European Chemicals Agency (echa.europa.eu)
Website, US EPA Substance Registry Services (ofmpub.epa.gov/sor internet/registry/substreg/home/overview/home.do)
Website, Chemical Abstracts Registry, American Chemical Society (www.cas.org)
Patty's Industrial Hygiene, 6th ed., Rose, Vernon, ed. ISBN: 978-0-470-07488-6
Casarett and Doull's Toxicology: The Basic Science of Poisons, 8th Ed., Klaasen, Curtis D., ed., ISBN: 978-0-07-176923-5.
Safety Data Sheets, Individual Manufacturers

SDS Prepared by:
ChemTel Inc.
1305 North Florida Avenue
Tampa, Florida USA 33602-2902
Toll Free North America 1-888-255-3924 Intl. +01 813-248-0573
Website: www.chemtelinc.com

Conductivity Standard 7000 µS/cm

SECTION 1: Identification

Product identifier

Product name: Conductivity Standard 7000 µS/cm
Product code: ACACS7000-Q

Recommended use of the product and restriction on use

Relevant identified uses: Laboratory chemicals
Uses advised against: Not determined or not applicable.
Reasons why uses advised against: Not determined or not applicable.

Manufacturer or supplier details

Manufacturer:
United States
AquaPhoenix Scientific
860 Gitts Run Road
Hanover
PA 17331
(717) 632-1291

Supplier:
United States
AccentPDIR
2564 Industry Lane
Norristown
PA 19403
(610) 630-7640

Emergency telephone number:

United States

Emergency Telephone No.: 800-255-3924

SECTION 2: Hazard(s) identification

GHS classification: Not a hazardous substance or mixture

Label elements

Hazard pictograms: None

Signal word: None

Hazard statements: None
Precautionary statements: None
Hazards not otherwise classified: None

SECTION 3: Composition/information on ingredients

Identification	Name	Weight %
CAS number: 7732-18-5	Water	>99
CAS number: 7447-40-7	Potassium Chloride	<0.5

Additional Information: None

SECTION 4: First aid measures

Description of first aid measures

General notes:

Not determined or not applicable.

After inhalation:

Loosen clothing as necessary and position individual in a comfortable position
Maintain an unobstructed airway
Get medical advice/attention if you feel unwell

After skin contact:

Rinse affected area with soap and water
If symptoms develop or persist, seek medical attention

After eye contact:

Rinse/flush exposed eye(s) gently using water for 15-20 minutes
Remove contact lenses, if present and easy to do
Continue rinsing
Get medical advice/attention

After swallowing:

Rinse mouth and then drink plenty of water
Do not induce vomiting
Get medical advice/attention if you feel unwell

Most important symptoms and effects, both acute and delayed

Acute symptoms and effects:

Not determined or not applicable.

Delayed symptoms and effects:

Not determined or not applicable.

Immediate medical attention and special treatment

Specific treatment:

Not determined or not applicable.

Notes for the doctor:

Not determined or not applicable.

SECTION 5: Firefighting measures

Extinguishing media

Suitable extinguishing media:

Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition

Unsuitable extinguishing media:

Not determined or not applicable.

Specific hazards during fire-fighting:

Thermal decomposition can lead to release of irritating gases and vapors

Special protective equipment for firefighters:

Wear protective eye wear, gloves and clothing
Refer to Section 8
Use typical firefighting equipment, self-contained breathing apparatus, special tightly sealed suit

Special precautions:

Heating causes a rise in pressure, risk of bursting and combustion
Shut off sources of ignition
Carbon monoxide and carbon dioxide may form upon combustion

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures:

Conductivity Standard 7000 µS/cm

Ensure adequate ventilation
Ensure air handling systems are operational
Wear protective eye wear, gloves and clothing

Environmental precautions:

Should not be released into the environment
Prevent from reaching drains, sewer or waterway

Methods and material for containment and cleaning up:

Absorb with non-combustible liquid-binding material (sand, diatomaceous earth (clay), acid binders, universal binders)
Dispose of contents / container in accordance with local regulations

Reference to other sections:

Not determined or not applicable.

SECTION 7: Handling and storage

Precautions for safe handling:

Do not eat, drink, smoke or use personal products when handling chemical substances.
Avoid breathing mist or vapor.
Use only with adequate ventilation.

Conditions for safe storage, including any incompatibilities:

Store in a cool, well-ventilated area.
Store away from foodstuffs.

SECTION 8: Exposure controls/personal protection

Only those substances with limit values have been included below.

Occupational Exposure limit values:

Country (Legal Basis)	Substance	Identifier	Permissible concentration
United States (OSHA)	Propan-1-ol	71-23-8	OSHA (PEL): 200 ppm (500 mg/m3)
ACGIH	Propan-1-ol	71-23-8	ACGIH TLV: TWA - 200 ppm
	Propan-1-ol	71-23-8	ACGIH TLV: STEL - 400 ppm

Biological limit values:

No biological exposure limits noted for the ingredient(s).

Information on monitoring procedures:

Not determined or not applicable.

Appropriate engineering controls:

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and mists below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above.

Personal protection equipment

Eye and face protection:

Safety goggles or glasses, or appropriate eye protection.

Skin and body protection:

Select glove material impermeable and resistant to the substance.

Respiratory protection:

When necessary, use NIOSH-approved breathing equipment.

Conductivity Standard 7000 µS/cm

General hygienic measures:

Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.
Perform routine housekeeping.
Wash contaminated clothing before reusing.

SECTION 9: Physical and chemical properties

Information on basic physical and chemical properties

Appearance	Clear, colorless liquid
Odor	Odorless
Odor threshold	Not available
pH	Not available
Melting point/freezing point	Approx (-6) - 0 °C
Initial boiling point/range	Approx 100.1 °C
Flash point (closed cup)	Not available
Evaporation rate	Not available
Flammability (solid, gas)	Not available
Upper flammability/explosive limit	Not available
Lower flammability/explosive limit	Not available
Vapor pressure	Not available
Vapor density	Not available
Density	Not available
Relative density	1 - 1.01
Solubilities	Not determined or not available.
Partition coefficient (n-octanol/water)	Not available
Auto/Self-ignition temperature	Not available
Decomposition temperature	Not available
Dynamic viscosity	Not available
Kinematic viscosity	Not available
Explosive properties	Not determined or not available.
Oxidizing properties	Not determined or not available.

Other information

SECTION 10: Stability and reactivity

Reactivity:

Does not react under normal conditions of use and storage.

Chemical stability:

Stable under normal conditions of use and storage.

Possibility of hazardous reactions:

None under normal conditions of use and storage.

Conditions to avoid:

None known.

Incompatible materials:

None known.

Conductivity Standard 7000 µS/cm

Hazardous decomposition products:
None known.

SECTION 11: Toxicological information

Acute toxicity
Assessment: Based on available data, the classification criteria are not met.
Product data: No data available.
Substance data: No data available.

Skin corrosion/irritation
Assessment: Based on available data, the classification criteria are not met.
Product data: No data available.
Substance data: No data available.

Serious eye damage/irritation
Assessment: Based on available data, the classification criteria are not met.
Product data: No data available.
Substance data: No data available.

Respiratory or skin sensitization
Assessment: Based on available data, the classification criteria are not met.
Product data: No data available.
Substance data: No data available.

Carcinogenicity
Assessment: Based on available data, the classification criteria are not met.
Product data: No data available.
Substance data: No data available.
International Agency for Research on Cancer (IARC): None of the ingredients are listed.
National Toxicology Program (NTP): None of the ingredients are listed.

Germ cell mutagenicity
Assessment: Based on available data, the classification criteria are not met.
Product data: No data available.
Substance data: No data available.

Reproductive toxicity
Assessment: Based on available data, the classification criteria are not met.
Product data: No data available.
Substance data: No data available.

Specific target organ toxicity (single exposure)
Assessment: Based on available data, the classification criteria are not met.
Product data: No data available.
Substance data: No data available.

Specific target organ toxicity (repeated exposure)
Assessment: Based on available data, the classification criteria are not met.
Product data: No data available.
Substance data: No data available.

Aspiration toxicity
Assessment: Based on available data, the classification criteria are not met.
Product data: No data available.
Substance data: No data available.

Information on likely routes of exposure: No data available.

Conductivity Standard 7000 µS/cm

Symptoms related to the physical, chemical and toxicological characteristics: No data available.
Other information: No data available.

SECTION 12: Ecological information

Acute (short-term) toxicity
Assessment: Based on available data, the classification criteria are not met.
Product data: No data available.
Substance data: No data available.

Chronic (long-term) toxicity
Product data: No data available.
Substance data: No data available.

Persistence and degradability
Product data: No data available.
Substance data: No data available.

Bioaccumulative potential
Product data: No data available.
Substance data: No data available.

Mobility in soil
Product data: No data available.
Substance data: No data available.

Other adverse effects: No data available.

SECTION 13: Disposal considerations

Disposal methods:
It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities (US 40CFR262.11)

SECTION 14: Transport information

United States Transportation of dangerous goods (49 CFR DOT)

UN number	Not Regulated
UN proper shipping name	Not Regulated
UN transport hazard class(es)	None
Packing group	None
Environmental hazards	None
Special precautions for user	None

International Maritime Dangerous Goods (IMDG)

UN number	Not Regulated
UN proper shipping name	Not Regulated
UN transport hazard class(es)	None
Packing group	None
Environmental hazards	None
Special precautions for user	None

International Air Transport Association Dangerous Goods Regulations (IATA-DGR)

Conductivity Standard 7000 µS/cm

UN number	Not Regulated
UN proper shipping name	Not Regulated
UN transport hazard class(es)	None
Packing group	None
Environmental hazards	None
Special precautions for user	None

Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code	
Bulk Name	None
Ship type	None
Pollution category	None

SECTION 15: Regulatory information

United States regulations

Inventory listing (TSCA):

71-23-8	Propan-1-ol	Listed
7447-40-7	Potassium Chloride	Listed
7732-18-5	Water	Listed

Significant New Use Rule (TSCA Section 5): Not determined.

Export notification under TSCA Section 12(b): Not determined.

SARA Section 311/312 hazards:

Acute	Chronic	Fire	Pressure	Reactive
No	No	No	No	No

SARA Section 302 extremely hazardous substances: Not determined.

SARA Section 313 toxic chemicals: Not determined.

CERCLA: Not determined.

RCRA: Not determined.

Section 112(r) of the Clean Air Act (CAA): Not determined.

Massachusetts Right to Know:

71-23-8	n-Propyl Alcohol	Listed
7447-40-7	Potassium Chloride	Not Listed
7732-18-5	Deionized Water	Not Listed

New Jersey Right to Know:

71-23-8	n-Propyl Alcohol	Not Listed
7447-40-7	Potassium Chloride	Not Listed
7732-18-5	Deionized Water	Not Listed

New York Right to Know:

71-23-8	n-Propyl Alcohol	Listed

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7447-40-7	Potassium Chloride	Not Listed
7732-18-5	Deionized Water	Not Listed

Pennsylvania Right to Know:

71-23-8	n-Propyl Alcohol	Listed
7447-40-7	Potassium Chloride	Not Listed
7732-18-5	Deionized Water	Not Listed

California Proposition 65: Not determined.

SECTION 16: Other information

Abbreviations and Acronyms: None

Disclaimer:

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations. The responsibility to provide a safe workplace remains with the user. The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment. The information contained herein is, to the best of our knowledge and belief, accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material. It is the responsibility of the user to comply with all applicable laws and regulations applicable to this material.

NFPA: 1-0-0

HMIS: 1-0-0

Initial preparation date: 04.27.2017

End of Safety Data Sheet

SAFETY DATA SHEET

1. Identification

Product identifier **AMCO CLEAR® TURBIDITY STANDARD, 10 NTU FOR LAMOTTE 2020WE**

Other means of identification

Product code 8578

Recommended use Reagent for determination of turbidity of liquids.

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name	GFS Chemicals, Inc.	
Address	P.O. Box 245 Powell, OH 43065 United States	
Telephone	Phone	740-881-5501
	Toll Free	800-858-9682
	Fax	740-881-5989
Website	www.gfschemicals.com	
E-mail	service@gfschemicals.com	
Emergency phone number	Emergency Assistance	Chemtrec 800-424-9300

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards Not classified.

Environmental hazards Not classified.

OSHA defined hazards Not classified.

Label elements

Hazard symbol None.

Signal word None.

Hazard statement The mixture does not meet the criteria for classification.

Precautionary statement

Prevention Observe good industrial hygiene practices.

Response Wash hands after handling.

Storage Store away from incompatible materials.

Disposal Dispose of waste and residues in accordance with local authority requirements.

Hazard(s) not otherwise classified (HNOC) None known.

Supplemental information None.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
WATER		7732-18-5	90 - 100
STYRENE DIVINYLBENZENE COPOLYMER BEADS		9003-70-7	<0.1
Other components below reportable levels			< 0.1

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact Dry skin with paper towel or similar.

Eye contact Rinse with water. Get medical attention if irritation develops and persists.

Ingestion Rinse mouth. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Use extinguishing agent suitable for type of surrounding fire. Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	No special precautions.
Methods and materials for containment and cleaning up	This product is miscible in water. Containment of this material should not be necessary. Flush with water. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	No special environmental precautions required.

7. Handling and storage

Precautions for safe handling	Avoid prolonged exposure. No special precautions required.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Do not allow material to freeze. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses with side shields (or goggles).
Skin protection	
Hand protection	Not normally needed.
Other	Wear suitable protective clothing.
Respiratory protection	No personal respiratory protective equipment normally required.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	Cloudy.
Physical state	Liquid.
Form	Aqueous solution.

Color	Colorless to white.
Odor	Odorless.
Odor threshold	Not available.
pH	6.7
Melting point/freezing point	32 °F (0 °C) estimated
Initial boiling point and boiling range	212 °F (100 °C) estimated
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Completely Miscible
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	1.00 g/cm3 estimated
Percent volatile	> 99.9 %
Specific gravity	1.00 estimated

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials. Do not freeze.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Prolonged inhalation may be harmful.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Expected to be a low ingestion hazard.
Symptoms related to the physical, chemical and toxicological characteristics	Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity

Product	Species	Test Results
AMCO CLEAR® TURBIDITY STANDARD, 10 NTU FOR LAMOTTE 2020WE (CAS Mixture)		
Acute		
Dermal		
LD50	Rabbit	99999 mg/kg
Oral		
LD50	Bird	99999 mg/kg
	Mouse	99999 mg/kg
	Rat	99999 mg/kg
TD	Rat	99999 mg/kg
TDL0	Rat	99999 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation Prolonged skin contact may cause temporary irritation.

Serious eye damage/eye irritation Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization Not available.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not available.

US. National Toxicology Program (NTP) Report on Carcinogens

Not available.

Reproductive toxicity This product is not expected to cause reproductive or developmental effects.

Specific target organ toxicity - single exposure Not classified.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard Not available.

Chronic effects Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity Not applicable.

Product		Species	Test Results
AMCO CLEAR® TURBIDITY STANDARD, 10 NTU FOR LAMOTTE 2020WE (CAS Mixture)			
Aquatic			
Crustacea	EC50	Daphnia	37000 mg/l, 48 hours estimated
Fish	LC50	Fish	22840.0156 mg/l, 96 hours estimated

* Estimates for product may be based on additional component data not shown.

Persistence and degradability No data is available on the degradability of this product.

Bioaccumulative potential No data available.

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions Wash to drains with lots of water. Dispose in accordance with all applicable regulations.

Local disposal regulations Dispose in accordance with all applicable regulations.

Hazardous waste code The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not established.

15. Regulatory information

US federal regulations

All components are on the U.S. EPA TSCA Inventory List.
This product is not known to be a "Hazardous Chemical" as defined by the OSHA Hazarc Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

SARA 304 Emergency release notification

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - No
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical	No

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA)	Not regulated.

US state regulations

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)

Not listed.

US. Massachusetts RTK - Substance List

Not regulated.

US. New Jersey Worker and Community Right-to-Know Act

Not listed.

US. Pennsylvania Worker and Community Right-to-Know Law

Not listed.

US. Rhode Island RTK

Not regulated.

US. California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date August-12-2013

Revision date October-12-2015

Version # 02

Disclaimer GFS Chemicals cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

Revision Information This document has undergone significant changes and should be reviewed in its entirety.

SAFETY DATA SHEET

Isobutylene

Section 1. Identification

GHS product identifier : Isobutylene

Chemical name : 2-methylpropene

Other means of identification : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

Product type : Gas.

Product use : Synthetic/Analytical chemistry.

Synonym : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

SDS # : 001031

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE GASES - Category 1
GASES UNDER PRESSURE - Liquefied gas

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Extremely flammable gas.
May form explosive mixtures with air.
Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Approach suspected leak area with caution.

Prevention : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response : Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

Storage : Protect from sunlight. Store in a well-ventilated place.

Disposal : Not applicable.

Hazards not otherwise classified : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : 2-methylpropene

Other means of identification : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

Product code : 001031

CAS number/other identifiers

CAS number : 115-11-7

Ingredient name	%	CAS number
Isobutylene	100	115-11-7

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Use only non-sparking tools. Avoid contact with eyes, skin and clothing. Empty containers retain product residue and can be hazardous. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F). Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Isobutylene	**ACGIH TLV (United States, 3/2017).** TWA: 250 ppm 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Section 8. Exposure controls/personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [Compressed gas.]

Color : Colorless.

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Melting point : -140.7°C (-221.3°F)

Boiling point : -6.9°C (19.6°F)

Critical temperature : 144.75°C (292.6°F)

Flash point : Closed cup: -76.1°C (-105°F)

Evaporation rate : Not available.

Flammability (solid, gas) : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.

Lower and upper explosive (flammable) limits : Lower: 1.8%
Upper: 9.6%

Vapor pressure : 24.3 (psig)

Vapor density : 1.94 (Air = 1)

Specific Volume (ft ^{3}/lb) : 6.6845

Gas Density (lb/ft ^{3}) : 0.1496 (25°C / 77 to °F)

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : 0.26 g/l

Partition coefficient: n-octanol/water : 2.34

Auto-ignition temperature : 465°C (869°F)

Decomposition temperature : Not available.

Viscosity : Not applicable.

Flow time (ISO 2431) : Not available.

Molecular weight : 56.12 g/mole

Aerosol product

Heat of combustion : -45029034 J/kg

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials : Oxidizers

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Isobutylene	LC50 Inhalation Vapor	Rat	550000 mg/m³	4 hours

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Section 11. Toxicological information

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Isobutylene	2.34	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Section 12. Ecological information

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1055	UN1055	UN1055	UN1055	UN1055
UN proper shipping name	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE
Transport hazard class(es)	2.1	2.1	2.1	2.1	2.1
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Additional information

DOT Classification : **Limited quantity** Yes.
Quantity limitation Passenger aircraft/rail: Forbidden. Cargo aircraft: 150 kg.
Special provisions 19, T50

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).
Explosive Limit and Limited Quantity Index 0.125
ERAP Index 3000
Passenger Carrying Ship Index Forbidden
Passenger Carrying Road or Rail Index Forbidden
Special provisions 29

IATA : **Quantity limitation** Passenger and Cargo Aircraft: Forbidden. Cargo Aircraft Only: 150 kg.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Air Act (CAA) 112 regulated flammable substances: Isobutylene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : This material is listed or exempted.

Canada : This material is listed or exempted.

China : This material is listed or exempted.

Europe : This material is listed or exempted.

Japan : **Japan inventory (ENCS)**: This material is listed or exempted.
Japan inventory (ISHL): Not determined.

Malaysia : Not determined.

New Zealand : This material is listed or exempted.

Philippines : This material is listed or exempted.

Republic of Korea : This material is listed or exempted.

Section 15. Regulatory information

Taiwan : This material is listed or exempted.

Thailand : Not determined.

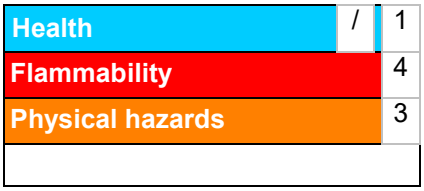
Turkey : Not determined.

United States : This material is listed or exempted.

Viet Nam : Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

National Fire Protection Association (U.S.A.)

Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
FLAMMABLE GASES - Category 1 GASES UNDER PRESSURE - Liquefied gas	Expert judgment Expert judgment

History

Date of printing : 5/10/2018

Date of issue/Date of revision : 5/10/2018

Date of previous issue : 7/11/2016

Version : 0.02

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973

Section 16. Other information

as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Safety Data Sheet

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Material Name	:	**Diesel (ULSD/Gasoil)**
Recommended Use / Restrictions of Use	:	Fuel for on-road diesel-powered engines. Fuel for use in off-road diesel engines, boilers, gas turbines and other combustion equipment.
Supplier	:	**Shell Eastern Trading (PTE) Ltd** 9 North Buona Vista Drive, #07-01, Tower 1, The Metropolis Singapore 138588 Singapore
Telephone	:	+65-6384 8000
Emergency Telephone Number	:	+44 (0) 151 350 4595

2. HAZARDS IDENTIFICATION

GHS Classification	:	Flammable liquids, Category 3 Aspiration hazard, Category 1 Acute toxicity, Category 4, Inhalation Skin corrosion/irritation, Category 2 Carcinogenicity, Category 2 Specific target organ toxicity - repeated exposure, Category 2, Blood., Thymus., Liver Hazardous to the aquatic environment - Long-term Hazard, Category 2 Acute hazards to the aquatic environment, Category 2
GHS Label Elements **Symbol(s)**	:	
Signal Words	:	Danger
Hazard Statement	:	PHYSICAL HAZARDS: H226: Flammable liquid and vapour. HEALTH HAZARDS:

H304: May be fatal if swallowed and enters airways.
H315: Causes skin irritation.
H332: Harmful if inhaled.
H351: Suspected of causing cancer.
H373: May cause damage to organs or organ systems through prolonged or repeated exposure.

ENVIRONMENTAL HAZARDS:
H411: Toxic to aquatic life with long lasting effects.
H401: Toxic to aquatic life.

GHS Precautionary Statements

Prevention : P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P261: Avoid breathing dust/fume/gas/mist/vapours/spray.
P280: Wear protective gloves/protective clothing/eye protection/face protection.

Response : P301+P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P331: Do NOT induce vomiting.

Disposal: : P501: Dispose of contents and container to appropriate waste site or reclaimer in accordance with local and national regulations.

Other Hazards which do not result in classification : Vapour in the headspace of tanks and containers may ignite and explode at temperatures exceeding auto-ignition temperature, where vapour concentrations are within the flammability range.
May ignite on surfaces at temperatures above auto-ignition temperature.
This material is a static accumulator. Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur.

Additional Information : This product is intended for use in closed systems only.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Mixture Description : Complex mixture of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons with carbon

numbers predominantly in the C9 to C25 range. May also contain several additives at <0.1% v/v each. May contain cetane improver (Ethyl Hexyl Nitrate) at <0.2% v/v.

May contain catalytically cracked oils in which polycyclic aromatic compounds, mainly 3-ring but some 4- to 6-ring species are present.

Classification of components according to GHS

Chemical Identity	Synonyms	CAS	Hazard Class (category)	Hazard Statement	Conc.
Fuels, diesel	Fuels, diesel	68334-30-5	Flam. Liq., 3; Asp. Tox., 1; Acute Tox., 4; Skin Corr., 2; Carc., 2; STOT RE, 2; Aquatic Chronic, 2; Aquatic Acute, 2;	H226; H304; H332; H315; H351; H373; H411; H401;	60.00 - 100.00 %
Distillates (Fischer-Tropsch) C8-26 - Branched and Linear	Distillates (Fischer-Tropsch) C8-26 - Branched and Linear	848301-67-7	Asp. Tox., 1; Flam. Liq., 4;	H304; H227;	0.00 - 30.00 %
Kerosine (Fischer Tropsch), Full range, C8-C16 branched and linear alkanes	Kerosine (Fischer Tropsch), Full range, C8-C16 branched and linear alkanes	848301-66-6	Asp. Tox., 1; Flam. Liq., 3;	H304; H226;	0.00 - 10.00 %

Additional Information : Dyes and markers can be used to indicate tax status and prevent fraud. Contains Cumene, CAS# 98-82-8 Contains Naphthalene, CAS # 91-20-3.

Refer to Ch 16 for full text of H phrases.

4. FIRST-AID MEASURES

Inhalation : Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.

Skin Contact : Remove contaminated clothing. Immediately flush skin with

		large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment. When using high pressure equipment, injection of product under the skin can occur. If high pressure injuries occur, the casualty should be sent immediately to a hospital. Do not wait for symptoms to develop.
Eye Contact	:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (38.3°C), shortness of breath, chest congestion or continued coughing or wheezing. Give nothing by mouth.
Most Important Symptoms/Effects, Acute & Delayed	:	If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Skin irritation signs and symptoms may include a burning sensation, redness, or swelling.
Immediate medical attention, special treatment	:	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Specific hazards arising from Chemicals	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Oxides of sulphur. Unidentified organic and inorganic compounds. Carbon monoxide may be evolved if incomplete combustion occurs. Will float and can be reignited on surface water. Flammable vapours may be present even at temperatures below the flash point. The vapour is heavier than air, spreads along the ground and distant ignition is possible.
Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use direct water jets on the burning product as they could cause a steam explosion and spread of the fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Protective Equipment & Precautions for Fire Fighters	:	Proper protective equipment including chemical resistant gloves are to be worn; chemical resistant suit is indicated if large contact with spilled product is expected. Self-Contained Breathing Apparatus must be worn when approaching a fire in a confined space. Select fire fighter's clothing approved to relevant Standards (e.g. Europe: EN469).
Additional Advice	:	Keep adjacent containers cool by spraying with water. If possible remove containers from the danger zone. If the fire cannot be extinguished the only course of action is to evacuate immediately. Contain residual material at affected sites to prevent material from entering drains (sewers), ditches, and waterways.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal. Observe the relevant local and international regulations. Evacuate the area of all non-essential personnel. Ventilate contaminated area thoroughly. Take precautionary measures against static discharges.

Personal Precautions, Protective Equipment and Emergency Procedures	:	Do not breathe fumes, vapour. Do not operate electrical equipment. Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area and evacuate all personnel. Attempt to disperse the gas or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Monitor area with combustible gas meter.
Environmental Precautions	:	Take measures to minimise the effects on groundwater. Contain residual material at affected sites to prevent material from entering drains (sewers), ditches, and waterways. Prevent from spreading or entering into drains, ditches or rivers by using sand, earth, or other appropriate barriers.
Methods and Material for Containment and Cleaning Up	:	Take precautionary measures against static discharges. For small liquid spills (< 1 drum), transfer by mechanical means to a labelled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate

absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. Shovel into a suitable clearly marked container for disposal or reclamation in accordance with local regulations.

Additional Advice : Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. Local authorities should be advised if significant spillages cannot be contained. Maritime spillages should be dealt with using a Shipboard Oil Pollution Emergency Plan (SOPEP), as required by MARPOL Annex 1 Regulation 26.

7. HANDLING AND STORAGE

General Precautions : Avoid breathing vapours or contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material. Air-dry contaminated clothing in a well-ventilated area before laundering. Prevent spillages. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Never siphon by mouth. Contaminated leather articles including shoes cannot be decontaminated and should be destroyed to prevent reuse.
Maintenance and Fuelling Activities - Avoid inhalation of vapours and contact with skin.

Precautions for Safe Handling : Avoid inhaling vapour and/or mists. Avoid prolonged or repeated contact with skin. When using do not eat or drink. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Earth all equipment. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. The vapour is heavier than air, spreads along the ground and distant ignition is possible.

Conditions for Safe Storage : Drum and small container storage: Drums should be stacked to a maximum of 3 high. Use properly labelled and closeable containers. Tank storage: Tanks must be specifically designed for use with this product. Bulk storage tanks should be diked (bunded). Locate tanks away from heat and other sources of ignition. Must be stored in a diked (bunded) well-ventilated area, away from sunlight, ignition sources and other sources of heat. Vapours from tanks should not be released to

		atmosphere. Breathing losses during storage should be controlled by a suitable vapour treatment system. The vapour is heavier than air. Beware of accumulation in pits and confined spaces. Keep container tightly closed and in a cool, well-ventilated place. Keep in a cool place. Electrostatic charges will be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk. The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable. Refer to section 15 for any additional specific legislation covering the packaging and storage of this product. Keep in a bunded area with a sealed (low permeability) floor, to provide containment against spillage. Prevent ingress of water.
Product Transfer	:	Avoid splash filling. Wait 2 minutes after tank filling (for tanks such as those on road tanker vehicles) before opening hatches or manholes. Wait 30 minutes after tank filling (for large storage tanks) before opening hatches or manholes. Keep containers closed when not in use. Contamination resulting from product transfer may give rise to light hydrocarbon vapour in the headspace of tanks that have previously contained gasoline. This vapour may explode if there is a source of ignition. Partly filled containers present a greater hazard than those that are full, therefore handling, transfer and sampling activities need special care. Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur. Be aware of handling operations that may give rise to additional hazards that result from the accumulation of static charges. These include but are not limited to pumping (especially turbulent flow), mixing, filtering, splash filling, cleaning and filling of tanks and containers, sampling, switch loading, gauging, vacuum truck operations, and mechanical movements. These activities may lead to static discharge e.g. spark formation. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/s until fill pipe submerged to twice its diameter, then <= 7 m/s). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations.
Recommended Materials	:	For containers, or container linings use mild steel, stainless steel. Aluminium may also be used for applications where it does not present an unnecessary fire hazard. Examples of suitable materials are: high density polyethylene (HDPE) and Viton (FKM), which have been specifically tested for compatibility with this product. For container linings, use

		amine-adduct cured epoxy paint. For seals and gaskets use: graphite, PTFE, Viton A, Viton B.
Unsuitable Materials	:	Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Examples of materials to avoid are: natural rubber (NR), nitrile rubber (NBR), ethylene propylene rubber (EPDM), polymethyl methacrylate (PMMA), polystyrene, polyvinyl chloride (PVC), polyisobutylene. However, some may be suitable for glove materials.
Container Advice	:	Containers, even those that have been emptied, can contain explosive vapours. Do not cut, drill, grind, weld or perform similar operations on or near containers.
Other Advice	:	Ensure that all local regulations regarding handling and storage facilities are followed. See additional references that provide safe handling practices for liquids that are determined to be static accumulators: American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practices on Static Electricity). CENELEC CLC/TR 50404 (Electrostatics – Code of practice for the avoidance of hazards due to static electricity).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

If the American Conference of Governmental Industrial Hygienists (ACGIH) value is provided on this document, it is provided for information only.

Occupational Exposure Limits

Material	Source	Type	ppm	mg/m3	Notation
Naphthalene	ACGIH	TWA	10 ppm		
	ACGIH	STEL	15 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
	SG OEL	TWA	10 ppm	52 mg/m3	
	SG OEL	STEL	15 ppm	79 mg/m3	

Fuels, diesel	ACGIH	SKIN_DES(Inhalable fraction and vapor.)			Can be absorbed through the skin.as total hydrocarbons
	ACGIH	TWA(Inhalable fraction and vapor.)		100 mg/m3	as total hydrocarbons
Cumene	ACGIH	TWA	50 ppm		
	SG OEL	TWA	50 ppm	246 mg/m3	

Additional Information : Skin notation means that significant exposure can also occur by absorption of liquid through the skin and of vapour through the eyes or mucous membranes.

Biological Exposure Index (BEI)

Material	Determinant	Sampling Time	BEI	Reference
Naphthalene	1-Naphthol, with hydrolysis + 2-Naphthol, with hydrolysis	Sampling time: End of shift.		ACGIH BEL (02 2013)

Appropriate Engineering Controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Use sealed systems as far as possible. Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits. Local exhaust ventilation is recommended. Eye washes and showers for emergency use. Always observe good personal hygiene measures, such as washing hands after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping. Define procedures for safe handling and maintenance of controls.

Educate and train workers in the hazards and control measures relevant to normal activities associated with this product. Ensure appropriate selection, testing and maintenance of equipment used to control exposure, e.g. personal protective equipment, local exhaust ventilation. Firewater monitors and deluge systems are recommended. Drain down system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.

Individual Protection Measures : Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.

Respiratory Protection : If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Where air-filtering respirators are unsuitable (e.g. airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus. All respiratory protection equipment and use must be in accordance with local regulations. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65°C(149 °F)].

Hand Protection : Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for > 480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same, but recognise that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time may be acceptable so long as appropriate maintenance and replacement regimes are followed. Glove thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material. Select gloves tested to a relevant standard (e.g. Europe EN374, US F739). When prolonged or frequent repeated contact occurs, Nitrile gloves may be suitable. (Breakthrough

		time of > 240 minutes.) For incidental contact/splash protection Neoprene, PVC gloves may be suitable.
Eye Protection	:	Chemical splash goggles (chemical monogoggles). If a local risk assessment deems it so, then chemical splash goggles may not be required and safety glasses may provide adequate eye protection.
Protective Clothing	:	Chemical resistant gloves/gauntlets, boots, and apron (where risk of splashing).
Thermal Hazards	:	Not applicable.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate. Validated exposure measurement methods should be applied by a competent person and samples analysed by an accredited laboratory. Examples of sources of recommended exposure measurement methods are given below or contact the supplier. Further national methods may be available. National Institute of Occupational Safety and Health (NIOSH), USA: Manual of Analytical Methods http://www.cdc.gov/niosh/ Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods http://www.osha.gov/
Environmental Exposure Controls	:	Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour. Information on accidental release measures are to be found in section 6. Take appropriate measures to fulfil the requirements of relevant environmental protection legislation. Avoid contamination of the environment by following advice given in Chapter 6. If necessary, prevent undissolved material from being discharged to waste water. Waste water should be treated in a municipal or industrial waste water treatment plant before discharge to surface water.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Colourless to yellowish. Liquid.
Odour	:	May contain a reodorant
Odour threshold	:	Data not available
pH	:	Not applicable
Initial Boiling Point and Boiling Range	:	170 - 390 °C / 338 - 734 °F
Pour point	:	<= 6 °C / 43 °F
Flash point	:	> 55 °C / 131 °F
Upper / lower Flammability or	:	1 - 6 %(V)

Explosion limits		
Auto-ignition temperature	:	> 220 °C / 428 °F
Vapour pressure	:	1 hPa at 20 °C / 68 °F
Relative Density	:	Data not available
Density	:	0.8 - 0.89 g/cm3 at 15 °C / 59 °F
Water solubility	:	Data not available
Solubility in other solvents	:	Data not available
n-octanol/water partition coefficient (log Pow)	:	3 - 6
Dynamic viscosity	:	Data not available
Kinematic viscosity	:	1.5 - 6 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	Data not available
Electrical conductivity	:	Low conductivity: < 100 pS/m, The conductivity of this material makes it a static accumulator., A liquid is typically considered nonconductive if its conductivity is below 100 pS/m and is considered semi-conductive if its conductivity is below 10 000 pS/m., Whether a liquid is nonconductive or semi-conductive, the precautions are the same., A number of factors, for example liquid temperature, presence of contaminants, and anti-static additives can greatly influence the conductivity of a liquid.
Evaporation rate (nBuAc=1)	:	Data not available
Decomposition Temperature	:	Data not available
Flammability	:	Not applicable.

10. STABILITY AND REACTIVITY

Chemical stability	:	Stable under normal use conditions.
Possibility of Hazardous Reactions	:	No hazardous reaction is expected when handled and stored according to provisions.
Conditions to Avoid	:	Avoid heat, sparks, open flames and other ignition sources.
Incompatible Materials	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage. Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases, including carbon monoxide, carbon dioxide and other organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.
Sensitivity to Static Discharge	:	Yes, in certain circumstances product can ignite due to static electricity.

11. TOXICOLOGICAL INFORMATION

Information on Toxicological effects

Basis for Assessment	:	Information given is based on product data, a knowledge of the components and the toxicology of similar products. Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).
Likely Routes of Exposure	:	Exposure may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion.
Acute Oral Toxicity	:	Low toxicity: LD50 > 5000 mg/kg , Rat
Acute Dermal Toxicity	:	Low toxicity: LD50 >2000 mg/kg , Rabbit
Acute Inhalation Toxicity	:	Harmful if inhaled. LC50 > 1.0 - <= 5.0 mg/l , 4 h, Rat High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.
Skin corrosion/irritation	:	Irritating to skin.
Serious eye damage/irritation	:	Expected to be slightly irritating.
Respiratory Irritation	:	Inhalation of vapours or mists may cause irritation to the respiratory system.
Respiratory or skin sensitisation	:	Not expected to be a sensitiser.
Aspiration Hazard	:	Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.
Germ cell mutagenicity	:	Positive in in-vitro, but negative in in-vivo mutagenicity assays.
Carcinogenicity	:	Limited evidence of carcinogenic effect. Repeated skin contact has resulted in irritation and skin cancer in animals.

Material	:	**Carcinogenicity Classification**
Naphthalene	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Naphthalene	:	NTP: Reasonably Anticipated to be a Human Carcinogen.
Naphthalene	:	IARC 2B: Possibly carcinogenic to humans.
Naphthalene	:	GHS / CLP: Carcinogenicity Category 2

Fuels, diesel	:	ACGIH Group A3: Confirmed animal carcinogen with unknown relevance to humans.
Fuels, diesel	:	GHS / CLP: Carcinogenicity Category 2
Distillates (Fischer-Tropsch) C8-26 - Branched and Linear	:	GHS / CLP: No carcinogenicity classification
Kerosine (Fischer Tropsch), Full range, C8-C16 branched and linear alkanes	:	GHS / CLP: No carcinogenicity classification
Cumene	:	IARC 2B: Possibly carcinogenic to humans.
Cumene	:	GHS / CLP: No carcinogenicity classification

Reproductive and Developmental Toxicity : Not expected to impair fertility. Not expected to be a developmental toxicant.

Specific target organ toxicity - single exposure : Not classified.

Specific target organ toxicity - repeated exposure : May cause damage to organs or organ systems through prolonged or repeated exposure. Blood. Thymus. Liver.

Additional Information : Classifications by other authorities under varying regulatory frameworks may exist.

12. ECOLOGICAL INFORMATION

Basis for Assessment : Information given is based on a knowledge of the components and the ecotoxicology of similar products. Fuels are typically made from blending several refinery streams. Ecotoxicological studies have been carried out on a variety of hydrocarbon blends and streams but not those containing additives. Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).

Acute Toxicity : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l (to aquatic organisms) LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract.

Fish : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Aquatic crustacea : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Algae/aquatic plants : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Microorganisms : Expected to be practically non toxic: LL/EL/IL50 > 100 mg/l

Chronic Toxicity

Fish : NOEC/NOEL expected to be > 0.01 - <= 0.1 mg/l (based on

		modeled data)
Aquatic crustacea	:	NOEC/NOEL expected to be > 0.1 - <= 1.0 mg/l (based on modeled data)
Mobility	:	Partly evaporates from water or soil surfaces, but a significant proportion will remain after one day. If product enters soil, one or more constituents will be mobile and may contaminate groundwater. Large volumes may penetrate soil and could contaminate groundwater. Floats on water.
Persistence/degradability	:	Major constituents are inherently biodegradable. The volatile constituents will oxidize rapidly by photochemical reactions in air.
Bioaccumulative Potential	:	Contains constituents with the potential to bioaccumulate. Log Kow > =4
Other Adverse Effects	:	Films formed on water may affect oxygen transfer and damage organisms.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses. Do not dispose of tank water bottoms by allowing them to drain into the ground. This will result in soil and groundwater contamination. Waste arising from a spillage or tank cleaning should be disposed of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
Container Disposal	:	Send to drum recoverer or metal reclaimer. Drain container thoroughly. After draining, vent in a safe place away from sparks and fire. Residues may cause an explosion hazard if heated above the flash point. Do not puncture, cut or weld uncleaned drums. Do not pollute the soil, water or environment with the waste container. Comply with any local recovery or waste disposal regulations.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations. Local regulations may be more stringent than regional or national requirements and must be in compliance.

14. TRANSPORT INFORMATION

Land (as per ADR classification): Regulated

Class	:	3
Packing group	:	III
Hazard indentification no.	:	30
UN number	:	1202
Danger label (primary risk)	:	3
Proper shipping name	:	DIESEL FUEL
Environmentally Hazardous	:	Yes

IMDG

Identification number	UN 1202
Proper shipping name	DIESEL FUEL
Class / Division	3
Packing group	III
Environmental hazards:	Yes

IATA (Country variations may apply)

UN number	:	1202
Proper shipping name	:	Diesel fuel
Class / Division	:	3
Packing group	:	III

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Pollution Category	**:**	Not applicable.
Ship Type	**:**	Not applicable.
Product Name	**:**	Not applicable.
Special Precaution	**:**	Not applicable.
Additional Information	**:**	MARPOL Annex 1 rules apply for bulk shipments by sea.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

Local Regulations

Workplace Safety and Health Act & Workplace Safety and Health (General Provision) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Environmental Protection and Management Act and Environmental Protection and Management	:	This product is subject to the requirement in the Act/ Regulations.

(Hazardous Substances) Regulations		
Maritime and Port Authority of Singapore (Dangerous Goods, Petroleum and Explosives) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Fire Safety Act and Fire Safety (Petroleum & Flammable Materials) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Classification triggering components	:	Contains fuels, diesel.
Other Information	:	IARC has classified diesel exhaust emissions as a Class 1 carcinogen - carcinogenic to humans. Steps should be taken to prevent personal exposure to diesel exhaust emissions.

16. OTHER INFORMATION

Hazard Statement

H226	Flammable liquid and vapour.
H227	Combustible liquid.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H332	Harmful if inhaled.
H351	Suspected of causing cancer.
H373	May cause damage to organs or organ systems through prolonged or repeated exposure.
H401	Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

Additional Information	:	This document contains important information to ensure the safe storage, handling and use of this product. The information in this document should be brought to the attention of the person in your organisation responsible for advising on safety matters.
SDS Version Number	:	1.1
SDS Effective Date	:	10.03.2014
SDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
Uses and Restrictions	:	This product must not be used in applications other than those recommended in Section 1, without first seeking the advice of the supplier. This product is not to be used as a solvent or cleaning agent;

for lighting or brightening fires; as a skin cleanser.

SDS Distribution : The information in this document should be made available to all who may handle the product.

Key/Legend to Abbrevations used in this SDS : The standard abbreviations and acronyms used in this document can be looked up in reference literature (e.g. scientific dictionaries) and/or websites.

Flam. Liq.	Flammable liquids
Asp. Tox.	Aspiration hazard
Acute Tox.	Acute toxicity
Skin Corr.	Skin corrosion/irritation
Carc.	Carcinogenicity
STOT RE	Specific target organ toxicity - repeated exposure

Key Literature References : The quoted data are from, but not limited to, one or more sources of information (e.g. toxicological data from Shell Health Services, material suppliers' data, CONCAWE, EU IUCLID date base, EC 1272 regulation, etc).

Disclaimer : This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

SAFETY DATA SHEET

CITGO Gasolines, All Grades Unleaded

Section 1. Identification

GHS product identifier : CITGO Gasolines, All Grades Unleaded

Synonyms : Unleaded Gasolines; Conventional Unleaded Gasoline with Ethanol; Unleaded Gasoline with Ethanol; Reformulated Unleaded Gasoline with Ethanol; Motor Gasolines; Petrol; Automobile Motor Fuels; Finished Gasolines; Gasoline, Regular Unleaded; Gasoline, Mid-grade Unleaded; Gasoline, Premium Unleaded; Reformulated Gasolines (RFG); Reformulated Motor Fuels; Oxygenated Motor Spirits; Gasoline, Regular Reformulated; Gasoline, Mid-grade Reformulated; Gasoline, Premium Reformulated; RBOB; GTAB; Arizona Clean Burning Gasoline (CBG); CARB Gasoline with Ethanol.

Material uses : Fuel.

Code : Various

MSDS # : UNLEAD

Supplier's details : CITGO Petroleum Corporation
P.O. Box 4689
Houston, TX 77210
sdsvend@citgo.com

Emergency telephone number : Technical Contact: (832) 486-4000
Medical Emergency: (832) 486-4700
CHEMTREC Emergency: (800) 424-9300
(United States Only)

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE LIQUIDS - Category 2
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2B
GERM CELL MUTAGENICITY - Category 1B
CARCINOGENICITY - Category 1B
TOXIC TO REPRODUCTION [Fertility] - Category 2
TOXIC TO REPRODUCTION [Unborn child] - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) [central nervous system (CNS)] - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) [Respiratory tract irritation and Narcotic effects] - Category 3
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 1
ASPIRATION HAZARD - Category 1

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Highly flammable liquid and vapor.
Causes skin and eye irritation.
May cause genetic defects.
May cause cancer.
Suspected of damaging fertility or the unborn child.
May be fatal if swallowed and enters airways.
May cause damage to organs. (central nervous system (CNS))
May cause respiratory irritation.
May cause drowsiness and dizziness.

Section 2. Hazards identification

Causes damage to organs through prolonged or repeated exposure.

Precautionary statements

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Use only outdoors or in a well-ventilated area. Do not breathe vapor. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling.

Response : Get medical attention if you feel unwell. IF exposed or if you feel unwell: Call a POISON CENTER or physician. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or physician if you feel unwell. IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. If skin irritation occurs: Get medical attention.

Storage : Store locked up. Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Supplemental label elements : Avoid contact with skin and clothing. Wash thoroughly after handling.

Hazards not otherwise classified : Prolonged or repeated contact may dry skin and cause irritation.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Other means of identification : Unleaded Gasolines; Conventional Unleaded Gasoline with Ethanol; Unleaded Gasoline with Ethanol; Reformulated Unleaded Gasoline with Ethanol; Motor Gasolines; Petrol; Automobile Motor Fuels; Finished Gasolines; Gasoline, Regular Unleaded; Gasoline, Mid-grade Unleaded; Gasoline, Premium Unleaded; Reformulated Gasolines (RFG); Reformulated Motor Fuels; Oxygenated Motor Spirits; Gasoline, Regular Reformulated; Gasoline, Mid-grade Reformulated; Gasoline, Premium Reformulated; RBOB; GTAB; Arizona Clean Burning Gasoline (CBG); CARB Gasoline with Ethanol.

Ingredient name	%	CAS number
Toluene	<20	108-88-3
Pentane, all isomers	<20	109-66-0
Xylenes, mixed isomers	<20	1330-20-7
Hexane, other isomers	<15	*
Heptane, all isomers	<15	142-82-5
Ethanol	0 - 10	64-17-5
Butane	0 - 10	106-97-8
Benzene	<4.9	71-43-2
Cumene	<4	98-82-8
Ethylbenzene	<4	100-41-4
n-Hexane	<3	110-54-3
Cyclohexane	<3	110-82-7
1,2,4-Trimethylbenzene	<2	95-63-6
Naphthalene	<2	91-20-3

* = Various ** = Mixture *** = Proprietary

Any concentration shown as a range is to protect confidentiality or is due to process variation.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention. If necessary, call a poison center or physician.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that gas or vapor is still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Wash skin thoroughly with soap and water or use recognized skin cleanser. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. If necessary, call a poison center or physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Get medical attention immediately. Call a poison center or physician. Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. Aspiration hazard if swallowed. Can enter lungs and cause damage. Do not induce vomiting. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute

Potential acute health effects

Eye contact : Causes eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness. May cause respiratory irritation. Breathing high concentrations can cause irregular heartbeats which can be fatal.

Skin contact : Causes skin irritation. Defatting to the skin.

Ingestion : Can cause central nervous system (CNS) depression. May be fatal if swallowed and enters airways. Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
respiratory tract irritation
coughing
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness
Breathing high concentrations can cause irregular heartbeats which can be fatal.

Skin contact : Adverse symptoms may include the following:
irritation
redness
dryness
cracking

Ingestion : Adverse symptoms may include the following:
nausea or vomiting

Indication of immediate medical attention and special treatment needed, if necessary

Section 4. First aid measures

Notes to physician : This material (or a component) may sensitize the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrthymias in individuals exposed to this material. If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

Specific treatments : Treat symptomatically and supportively.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that gas or vapor is still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Specific hazards arising from the chemical : Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Extinguishing media

Suitable extinguishing media : Use dry chemical, carbon dioxide (CO_2,) water spray (fog) or foam. SMALL FIRE: Steam, CO_2, dry chemical or inert gas (e.g., nitrogen). LARGE FIRE: Use foam, water fog or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, ignition or explosion.

Unsuitable extinguishing media : Do not use water jet.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Section 6. Accidental release measures

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Absorb with an inert material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Use only as a motor fuel. Do not syphon by mouth. Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Avoid exposure during pregnancy. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not swallow. Avoid release to the environment. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container. Non equilibrium conditions may increase the fire hazard associated with this product. Always bond receiving containers to the fill pipe before and during loading. Always confirm that receiving container is properly grounded. Bonding and grounding alone may be inadequate to eliminate fire and explosion hazards. Carefully review operations that may increase the risks such as tank and container filling, tank cleaning, sampling, gauging, loading, filtering, mixing, agitation, etc. In addition to bonding and grounding, efforts to mitigate the hazards may include, but are not limited to, ventilation, inerting and/or reduction of transfer velocities.

Always keep nozzle in contact with the container throughout the loading process. Do NOT fill any portable container in or on a vehicle.

Special precautions, such as reduced loading rates and increased monitoring, must be observed during "switch loading" operations (i.e., loading this material in tanks or shipping compartments that previously contained a dissimilar product).

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental

Section 7. Handling and storage

contamination.

Bulk Storage Conditions: Maintain all storage tanks in accordance with applicable regulations. Use necessary controls to monitor tank inventories. Inspect all storage tanks on a periodic basis. Test tanks and associated piping for tightness. Maintain the automatic leak detection devices to assure proper working condition.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Pentane, all isomers	**ACGIH TLV (United States, 4/2014).** TWA: 1000 ppm 8 hours. **OSHA PEL (United States, 2/2013).** TWA: 1000 ppm 8 hours. TWA: 2950 mg/m³ 8 hours.
Toluene	**OSHA PEL Z2 (United States, 2/2013).** TWA: 200 ppm 8 hours. CEIL: 300 ppm AMP: 500 ppm 10 minutes. **ACGIH TLV (United States, 4/2014).** TWA: 20 ppm 8 hours.
Xylenes, mixed isomers	**ACGIH TLV (United States, 4/2014).** TWA: 100 ppm 8 hours. TWA: 434 mg/m³ 8 hours. STEL: 150 ppm 15 minutes. STEL: 651 mg/m³ 15 minutes. **OSHA PEL (United States, 2/2013).** TWA: 100 ppm 8 hours. TWA: 435 mg/m³ 8 hours.
Hexane, other isomers	**ACGIH (United States).** TWA: 500 ppm 8 hours. STEL: 1000 ppm 15 minutes.
Heptane, all isomers	**ACGIH TLV (United States, 4/2014).** TWA: 400 ppm 8 hours. TWA: 1640 mg/m³ 8 hours. STEL: 500 ppm 15 minutes. STEL: 2050 mg/m³ 15 minutes. **OSHA PEL (United States, 2/2013).** TWA: 500 ppm 8 hours. TWA: 2000 mg/m³ 8 hours.
Ethanol	**ACGIH (United States).** TWA: 1000 ppm 8 hours. **OSHA (United States).** TWA: 1000 ppm 8 hours. **ACGIH TLV (United States, 4/2014).** STEL: 1000 ppm 15 minutes. **OSHA PEL (United States, 2/2013).** TWA: 1000 ppm 8 hours. TWA: 1900 mg/m³ 8 hours.
Butane	**ACGIH (United States).** TWA: 800 ppm 8 hours. **ACGIH TLV (United States, 4/2014).** STEL: 1000 ppm 15 minutes.
Benzene	**ACGIH TLV (United States, 4/2014). Absorbed through skin.** TWA: 0.5 ppm 8 hours. TWA: 1.6 mg/m³ 8 hours. STEL: 2.5 ppm 15 minutes. STEL: 8 mg/m³ 15 minutes.

Section 8. Exposure controls/personal protection

	OSHA PEL (United States, 2/2013). TWA: 1 ppm 8 hours. STEL: 5 ppm 15 minutes. **OSHA PEL Z2 (United States, 2/2013).** TWA: 10 ppm 8 hours. CEIL: 25 ppm AMP: 50 ppm 10 minutes.
Cumene	**ACGIH TLV (United States, 4/2014).** TWA: 50 ppm 8 hours. **OSHA PEL (United States, 2/2013). Absorbed through skin.** TWA: 50 ppm 8 hours. TWA: 245 mg/m³ 8 hours.
Ethylbenzene	**ACGIH TLV (United States, 4/2014).** TWA: 20 ppm 8 hours. **OSHA PEL (United States, 2/2013).** TWA: 100 ppm 8 hours. TWA: 435 mg/m³ 8 hours.
n-Hexane	**ACGIH TLV (United States, 4/2014). Absorbed through skin.** TWA: 50 ppm 8 hours. **OSHA PEL (United States, 2/2013).** TWA: 500 ppm 8 hours. TWA: 1800 mg/m³ 8 hours.
Cyclohexane	**ACGIH TLV (United States, 4/2014).** TWA: 100 ppm 8 hours. **OSHA PEL (United States, 2/2013).** TWA: 300 ppm 8 hours. TWA: 1050 mg/m³ 8 hours.
1,2,4-Trimethylbenzene	**ACGIH TLV (United States, 4/2014).** TWA: 25 ppm 8 hours. TWA: 123 mg/m³ 8 hours.
Naphthalene	**ACGIH (United States). Absorbed through skin.** TWA: 10 ppm 8 hours. STEL: 15 ppm 15 minutes. **OSHA (United States).** TWA: 10 ppm 8 hours. **ACGIH TLV (United States, 4/2014). Absorbed through skin.** TWA: 10 ppm 8 hours. TWA: 52 mg/m³ 8 hours. **OSHA PEL (United States, 2/2013).** TWA: 10 ppm 8 hours. TWA: 50 mg/m³ 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, vapor controls, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Section 8. Exposure controls/personal protection

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles. Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Avoid skin contact with liquid. Chemical-resistant gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: Heavy duty, industrial grade chemically resistant gloves constructed of nitrile, neoprene, polyethylene, fluoroelastomer rubber or polyvinyl chloride as approved by glove manufacturer. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. Leather gloves are not protective for liquid contact.

Body protection : Avoid skin contact with liquid. Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Avoid skin contact with liquid. Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Leather boots are not protective for liquid contact.

Respiratory protection : Avoid inhalation of gases, vapors, mists or dusts. Use a properly fitted, air-purifying or supplied-air respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. If an air purifying respirator is appropriate, use one equipped with cartridges rated for organic vapors.

Section 9. Physical and chemical properties

Physical state : Liquid.

Color : Transparent, clear to amber or red.

Odor : Pungent, characteristic gasoline.

pH : Not applicable

Boiling point/boiling range : 38 to 204°C (100.4 to 399.2°F)

Flash point : Closed cup: -43°C (-45.4°F) [Tagliabue [ASTM D-56]]

Evaporation rate : 7.5 (n-butyl acetate. = 1)

Lower and upper explosive (flammable) limits : Lower: 1.4%
Upper: 7.6%

Vapor pressure : 29.3 to 60 kPa (220 to 450 mm Hg) [room temperature]

Vapor density : 3 to 4 [Air = 1]

Relative density : 0.72 to 0.77

Solubility : Very slightly soluble in the following materials: cold water.

Auto-ignition temperature : 280°C (536°F)

Viscosity : Kinematic (room temperature): <0.01 cm^2/s (<1 cSt)

Section 10. Stability and reactivity

Reactivity : Not expected to be Explosive, Self-Reactive, Self-Heating, or an Organic Peroxide under US GHS Definition(s).

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.

Incompatible materials : Reactive or incompatible with the following materials:
oxidizing materials

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Toluene	LC50 Inhalation Vapor	Rat	>20 mg/l	4 hours
	LD50 Dermal	Rabbit	12267 mg/kg	-
	LD50 Oral	Rat - Male	5580 mg/kg	-
	TDLo Oral	Rat	1000 mg/kg	-
Xylenes, mixed isomers	LC50 Inhalation Vapor	Rat	5000 ppm	4 hours
	LC50 Inhalation Vapor	Rat	6700 ppm	4 hours
	LD50 Oral	Mouse	2119 mg/kg	-
	LD50 Oral	Rat	4300 mg/kg	-
	LD50 Oral	Rat	4300 mg/kg	-
Hexane, other isomers	LC50 Inhalation Gas.	Rat	48000 ppm	4 hours
Heptane, all isomers	LD50 Dermal	Rabbit	>2000 mg/kg	-
	LD50 Oral	Rat	>5000 mg/kg	-
Ethanol	LC50 Inhalation Vapor	Mouse	>40000 ppm	10 minutes
	LC50 Inhalation Vapor	Rat	124700 mg/m³	4 hours
	LD50 Oral	Guinea pig	5560 mg/kg	-
	LD50 Oral	Rabbit	6300 mg/kg	-
	LD50 Oral	Rat	7060 mg/kg	-
Butane	LC50 Inhalation Vapor	Mouse	680000 mg/m³	2 hours
	LC50 Inhalation Vapor	Rat	658000 mg/m³	4 hours
Benzene	LC50 Inhalation Vapor	Rat	10000 ppm	7 hours
	LD50 Oral	Mammal - species unspecified	5700 mg/kg	-
	LD50 Oral	Mouse	4700 mg/kg	-
	LD50 Oral	Rat	6400 mg/kg	-
Cumene	LC50 Inhalation Vapor	Mouse	10 g/m³	7 hours
	LD50 Dermal	Rabbit	12300 uL/kg	-
	LD50 Oral	Rat	2.9 g/kg	-
	LD50 Oral	Rat	4000 mg/kg	-
Ethylbenzene	LD50 Dermal	Rabbit	>5000 mg/kg	-
	LD50 Oral	Rat	3500 mg/kg	-
n-Hexane	LC50 Inhalation Vapor	Rat	48000 ppm	4 hours
	LD50 Oral	Rat	15840 mg/kg	-
Cyclohexane	LC50 Inhalation Vapor	Mouse	70000 mg/m³	2 hours
	LD50 Oral	Rat	6240 mg/kg	-
	LD50 Oral	Rat	12705 mg/kg	-

Section 11. Toxicological information

	LD50 Oral	Rat	>5000 mg/kg	-
	LDLo Oral	Rabbit	5500 mg/kg	-
1,2,4-Trimethylbenzene	LC50 Inhalation Vapor	Rat	18000 mg/m³	4 hours
	LD50 Oral	Mouse	6900 mg/kg	-
	LD50 Oral	Rat	5 g/kg	-
Naphthalene	LD50 Oral	Rat	490 mg/kg	-

Conclusion/Summary : **Pentane, all isomers**: Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.
Toluene: Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse) can cause CNS depression, cardiac arrhythmias and death.
Xylenes, mixed isomers: Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.
Heptane, all isomers: Heptane is a CNS depressant and narcosis at elevated concentrations.
Ethanol: Inhalation exposure to ethanol vapor at concentrations above applicable workplace exposure levels is expected to produce eye and mucus membrane irritation. Human exposure at concentrations from 1000 to 5000 ppm produced symptoms of narcosis, stupor and unconsciousness. Subjects exposed to ethanol vapor in concentrations between 500 and 10,000 ppm experienced coughing and smarting of the eyes and nose. At 15,000 ppm there was continuous lacrimation and coughing. While extensive acute and chronic effects can be expected with ethanol consumption, ingestion is not expected to be a significant route of exposure to this product.
Butane: Studies in laboratory animals indicate exposure to extremely high levels of butanes (1-10 or higher vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.
Cumene: Overexposure to cumene may cause upper respiratory tract irritation and CNS depression.
n-Hexane: n-Hexane is a CNS depressant and narcosis at elevated concentrations.
Cyclohexane: Cyclohexane is a CNS depressant and narcosis at elevated concentrations.

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
Toluene	Eyes - Mild irritant	Rabbit	-	0.5 minutes 100 milligrams	-
	Eyes - Mild irritant	Rabbit	-	870 Micrograms	-
	Skin - Mild irritant	Pig	-	24 hours 250 microliters	-
	Skin - Mild irritant	Rabbit	-	435 milligrams	-
	Skin - Moderate irritant	Rabbit	-	500 milligrams	-
Xylenes, mixed isomers	Skin - Mild irritant	Rat	-	8 hours 60 microliters	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 milligrams	-
	Skin - Moderate irritant	Rabbit	-	100 Percent	-
Ethanol	Eyes - Mild irritant	Rabbit	-	24 hours 500 milligrams	-
	Eyes - Moderate irritant	Rabbit	-	0.066666667 minutes 100 milligrams	-
	Eyes - Moderate irritant	Rabbit	-	100 microliters	-
	Skin - Mild irritant	Rabbit	-	400 milligrams	-

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	Skin - Moderate irritant	Rabbit	-	24 hours 20 milligrams	-
Benzene	Eyes - Moderate irritant	Rabbit	-	88 milligrams	-
	Skin - Mild irritant	Rat	-	8 hours 60 microliters	-
	Skin - Mild irritant	Rabbit	-	24 hours 15 milligrams	-
Cumene	Eyes - Mild irritant	Rabbit	-	86 milligrams	-
	Skin - Mild irritant	Rabbit	-	24 hours 10 milligrams	-
Ethylbenzene	Skin - Mild irritant	Rabbit	-	24 hours 15 milligrams	-
n-Hexane	Eyes - Mild irritant	Rabbit	-	10 milligrams	-
1,2,4-Trimethylbenzene	Skin - Edema	Rabbit	3	-	-
Naphthalene	Skin - Mild irritant	Rabbit	-	495 milligrams	-

Skin : **Xylenes, mixed isomers**: May cause skin irritation.
Cyclohexane: Cyclohexane can cause eye, skin and mucous membrane irritation.

Eyes : **Xylenes, mixed isomers**: May cause eye irritation.

Respiratory : No additional information.

Sensitization

Skin : **Toluene**: Non-sensitizer to skin.

Respiratory : **Toluene**: Non-sensitizer to lungs.

Mutagenicity

Conclusion/Summary : **Heptane, all isomers**: n-heptane was not mutagenic in the Salmonella/microsome (Ames) assay.
Benzene: Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes.

Carcinogenicity

Product/ingredient name	Result	Species	Dose	Exposure
Benzene	Positive - Inhalation - TD	Rat - Female	-	-

Conclusion/Summary : **Ethanol**: IARC Monograph 96 (2010) identified Ethanol in alcoholic beverages as a Group 1 carcinogen.
Benzene: Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia. Also, studies suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems.
Ethylbenzene: Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as “possibly carcinogenic to humans” (Group 2B).
Cumene: Studies in laboratory animals indicate evidence of adverse effects on the kidney and adrenal glands following high level exposure. The relevance of these findings to humans is not clear at this time. IARC has classified cumene as “possibly carcinogenic to humans” (Group 2B). In addition, NTP has determined cumene is reasonably anticipated to be a human carcinogen based on sufficient evidence of carcinogenicity from studies in experimental animals.

Classification

Section 11. Toxicological information

Product/ingredient name	OSHA	IARC	NTP
Toluene	-	3	-
Xylenes, mixed isomers	-	3	-
Ethanol	-	1	-
Benzene	+	1	Known to be a human carcinogen.
Ethylbenzene	-	2B	-
Cumene	-	2B	Reasonably anticipated to be a human carcinogen.
Naphthalene	-	2B	Reasonably anticipated to be a human carcinogen.

Reproductive toxicity

Conclusion/Summary : **Toluene**: Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure.
Benzene: One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.
Ethylbenzene: Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time.
n-Hexane: In laboratory studies, prolonged exposure to elevated concentrations of n-hexane was associated with decreased sperm count and degenerative changes in the testicles of rats.

Teratogenicity

Product/ingredient name	Result	Species	Dose	Exposure
Benzene	Negative - Inhalation	Rat	-	-

Conclusion/Summary : No additional information.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
Toluene	Category 3	Not applicable.	Narcotic effects
Pentane, all isomers	Category 3	Not applicable.	Narcotic effects
Hexane, other isomers	Category 3	Not applicable.	Narcotic effects
Heptane, all isomers	Category 3	Not applicable.	Narcotic effects
Ethanol	Category 3	Not applicable.	Respiratory tract irritation
Butane	Category 2	Not determined	central nervous system (CNS)
Cumene	Category 3	Not applicable.	Respiratory tract irritation
Ethylbenzene	Category 3	Not applicable.	Respiratory tract irritation
n-Hexane	Category 3	Not applicable.	Narcotic effects
Cyclohexane	Category 3	Not applicable.	Narcotic effects

Section 11. Toxicological information

1,2,4-Trimethylbenzene	Category 3	Not applicable.	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
Toluene Benzene n-Hexane	Category 2 Category 1 Category 2	Inhalation Inhalation Inhalation	kidneys blood system peripheral nervous system

Aspiration hazard

Name	Result
CITGO Gasolines, All Grades Unleaded	ASPIRATION HAZARD - Category 1
Pentane, all isomers	ASPIRATION HAZARD - Category 1
Toluene	ASPIRATION HAZARD - Category 1
Hexane, other isomers	ASPIRATION HAZARD - Category 1
Heptane, all isomers	ASPIRATION HAZARD - Category 1
Benzene	ASPIRATION HAZARD - Category 1
Cumene	ASPIRATION HAZARD - Category 1
Ethylbenzene	ASPIRATION HAZARD - Category 1
n-Hexane	ASPIRATION HAZARD - Category 1
Cyclohexane	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure : Routes of entry anticipated: Oral, Dermal, Inhalation.

Potential acute health effects

Eye contact : Causes eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness. May cause respiratory irritation. Breathing high concentrations can cause irregular heartbeats which can be fatal.

Skin contact : Causes skin irritation. Defatting to the skin.

Ingestion : Can cause central nervous system (CNS) depression. May be fatal if swallowed and enters airways. Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
respiratory tract irritation
coughing
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness
Breathing high concentrations can cause irregular heartbeats which can be fatal.

Skin contact : Adverse symptoms may include the following:
irritation
redness
dryness
cracking

Ingestion : Adverse symptoms may include the following:
nausea or vomiting

Potential chronic health effects

Section 11. Toxicological information

General : Causes damage to organs through prolonged or repeated exposure. Prolonged or repeated contact can defat the skin and lead to irritation, cracking and/or dermatitis.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : May cause genetic defects.

Teratogenicity : Suspected of damaging the unborn child.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : Suspected of damaging fertility.

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
Toluene	Acute EC50 433 ppm Marine water	Algae - Skeletonema costatum	96 hours
	Acute EC50 12500 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	72 hours
	Acute EC50 11600 µg/l Fresh water	Crustaceans - Gammarus pseudolimnaeus - Adult	48 hours
	Acute EC50 6000 µg/l Fresh water	Daphnia - Daphnia magna - Juvenile (Fledgling, Hatchling, Weanling)	48 hours
	Acute LC50 5500 µg/l Fresh water	Fish - Oncorhynchus kisutch - Fry	96 hours
	Chronic NOEC 500000 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	96 hours
	Chronic NOEC 1000 µg/l Fresh water	Daphnia - Daphnia magna	21 days
Xylenes, mixed isomers	Acute EC50 90 mg/l Fresh water	Crustaceans - Cypris subglobosa	48 hours
	Acute LC50 8.5 ppm Marine water	Crustaceans - Palaemonetes pugio - Adult	48 hours
	Acute LC50 8500 µg/l Marine water	Crustaceans - Palaemonetes pugio	48 hours
	Acute LC50 15700 µg/l Fresh water	Fish - Lepomis macrochirus - Juvenile (Fledgling, Hatchling, Weanling)	96 hours
	Acute LC50 19000 µg/l Fresh water	Fish - Lepomis macrochirus	96 hours
	Acute LC50 13400 µg/l Fresh water	Fish - Pimephales promelas	96 hours
	Acute LC50 16940 µg/l Fresh water	Fish - Carassius auratus	96 hours
Heptane, all isomers	Acute EC50 1.5 mg/l	Daphnia - Daphnia magna	48 hours
	Acute LC50 4 mg/l	Fish - Carassius auratus	24 hours
	Acute LC50 375000 µg/l Fresh water	Fish - Oreochromis mossambicus	96 hours
	Acute LC50 4924 ppm Fresh water	Fish - Gambusia affinis - Adult	96 hours
Ethanol	Acute EC50 17.921 mg/l Marine water	Algae - Ulva pertusa	96 hours
	Acute EC50 2000 µg/l Fresh water	Daphnia - Daphnia magna	48 hours
	Acute LC50 25500 µg/l Marine water	Crustaceans - Artemia franciscana - Larvae	48 hours
	Acute LC50 42000 µg/l Fresh water	Fish - Oncorhynchus mykiss	4 days
	Chronic NOEC 4.995 mg/l Marine water	Algae - Ulva pertusa	96 hours
	Chronic NOEC 0.375 ul/L Fresh water	Fish - Gambusia holbrooki - Larvae	12 weeks
Benzene	Acute EC50 29000 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	72 hours
	Acute EC50 1360000 µg/l Fresh water	Algae - Scenedesmus abundans	96 hours
	Acute EC50 9230 µg/l Fresh water	Daphnia - Daphnia magna - Neonate	48 hours
	Acute LC50 21000 µg/l Marine water	Crustaceans - Artemia salina - Nauplii	48 hours
	Acute LC50 5.28 ul/L Fresh water	Fish - Oncorhynchus gorbuscha - Fry	96 hours
	Chronic NOEC 1.5 to 5.4 ul/L Marine water	Fish - Morone saxatilis - Juvenile (Fledgling, Hatchling, Weanling)	4 weeks

Section 12. Ecological information

Cumene	Acute EC50 2600 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	72 hours
	Acute EC50 7400 µg/l Fresh water	Crustaceans - Artemia sp. - Nauplii	48 hours
	Acute EC50 10600 µg/l Fresh water	Daphnia - Daphnia magna - Neonate	48 hours
	Acute LC50 2700 µg/l Fresh water	Fish - Oncorhynchus mykiss	96 hours
Ethylbenzene	Acute EC50 4600 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	72 hours
	Acute EC50 3600 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	96 hours
	Acute EC50 2930 µg/l Fresh water	Daphnia - Daphnia magna - Neonate	48 hours
	Acute LC50 5200 µg/l Marine water	Crustaceans - Americamysis bahia	48 hours
	Acute LC50 4200 µg/l Fresh water	Fish - Oncorhynchus mykiss	96 hours
	Chronic NOEC 1000 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	96 hours
n-Hexane	Acute LC50 2500 µg/l Fresh water	Fish - Pimephales promelas	96 hours
Cyclohexane	Acute LC50 4530 µg/l Fresh water	Fish - Pimephales promelas	96 hours
1,2,4-Trimethylbenzene	Acute LC50 17000 µg/l Marine water	Crustaceans - Cancer magister - Zoea	48 hours
	Acute LC50 4910 µg/l Marine water	Crustaceans - Elasmopus pectenicrus - Adult	48 hours
	Acute LC50 7720 µg/l Fresh water	Fish - Pimephales promelas	96 hours
	Acute LC50 22.4 mg/l Fresh water	Fish - Tilapia zillii	96 hours
Naphthalene	Acute EC50 1.6 ppm Fresh water	Daphnia - Daphnia magna	48 hours
	Acute LC50 2350 µg/l Marine water	Crustaceans - Palaemonetes pugio	48 hours
	Acute LC50 213 µg/l Fresh water	Fish - Melanotaenia fluviatilis - Larvae	96 hours
	Chronic NOEC 0.67 ppm Fresh water	Fish - Oncorhynchus kisutch	40 days

Conclusion/Summary : Not available.

Persistence and degradability

Conclusion/Summary : **Toluene**: Rapidly biodegradable in aerobic conditions.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Pentane, all isomers	3.45	171	low
Toluene	2.73	8.3	low
Xylenes, mixed isomers	3.12	8.1 to 25.9	low
Heptane, all isomers	4.66	552	high
Ethanol	-0.35	-	low
Butane	2.89	-	low
Benzene	2.13	4.27	low
Cumene	3.55	94.69	low
Ethylbenzene	3.6	-	low
n-Hexane	4	501.187	high
Cyclohexane	3.44	167	low
1,2,4-Trimethylbenzene	3.63	243	low
Naphthalene	3.4	36.5 to 168	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

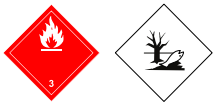
Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

RCRA classification : D001, D018

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Xylenes, mixed isomers	1330-20-7	Listed	U239
Toluene	108-88-3	Listed	U220
Benzene	71-43-2	Listed	U019
Cumene	98-82-8	Listed	U055
Cyclohexane	110-82-7	Listed	U056

Section 14. Transport information

	DOT Classification	IMDG	IATA
UN number	UN1203	UN 1203	UN1203
UN proper shipping name	UN 1203, Gasoline, 3 PG II.	UN 1203, Gasoline, 3 PG II.	UN 1203, Gasoline, 3 PG II.
Transport hazard class(es)	3	3 	3
Packing group	II	II	II
Environmental hazards	Yes.	Yes.	Yes.
Additional information	**Packaging instruction** **Passenger aircraft** Quantity limitation: 5 L **Cargo aircraft** Quantity limitation: 60 L	-	**Cargo Aircraft Only**Quantity limitation: 60 L **Limited Quantities - Passenger Aircraft**Quantity limitation: 5 L

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Section 15. Regulatory information

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

Clean Water Act (CWA) 307: Toluene; Benzene; Ethylbenzene; Naphthalene

Clean Water Act (CWA) 311: Xylenes, mixed isomers; Toluene; Benzene; Ethylbenzene; Cyclohexane; Naphthalene

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

Clean Air Act (CAA) 112 regulated flammable substances: Pentane; Butane

SARA 302/304

Composition/information on ingredients

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Name	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Octanes, all isomers	Yes.	No.	No.	Yes.	No.
Pentane	Yes.	No.	No.	Yes.	No.
Toluene	Yes.	No.	No.	Yes.	Yes.
Hexane, other isomers	Yes.	No.	No.	Yes.	Yes.
Heptane	Yes.	No.	No.	Yes.	No.
Xylenes, mixed isomers	Yes.	No.	No.	Yes.	No.
Ethanol	Yes.	No.	No.	Yes.	Yes.
Butane	Yes.	Yes.	No.	Yes.	No.
Nonane, all isomers	Yes.	No.	No.	Yes.	No.
Benzene	Yes.	No.	No.	Yes.	Yes.
n-hexane	Yes.	No.	No.	Yes.	Yes.
Cumene	Yes.	No.	No.	Yes.	Yes.
Methylcyclohexane	Yes.	No.	No.	Yes.	No.
Trimethylbenzene, all isomers	Yes.	No.	No.	Yes.	Yes.
Ethylbenzene	Yes.	No.	No.	Yes.	Yes.
2,2,4-Trimethylpentane	Yes.	No.	No.	Yes.	No.
1,2,4-Trimethylbenzene	Yes.	No.	No.	Yes.	No.
Cyclohexane	Yes.	No.	No.	Yes.	No.
Cyclopentane	Yes.	No.	No.	Yes.	No.
Naphthalene	Yes.	No.	No.	Yes.	Yes.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	Toluene	108-88-3	<20
	Xylenes, mixed isomers	1330-20-7	<20
	Benzene	71-43-2	<5
	Ethylbenzene	100-41-4	<4
	Cumene	98-82-8	<4
	n-Hexane	110-54-3	<3
	Cyclohexane	110-82-7	<3
	1,2,4-Trimethylbenzene	95-63-6	<2
	Naphthalene	91-20-3	<2

Section 15. Regulatory information

Supplier notification	Toluene	108-88-3	<20
	Xylenes, mixed isomers	1330-20-7	<20
	Benzene	71-43-2	<5
	Ethylbenzene	100-41-4	<4
	Cumene	98-82-8	<4
	n-Hexane	110-54-3	<3
	Cyclohexane	110-82-7	<3
	1,2,4-Trimethylbenzene	95-63-6	<2
	Naphthalene	91-20-3	<2

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : The following components are listed: HEPTANE (N-HEPTANE); Xylenes, mixed isomers; Toluene; Octanes, all isomers; PENTANE; ETHYL ALCOHOL; BENZENE; Butane; Cumene; Ethylbenzene; Trimethylbenzene, all isomers; Methylcyclohexane; n-Hexane; Ethyltoluene; Cyclohexane; 2,2,4-Trimethylpentane; PSEUDOCUMENE; Cyclopentane

New York : The following components are listed: Toluene; Benzene; Cumene; Benzene, 1-methylethyl-; Ethylbenzene; Hexane; Cyclohexane; Benzene, hexahydro-; 2,2,4-Trimethylpentane; Naphthalene

New Jersey : The following components are listed: Gasoline

Pennsylvania : The following components are listed: Gasoline

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

Ingredient name	%	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
Gasoline engine exhaust (condensates / extracts)	100	Yes.	No.	No.	No.
Toluene	<20	No.	Yes.	No.	7000 µg/day (ingestion)
Ethanol	<10	Yes.	Yes.	No.	No.
Benzene	<5	Yes.	Yes.	6.4 µg/day (ingestion) 13 µg/day (inhalation)	24 µg/day (ingestion) 49 µg/day (inhalation)
Ethylbenzene	<5	Yes.	No.	41 µg/day (ingestion) 54 µg/day (inhalation)	No.
Cumene	<5	Yes.	No.	No.	No.
Naphthalene	<2	Yes.	No.	Yes.	No.

International regulations

International lists : **Australia inventory (AICS)**: All components are listed or exempted.
China inventory (IECSC): All components are listed or exempted.
Japan inventory: All components are listed or exempted.
Korea inventory: All components are listed or exempted.
Malaysia Inventory (EHS Register): All components are listed or exempted.
New Zealand Inventory of Chemicals (NZIoC): All components are listed or exempted.
Philippines inventory (PICCS): All components are listed or exempted.
Taiwan inventory (CSNN): All components are listed or exempted.

Canada inventory : All components are listed or exempted.

EU Inventory : All components are listed or exempted.

WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

Section 16. Other information

National Fire Protection Association (U.S.A.)

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History

Date of issue/Date of revision : 5/19/2015.

Key to abbreviations :
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

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CITGO is a registered trademark of CITGO Petroleum Corporation

1. IDENTIFICATION

Product Identifier: Kerosene

Synonyms: Kero, Kerosine Motor Fuel, Ultra Low Sulfur Kero, ULSK , Dyed Kerosene Dye, K1, K2, Fuel Oil No 1, JP-4, JP-5, JP-8 Jet Fuels, Coal-oil, Range-oil, Pesticide Code 063501, SRK Solvent, Low Aromatic Feedstock, Artic Grade Oil (DFA)

Intended use of the product: Fuel

Contact:
Global Companies LLC
Water Mill Center
800 South St.
Waltham, MA 02454-9161
www.globalp.com

Contact Information: EMERGENCY TELEPHONE NUMBER (24 hrs): CHEMTREC (800) 424-9300
COMPANY CONTACT (business hours): 800-542-0778

2. HAZARD IDENTIFICATION

According to OSHA 29 CFR 1910.1200 HCS

Classification of the Substance or Mixture

Classification (GHS-US):

Flam. Liquid	Category 3	H226
Skin Corrosion/Irritation	Category 2	H315
Aspiration Hazard	Category 1	H304
STOT SE	Category 3	H336
Aquatic Chronic	Category 2	H411

Labeling Elements

Signal Word (GHS-US): **Danger**

Hazard Statements (GHS-US)
H226 – Flammable liquid and vapor.
H315 – Causes Skin irritation.
H304 – May be fatal if swallowed and enters airways.
H336 – May cause drowsiness or dizziness.
H411 – Toxic to aquatic life with long lasting effects.

Precautionary Statements (GHS-US):
P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233 - Keep container tightly closed.
P240 – Ground/bond container and receiving equipment.
P241 – Use explosion-proof electrical/ventilating/lighting equipment pursuant to applicable electrical code.
P242 – Use only non-sparking tools.
P243 – Take precautionary measures against static discharge.
P261 – Avoid breathing dust/fume/gas/mist/vapors/spray.
P264 – Wash skin thoroughly after handling.

P271 – Use only outdoors or in a well-ventilated area.
P273 – Avoid release to the environment.
P280 - Wear protective gloves/protective clothing/eye protection/face protection.
P303+361+353 - If on skin (or hair): Take off immediately all contaminated clothing. Rinse with water/shower.
P308+311 - If exposed or concerned: Get medical advice/attention.
P301+310 - If swallowed: Immediately call a poison center/doctor/…
P331 - Do NOT induce vomiting.
P370+P378 – In case of fire use firefighting foam or other appropriate media for Class B fires to extinguish.
P403+235 - Store in a well-ventilated place. Keep cool.
P405 - Store locked up.
P501 – Dispose of contents/container in accordance with local/regional/national/international regulation.

Other information:

NFPA 704
Health: 2
Fire: 2
Reactivity: 0

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Composition Information
Mixture

Name	Product Identifier (CAS#)	% (w/w)	Classification
Kerosene	8008-20-6	100	Flam Gas 3, H226; Skin Irrit. 2, H315; Aspiration 1, H304; STOT SE 3, H336; Aquatic Chronic H411
Naphthalene	91-20-3	0.04	Carc. 2, H351; Acute Tox. 4, H302; Aquatic Acute 1, H400; Aquatic Chronic 1, H410

Additional Formulation Information
A complex combination of hydrocarbons including naphthenes, paraffins, and aromatics.

4. FIRST AID MEASURES

Response

Route	Measures
Inhalation	Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.
Ingestion	Aspiration Hazard: DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.
Eye Contact	In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention. In case of contact lenses, remove immediately.

Route	Measures
Skin Contact	Remove contaminated clothing and shoes. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops. Thermal burns require immediate medical attention depending on the severity and of the area of the body burned.

Most Important Symptoms
Contact with eyes and face may cause irritation. Long-term exposure may cause dermatitis (itching, irritation, pain and swelling). Kerosene has shown to augment the toxicity of skin sensitizing agents.

Inhalation may cause irritation and significant or long term exposure could cause respiratory insufficiency and pulmonary edema.

Immediate Medical Attention and Special Treatment
For contact with skin or eyes, immediately wash or flush contaminated eyes with gently flowing water. If possible, irrigate each eye continuously with 0.9% saline (NS). If ingested, rinse mouth and administer 5 m/kg up to 200 ml of water of dilution if the patient can swallow. Do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs).

If inhaled, administer oxygen or establish a patent airway if breathing is labored. Suction if necessary. Monitor closely, anticipate seizures. Consider orotracheal or nostracheal intubation of airway control if patient is unconscious or is in severe respiratory distress.

Discard any clothing or shoes contaminated as they may be flammable.

5. FIRE-FIGHTING MEASURES

Extinguishing Media
Foam, carbon dioxide, dry chemical are most suitable

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, C02, water spray, firefighting foam, or Halon. Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other firefighting equipment.

LARGE FIRES: Foam, carbon dioxide, dry chemical. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

During certain times of the year and/or in certain geographical locations, fuel oil may contain additional additives. Firefighting foam suitable for polar solvents is recommended for fuel with greater than 10% oxygenate concentration - refer to NFPA 11 'Low Expansion Foam -1994 Edition."

Specific Hazards / Products of Combustion
Moderate fire hazard when exposed to heat or flame with a very low flash point. Flammable and easily ignited when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

Combustion may produce smoke, carbon monoxide and other products of incomplete combustion.

Special Precautions and Protective Equipment for Firefighters
Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied firefighting foam.

Fighting Equipment/Instructions
Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH- approved pressure-demand self-contained breathing apparatus with full face piece and protective clothing.

Refer to Section 9 for fire properties of this chemical including flash point, auto ignition temperature, and explosive limits.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY SPCC, SPILL CONTINGENCY or EMERGENCY PLAN.

Personal Precautions
Due to high vapor density, flammable / toxic vapors may be present in low lying areas, dikes, pits, drains, or trenches. Vapors may accumulate in low lying areas and reach ignitable concentrations. Ventilate the area. Use of non-sparking tools and intrinsically safe equipment is recommended. Potential for flammable atmosphere should be monitored using a combustible gas indicator positioned downwind of the spill area. Refer to Sections 2 and 7 for further hazard warnings and handling instructions.

Use appropriate personal protective equipment to prevent eye/skin contact and absorption. Use NIOSH approved respiratory protection, if warranted, to prevent exposures above permissible limits. Refer to Section 8. Contaminated clothing should not be near sources of ignition.

Emergency Measures
As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions. Consider wind direction. Secure all ignition sources (flame, spark, hot work, hot metal, etc.) from area. Evaluate the direction of product travel, diking sewers, etc. to confirm spill areas. Do not touch or walk-through spilled material. For large spills, isolate initial action distance downwind 1,000 ft. (300 m).

Environmental Precautions
Stop the spill to prevent environmental release if it can be done safely. Product is toxic to aquatic life. Take action to isolate environmental receptors including drains, storm sewers and natural water bodies. Keep on impervious surface if at all possible. Use water sparingly to prevent product from spreading. Foam and absorbents may be used to reduce / prevent airborne release.

Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Follow federal, state or local requirements for reporting environmental release where necessary. Refer to Section 15 for further information.

Containment and Clean-Up Methods
Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of firefighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with dry earth, sand or other non-combustible, inert oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container with clean, non-sparking tools for reclamation or disposal. Response and cleanup crews must be properly trained and must utilize proper protective equipment. Refer to Section 8 for appropriate protective equipment.

7. HANDLING AND STORAGE

USE ONLY AS A FUEL.
DO NOT SIPHON BY MOUTH.

Handling Precautions
Handle as a combustible liquid. Keep away from heat, sparks, and open flame. No smoking. Electrical equipment should be approved for classified area. Bond and ground containers during product transfer pursuant to NFPA 70 and API RP 2003 to reduce the possibility of static-initiated fire or explosion. Follow precautions to prevent static initiated fire.

Use good personal hygiene practices. Use only with protective equipment specified in Section 8. Avoid repeated and/or prolonged skin exposure. Use only outdoors or in well ventilated areas. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves. Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when

higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API RP 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

Storage
Large quantities of kerosene are stored in cylindrical floating-roof or fixed-roof tanks at an ambient storage temperature. Separate from incompatible chemicals (Refer to Section 10) by distance or secondary containment. Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers that are clearly labeled. Label all secondary containers that this material is transferred into with the chemical name and associated hazard(s). Empty product containers or vessels may contain flammable vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Storage tanks should have a venting system. If stored in small containers, the area should be well ventilated and protected from potential damage or vehicular traffic. Post “No Smoking” signs in product storage areas. This storage area should comply with NFPA 30 “Flammable and Combustible Liquid Code” or applicable building code. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 “Cleaning Mobile Tanks in Flammable and Combustible Liquid Service” and API RP 2015 “Safe Entry and Cleaning of Petroleum Storage Tanks”.

Incompatibles
Keep away from strong oxidizers, ignition sources and heat.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Limits

Component	CAS #	List	Value
Kerosene	8008-20-6	ACGIH TLV-TWA	200 mg/m3*
Naphthalene	91-20-3	ACGIH TLV-TWA OSHA PEL ACGIH STEL	10 ppm 10 ppm 15 ppm

*Critical effects; Skin & Upper Respiratory Tract irritant; CNS impairment.

Engineering Controls
Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces. Intrinsically safe equipment and non-sparking tools shall be used in circumstances where concentrations may exceed lower flammable limits. Grounding and bonding shall be used to prevent accumulation and discharge of static electricity. Emergency shower and eyewash should be provided in proximity to handling areas in the event of exposure to decontaminate.

Personal Protective Equipment

Exposure	Equipment
Eye / Face	Wear appropriate chemical protective glasses or goggles or face shields to prevent skin and eye contact especially caused from splashing.
Skin	Wear appropriate personal protective clothing to prevent skin contact. Gloves constructed of nitrile, neoprene or PVC are recommended when handling this material. Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure.
Respiratory	A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection and limitations. Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.
Thermal	Product is stored at ambient temperature. No thermal protection is required except for emergency operations involving actual or potential for fire. Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

9. PHYSICAL AND CHEMICAL PROPERTIES

Property	Value	
Appearance	Pale yellow to water-white. May be dyed red.	
Odor	Strong characteristic petroleum distillate odor.	
Odor Threshold	1 ppm	
pH	Not available	
Melting Point	-4 ˚F (-20 ˚C)	
Boiling Point Range	300 to 580 ˚F (149 to 304 ˚C)	
Flash Point	100.4 – 125.6 ˚F (38 -52 ˚C)	
Evaporation Rate	Slow, varies with conditions	
Flammability	Flammable liquid	
Flammable Limits	0.7 % - 5.0%	
Vapor Pressure	0.480 mm Hg @ 20 ˚C	
Vapor Density	4.5	(air=1)
Specific Gravity	0.80 to <1.0	(water=1)
Solubility	Insol in water; miscible with other petroleum solvents.	
Partition Coefficient (N-octanol/water)	Log Kow range of 3.3 to >.6.0	
Autoignition Temperature	410 ˚F (210 ˚C)	
Decomposition Temperature	When heated it emits acrid smoke and irritating vapors.	
Viscosity	1.39 – 1.50 mm2/x (40C)	
Percent Volatiles	100	

10. STABILITY AND REACTIVITY

Stability
This is a stable material that is flammable liquid (OSHA/GHS hazard category 3). Stable during transport.

Reactivity
Material is not self-reacting. Flammable concentrations may be present in air. Compound can react with oxidizing materials.

Possibility of Hazardous Reactions
Hazardous polymerization will not occur.

Incompatibility
Keep away from strong oxidizers such as nitric and sulfuric acids.

Conditions to Avoid
Avoid high temperatures, open flames, sparks, static electricity, welding, smoking and other ignition sources.

Hazardous Decomposition Products
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

11. TOXICOLOGICAL INFORMATION

Acute Toxicity:
Acute Toxicity (Inhalation LC50)
Kerosene (8008-20-6)
LC50 Inhalation Rat >5.28 mg/l/4h

Acute Toxicity (Dermal LC50)
Kerosene (8008-20-6)
LD50 Dermal Rabbit >2000 mg/kg

Acute Toxicity (Oral LC50)
Kerosene (8008-20-6)
LD50 Dermal Rabbit >5000 mg/kg

Skin Corrosion/Irritation: Prolonged and repeated contact may cause skin irritation leading to dermatitis. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

Serious Eye Damage/Irritation: Not classified

Respiratory or Skin Sensitization: Not classified

Germ Cell Mutagenicity: Not classified

Teratogenicity: Not available

Carcinogenicity: OSHA: NO IARC: NO NTP: NO ACGIH: No

Reproductive Toxicity: Not classified

Specific Target Organ Toxicity (Repeated Exposure): Not classified

Specific Target Organ Toxicity (Single Exposure): Inhalation exposure may cause drowsiness or dizziness by inhalation exposure.

Aspiration Hazard: The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Potential Health Effects: Vapor irritating to skin, eyes, nose, and throat. Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

WARNING: The burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

12. ECOLOGICAL INFORMATION

Toxicity:
This material is expected to be toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment.

Data for Component: Kerosene (8008-20-6)

> Material is toxic to aquatic organisms based on an acute basis (LC50/EC50 >1 but ≤ 10 mg/L in the most sensitive species tested).
>
> Material is a long-term aquatic hazard based on a chronic basis (LC50/EC50 >1 but ≤ 10 mg/L in the most sensitive species tested).

Persistence and Degradation: This material is not expected to be readily biodegradable.

Bioaccumulative Potential: Not available

Mobility In Soil: Not available

Other Adverse Effects: None known

Other Information: Avoid release to the environment.

13. DISPOSAL CONSIDERATIONS

Consult federal, state and local waste regulations to determine appropriate disposal options. May be considered a hazardous waste if disposed. Direct solid waste (landfill) or incineration at a solid waste facility is not permissible. Do not discharge to sanitary or storm sewer. Personnel handling waste containers should follow precautions provided in this document.

Shipping containers must be DOT authorized packages. Follow licensure and regulations for transport of hazardous material and hazardous waste as applicable.

14. TRANSPORT INFORMATION

US DOT

UN Identification Number	UN 1223
Proper Shipping Name	Kerosene
Hazard Class and Packing Group	3, PGIII
Shipping Label	Flammable liquid
Placard / Bulk Package	Flammable liquid, 1223
Emergency Response Guidebook Guide Number	128

IATA Information

UN Identification Number	UN 1223
Proper Shipping Name	Kerosene
Hazard Class and Packing Group	3, PGIII
ICAO Label	3
Packing Instructions Cargo	366, Y344
Max Quantity Per Package Cargo	220L
Packing Instructions Passenger	366, Y355
Max Quantity per Package	60L

ICAO

UN Identification Number	UN 1223
Shipping Name / Description	Kerosene
Hazard Class and Packing Group	3, PG III
IMDG Label	3

IMDG

UN Identification Number	UN1223
Shipping Name / Description	Kerosene
Hazard Class and Packing Group	3, PGIII
IMDG Label	3
EmS Number	F-E-S-E
Marine Pollutant	Yes

15. REGULATORY INFORMATION

U.S. Federal, State, and Local Regulatory Information

Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other federal, state, or local regulations; consult those regulations applicable to your facility/operation.

OSHA Hazard Communication Standard

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Immediate (Acute) Health Hazard	Yes
Delayed (Chronic) Health Hazard	Yes
Fire Hazard	Yes
Reactive Hazard	No
Sudden Release of Pressure Hazard	No

Clean Water Act (Oil Spills)
Any spill or release of this product to "navigable waters" (Essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) or, if not practical, the U.S. Coast Guard with follow up to the National Response Center, as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA Section 103 and SARA Section 304 (Release to the Environment)
The CERCLA definition of hazardous substances contains a "petroleum exclusion" clause which exempts this material. This product does not contain any chemicals subject to the reporting requirements of CERCLA Section 103 or SARA 304.

SARA Section 313- Supplier Notification
This product does not contain any chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372.

Pennsylvania Right to Know Hazardous Substance list:
The following product components are cited in the Pennsylvania Special Hazardous Substance List, and are present at levels which require reporting.

Component	CAS	Amount
Kerosene	8008-20-6	100%

New Jersey Right to Know Hazardous Substance list:
The following product components are cited in the New Jersey Right to Know Hazardous Substance List, and are present at levels which require reporting.

Component	CAS	Amount
Kerosene	8008-20-6	100%

California Proposition 65
WARNING: This product contains chemicals known to the State of California to cause Cancer or Reproductive Toxicity.

Component	CAS	Amount
Naphthalene	91-20-3	0.04%

U.S. Toxic Substances Control Act
All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30.

CEPA - Domestic Substances List (DSL)
All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

Canadian Regulatory Information (WHMIS)
Class B3 – Combustible Liquid
Class D2B – Materials causing other toxic effects. Toxic material.

16. OTHER INFORMATION

Version	3
Issue Date	May 20, 2016
Prior Issue Date	February 10, 2015

Description of Revisions
Revised to meet Globally Harmonized System for chemical hazard communication requirements pursuant to OSHA regulatory revisions 77 FR 17884, March 26, 2012.

Abbreviations

˚F	Degrees Fahrenheit (temperature)
<	Less than
=	Equal to
>	Greater than
AP	Approximately
C	Centigrade (temperature)
kg	Kilogram
L	Liter
mg	Milligrams
mL	Milliliter
mm^2	Square millimeters
mmHg	Millimeters of mercury (pressure)
N/A	Not applicable
N/D	Not determined
ppm	Parts per million
sec	Second
ug	Micrograms

Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
AL	Action Level
ANSI	American National Standards Institute
API	American Petroleum Institute
CAS	Chemical Abstract Service
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation
EC50	Ecological concentration 50%
EPA	U.S. Environmental Protection Agency
ERPG	Emergency Response Planning Guideline
GHS	Global Harmonized System
HMIS	Hazardous Materials Information System
IARC	International Agency for Research On Cancer
IATA	International Air Transport Association
IMDG	International Maritime Dangerous Goods
Koc	Soil Organic Carbon
LC50	Lethal concentration 50%
LD50	Lethal dose 50%
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act Reauthorization Act of 1986 Title III
REL	Recommended Exposure Limit (NIOSH)
RVP	Reid Vapor Pressure
SARA	Superfund Amendments and
SCBA	Self Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
UN	United Nations
UNECE	United Nations Economic Commission for Europe
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Canadian Workplace Hazardous Materials Information System

Disclaimer of Expressed and Implied Warranties

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

** End of Safety Data Sheet **

Safety Data Sheet

Chemical Name: Propane

Synonyms: Dimethylmethane, Liquefied Petroleum Gas (LPG), Sales Propane, Commercial Propane, Refinery Propane, Product Propane (non-odorized)

Section 1 - Chemical Product and Company Identification

Company Information

Ferrellgas (Blue Rhino)
One Liberty Plaza
Liberty, MO 64068
Emergency # 800-424-9300 (CHEMTREC)
General SDS assistance # 855-738-9178 (Ferrellgas Safety Department)

Product Information

Product: Propane (odorized)
Chemical Name: Propane
Chemical Family: Liquified Petroleum Gas (Paraffinic Hydrocarbons)
Chemical Formula: C_3H_8

Section 2 - Hazards Identification

GHS Classification:

Flammable Gas - Category 1
Gases Under Pressure - Liquefied Gas

GHS LABEL ELEMENTS

Pictogram(s)

Signal Word

Danger

Hazard Statements

H220 - Extremely flammable gas.
H280 - Contains gas under pressure, may explode if heated.

Precautionary Statements

Prevention
P210 - Keep away from heat/sparks/open flames/hot surfaces. No smoking
Response
P376 - Stop leak if safe to do so.
P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 - Eliminate all ignition sources if safe to do so.
Storage
P403 - Store in a well-ventilated place.
P405 - Store locked up.
P410 - Protect from sunlight.
Disposal
P501 - Dispose of contents/container in accordance with local/regional/national/international regulations.

Section 3 - Composition / Information on Ingredients

CAS #	Component	Percent
74-98-6	Propane	85 - 100
106-97-8	Butane and heavier	0 - 2.5
74-84-0	Ethane	0 - 5
115-07-1	Propylene	0 - 10
75-08-1	Ethyl Mercaptan	0 - 0.0025

Section 4 - First Aid Measures

First Aid: Eyes

Direct contact with liquid propane can result in eye burns.

In case of contact with eyes, hold eyelids open to allow liquid to evaporate and gently flush with lukewarm water. Cover eyes to protect from light. Seek immediate medical attention.

First Aid: Skin

Direct contact with liquid propane can result in skin burns (frostbite).

Remove contaminated clothing. In case of blistering, frostbite or freeze burns seek immediate medical attention.

First Aid: Ingestion

Risk of ingestion is extremely low. However, if oral exposure occurs, seek immediate medical assistance.

First Aid: Inhalation

This product is classified as a simple asphyxiant. High vapor concentrations may produce a reversible central nervous system depression (anesthesia) and asphyxiation.

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

Section 5 - Fire Fighting Measures

General Fire Hazards

See Section 9 for Flammability Properties.

Liquid releases flammable vapors at well below ambient temperatures and readily forms a flammable mixture with air. Dangerous fire and explosion hazard when exposed to heat, sparks or flame. Vapors are heavier than air and may travel long distances to a point of ignition and flash back.

Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

Extinguishing Media

Use extinguishing media suitable for the surrounding material, preferably or, any extinguisher suitable for Class B fires, dry chemical, fire fighting foam, CO_2, and other gaseous agents. However, fire should not be extinguished unless flow of gas can be immediately stopped.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment/Instructions

Gas fires should not be extinguished unless flow of gas can be immediately stopped. Shut off gas source and allow gas to burn out. If spill or leak has not ignited, determine if water spray may assist in dispersing gas or vapor to protect personnel attempting to stop leak. Use water to cool equipment, surfaces and containers exposed to fire and excessive heat. For large fire the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Isolate area, particularly around ends of storage vessels. Let vessel, tank car or container burn unless leak can be stopped. Withdraw immediately in the event of a rising sound from a venting safety device. Large fires typically require specially trained personnel and equipment to isolate and extinguish the fire.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Section 6 - Accidental Release Measures

Recovery and Neutralization

Stop the source of the release, if safe to do so.

Materials and Methods for Clean-Up

Do not flush down sewer or drainage systems. Do not touch spilled liquid (frostbite/freeze burn hazard!). Consider the use of water spray to disperse vapors. Isolate the area until gas has dispersed. Ventilate and gas test area before entering.

Emergency Measures

Evacuate nonessential personnel and secure all ignition sources. No road flares, smoking or flames in hazard area. Consider wind direction, stay upwind and uphill, if possible. Evaluate the direction of product travel. Vapor cloud may be white, but color will dissipate as cloud disperses - fire and explosion hazard is still present!

Personal Precautions and Protective Equipment

Do not touch spilled liquid (frostbite/freeze burn hazard!).

Environmental Precautions

Do not flush down sewer or drainage systems.

Prevention of Secondary Hazards

None

Section 7 - Handling and Storage

Handling Procedures

Keep away from flame, sparks, ingnition sources and excessive temperatures. Use only in well ventilated areas.

Storage Procedures

Store only in approved containers. Keep away from flame, sparks, excessive temperatures and open flame. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Incompatibilities

Keep away from strong oxidizers, ignition sources and heat. Explosion hazard when exposed to chlorine dioxide. Heating barium peroxide with propane causes violent exothermic reaction. Heated chlorine-propane mixtures are explosive under some conditions.

Section 8 - Exposure Controls / Personal Protection

Component Exposure Limits

Propane (74-98-6)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases: Alkane C1-4)
OSHA: 1000 ppm TWA; 1800 mg/m3 TWA
NIOSH: 1000 ppm TWA; 1800 mg/m3 TWA

Ethane (74-84-0)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases: Alkane C1-4)

Propylene (115-07-1)

ACGIH: 500 ppm TWA

Engineering Measures

Use adequate ventilation to keep gas and vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces. Use explosion-proof equipment and lighting in classified/controlled areas.

Personal Protective Equipment: Respiratory

Use a NIOSH approved positive-pressure, supplied air respirator with escape bottle or self-contained breathing apparatus (SCBA) for gas concentrations above occupational exposure limits, for potential for uncontrolled release, if exposure levels are not known, or in an oxygen-deficient atmosphere. CAUTION: Flammability limits (i.e., explosion hazard) should be considered when assessing the need to expose personnel to concentrations requiring respiratory protection.

Personal Protective Equipment: Hands

Use cold-impervious, insulating gloves where contact with liquid may occur.

Personal Protective Equipment: Eyes

Where there is a possibility of liquid contact, wear splash-proof safety glasses and faceshield.

Personal Protective Equipment: Skin and Body

Where contact with liquid may occur, wear appropriate cold insulating protective clothing and faceshield.

Section 9 - Physical & Chemical Properties

Appearance:	Colorless	Odor:	Odorless
Physical State:	Gas	pH:	ND
Max Vapor Pressure:	208 psig @ 100 °F (37.8 °C)	Vapor Density:	1.56 @ 32°F (0°C)
Boiling Point:	-43.8°F (-42.1°C)	Molecular Weight:	44.096
Solubility (H2O):	slight (0.1 to 1.0%)	Specific Gravity:	1.52 (Air = 1)
Expansion Ratio:	1 to 270 (from liquid to gas @ 14.7 psia)	Burning Rate:	ND
Evaporation Rate:	ND	VOC:	ND
Octanol/H2O Coeff.:	ND	Flash Point:	-156°F (-104 °C)
Flash Point Method:	PMCC	Auto Ignition:	842°F (450°C)
Upper Flammability Limit (UFL):	9.6%		
Lower Flammability Limit (LFL):	2.15%		

Section 10 - Chemical Stability & Reactivity Information

Chemical Stability

This is a stable material.

Hazardous Polymerization

Will not occur.

Conditions to Avoid

Keep away from strong oxidizers, ignition sources and heat.

Incompatible Products

Explosion hazard when exposed to chlorine dioxide. Heating barium peroxide with propane causes violent exothermic reaction. Heated chlorine-propane mixtures are explosive under some conditions.

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke) may be formed during combustion.

Section 11 - Toxicological Information

Acute Toxicity

A: General Product Information

Propane exhibits some degree of anesthetic action and is mildly irritating to the mucous membranes. At high concentrations propane acts as a simple asphyxiant without other significant physiological effects. High concentrations may cause death due to oxygen depletion.

Potential Health Effects: Skin Corrosion Property/Stimulativeness

Vapors are not irritating. Direct contact to skin or mucous membranes with liquefied product or cold vapor may cause freeze burns and frostbite. Contact to mucous membranes with liquefied product may cause frostbite and freeze burns. Signs of frostbite include a change in the color of the skin to gray or white, possibly followed by blistering. Skin may become inflamed and painful.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

Vapors are not irritating. However, contact with liquid or cold vapor may cause frostbite, freeze burns, and permanent eye damage.

Potential Health Effects: Ingestion

Ingestion is unlikely. Contact with mucous membranes with liquefied product may cause frostbite and freeze burns.

Potential Health Effects: Inhalation

This product is considered to be non-toxic by inhalation. Inhalation of high concentrations may cause central nervous system depression such as dizziness, drowsiness, headache, and similar narcotic symptoms, but no long-term effects. Numbness, a "chilly" feeling, and vomiting have been reported from accidental exposures to high concentrations. This product is a simple asphyxiant. In high concentrations it will displace oxygen from the breathing atmosphere, particularly in confined spaces. Signs of asphyxiation will be noticed when oxygen is reduced to below 16%, and may occur in several stages. Symptoms may include rapid breathing and pulse rate, headache, dizziness, visual disturbances, mental confusion, incoordination, mood changes, muscular weakness, tremors, cyanosis, narcosis and numbness of the extremities. Unconsciousness leading to central nervous system injury and possibly death will occur when the atmospheric oxygen concentration is reduced to about 6% to 8% or less.

WARNING: The burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This product is not reported to have any mutagenic effects.

Carcinogenicity

A: General Product Information

This product is not reported to have any carcinogenic effects.

Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Repeated Exposure

This product is not reported to have any specific target organ repeat effects.

Aspiration Respiratory Organs Hazard

This product is not reported to have any aspiration hazard effects.

Section 12 - Ecological Information

Ecotoxicity

A: General Product Information

Liquid release is only expected to cause localized, non-persistent environmental damage, such as freezing. Biodegradation of this product may occur in soil and water. Volatilization is expected to be the most important removal process in soil and water. This product is expected to exist entirely in the vapor phase in ambient air.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

No ecotoxicity data is available for this product's components.

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

Section 13 - Disposal Considerations

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

Section 14 - Transportation Information

DOT Information

UN #: 1075 or 1978 Hazard Class: 2.1

Shipping Name: Petroleum Gases, Liquefied

Placard:

Section 15 - Regulatory Information

Regulatory Information

Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Propylene (115-07-1)

SARA 313: 1.0 % de minimis concentration

SARA Section 311/312 – Hazard Classes

Acute Health	Chronic Health	Fire	Sudden Release of Pressure	Reactive
--	--	X	X	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION PERCENT BY VOLUME
Propylene (115-07-1)	30 max

State Regulations

Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Propane	74-98-6	No	Yes	Yes	Yes	Yes	Yes
Ethane	74-84-0	No	Yes	Yes	Yes	Yes	Yes
Propylene	115-07-1	Yes	Yes	Yes	Yes	Yes	Yes

Component Analysis - WHMIS IDL

No components are listed in the WHMIS IDL.

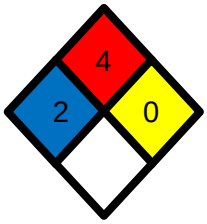
Additional Regulatory Information

Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EU
Propane	74-98-6	Yes	DSL	EINECS
Ethane	74-84-0	Yes	DSL	EINECS
Propylene	115-07-1	Yes	DSL	EINECS

* * * Section 16 - Other Information * * *

NFPA® Hazard Rating	Health	2
	Fire	4
	Reactivity	0



HMIS® Hazard Rating	Health	2	Moderate
	Fire	4	Severe
	Physical	0	Minimal

Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration., NJTSR = New Jersey Trade Secret Registry; TSCA = Toxic Substance Control Act; EU = European Union; CAN = Canada

Literature References

None

Other Information

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Issue Information

This Safety Data Sheet supersedes all previous editions.

Issued: January, 2015

Issued by: Ferrellgas Safety Department

Ferrellgas
One Liberty Plaza
Liberty, MO 64068

APPENDIX F
IDENTIFYING IMAGES OF AGGRESSIVE FAUNA AND FLORA

Dewey Loeffel Route 203 Property
Nassau, New York

POISONOUS PLANTS – GIANT HOGWEED

Photos Courtesy of New York State Department of Environmental Conservation

Do Not Touch This Plant!

Giant Hogweed (Heracleum mantegazzianum) is an invasive Federally listed noxious weed. Its sap can cause severe skin and eye irritation, painful blistering, permanent scarring and blindness when in combination with moisture and sunlight. Contact between the skin and the sap of this plant occurs either through brushing against the bristles on the stem or breaking the stem or leaves.

Geographic Distribution in The United States:
Giant Hogweed was introduced to Europe and the United Kingdom in the late nineteenth century and to the United States in the early twentieth century as an ornamental garden plant. It has become established in New England, the Mid-Atlantic Region and the Northwest. Giant Hogweed has been positively identified in the following states:

Connecticut	New York	Ohio	Pennsylvania
Michigan	Maryland	Maryland	Massachusetts
New Hampshire	North Carolina		

Giant Hogweed grows along streams and rivers and in fields, forests, yards and roadsides. It prefers open sites with abundant light and moist soil but it can grow in partially shaded habitats, too.

What To Do If You Come In Contact with Giant Hogweed:
This plant poses a serious health threat. Follow these simple steps if you have come into contact with Giant Hogweed:

- Wash the affected area immediately with soap and COLD water.
- Keep exposed area away from sunlight for 48 hours.
- If a reaction occurs, topical steroids applied early can reduce the severity and ease discomfort.
- If sap goes in eyes, rinse them with water and wear sunglasses.
- Contact your physician if you think you have been burned by giant hogweed.

Dewey Loeffel Route 203 Property
Nassau, New York

Giant Hogweed Identification:

Some other plants look very similar to Giant Hogweed including Wild Parsnip, Cow Parsnip, Angelica, and Poison Hemlock. For exact identification of the Giant Hogweed plant a taxonomic key to species identification should be used. The following is a summary of characteristic features of the Giant Hogweed plant:

- White flowers with 50-150 flower rays clustered into an umbrella shaped flower cluster up to 2.5 feet across.
- Between 7 and 14 feet tall (depending upon growth stage and if mowed or cut.
- Huge leaves, incised and deeply lobed up to 5 feet across.
- Stems are green with extensive purple splotches and prominent coarse white hairs. Stems are also hollow, ridged, 2-4 inches in diameter, and have a thick circle of hairs at base of leaf stalk.

Additional information regarding Giant Hogweed is available in the following links:

General Info:	http://www.dec.ny.gov/animals/39809.html
Hazards & Safety Info:	http://www.dec.ny.gov/animals/72556.html
Identification Key:	http://www.dec.ny.gov/animals/72766.html
Geographic Distribution:	http://pest.ceris.purdue.edu/map.php?code=PFFAQBC#

Venomous Spiders of New York – Northern Black Widow

Habitat

The black widow is commonly found in the following places:
Outdoors - woodpiles, rubble piles, under stones, in hollow stumps, and in rodent burrows, privies, sheds and garages.
Indoors - undisturbed, cluttered areas in basements and crawl spaces.
Irrigation boxes, manholes, valve boxes and other underground facilities

Identification

- The female black widow is normally shiny black, with a red hourglass marking (see photo) on the underside of the abdomen.
- The abdominal marking may range in color from yellowish orange to red and its shape may range from an hourglass to a dot.
- The body of an adult black widow female is about 1/2 inch long.

Pictures from CDC Public Health Image Library http//phil.cdc.gov/phil/home.asp

Dewey Loeffel Route 203 Property
Nassau, New York

Protection

- Wear a long-sleeved shirt, hat, gloves, and boots when handling boxes, firewood, lumber, and rocks, etc.
- Inspect and shake out clothing and shoes before getting dressed.
- Use insect repellants, such as DEET or Picaridin, on clothing and footwear.

Symptoms

- The bite of the black widow may be painful or it may go unnoticed.
- The skin may display one or two bite marks with local swelling. Pain usually progresses from the
  bite site and eventually to the abdomen and back.

- Symptoms may include nausea, profuse perspiration, tremors, labored breathing, restlessness, increased blood pressure and fever.
- The pain from the bite will usually persist for the first 8-12 hours.
- Severe cramping or rigidity may occur in the abdominal muscles.
- Symptoms may continue for several days

Treatment

- Clean the bite area with soap and water.
- Elevate and immobilize the extremity.
- Apply ice to the bite area to slow absorption of the venom.
- Seek medical attention immediately.
- If you have a heart condition or other heart problem, you may need hospitalization.

Additional information regarding Venomous Spiders is available in OSHA Fact Sheets found at:
http://www.osha.gov/OshDoc/data_Hurricane_Facts/black_widow_spider.pdf

http://www.osha.gov/OshDoc/data_Hurricane_Facts/brown_recluse_spider.pdf

Snakes

Timber Rattlesnake

Northern Copperhead

Eastern Massassauga

Dewey Loeffel Route 203 Property
Nassau, New York

Considerations:
Each year there are about snakebite 7,000 victims in the U.S. most of which occur in the summer season.

All poisonous snake bites are medical emergencies as snake bites can cause local tissue damage (necrosis), bleeding and destruction of blood cells (hematological problems, and nerve damage including paralysis and coma.

Causes:
Poisonous snake bites include bites by any of the following species of snakes; rattlesnakes including Massasauga, Timber, and Eastern Diamondback species, Northern, Southern, Western and Osage copperheads, water moccasin/cottonmouths, and coral snake.

To find a comprehensive list of poisonous snakes in your particular work area refer to the following link for venomous snakes by state
http://www.venombyte.com/venom/snakes/venomous_snakes_by_state.asp

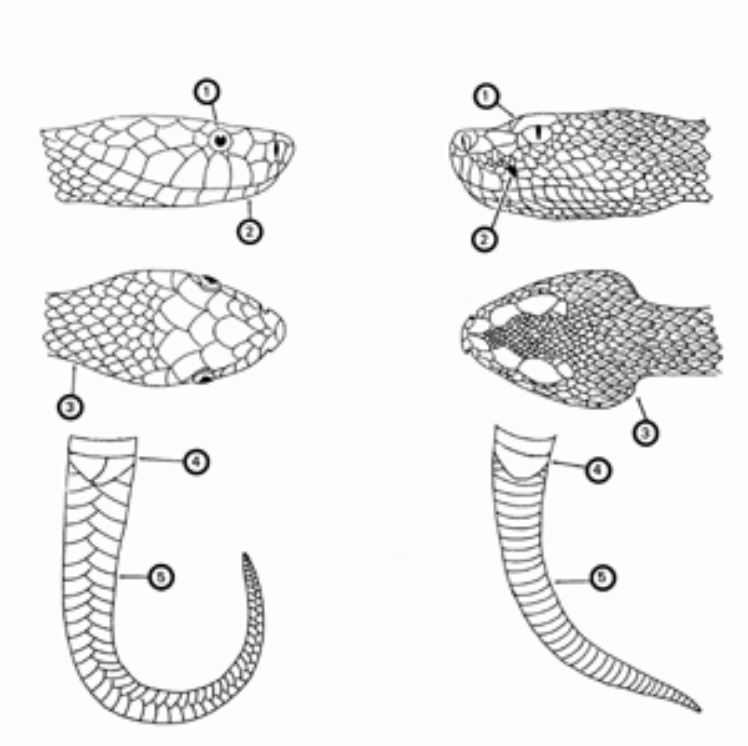
Prevention:
- Even though most snakes are not poisonous, avoid picking up or playing with any snake unless you have been properly trained.
- When working in an area known to have snakes, wear long pants, boots, and snake chaps if possible.
- Do not thrust hands or feet into any areas if you cannot see into the area.
- Tap ahead of you with walking stick before entering an area with an obscured view of your feet.
- Snakes will attempt to avoid you if given adequate warning.

Call 911 Immediately if someone has been bitten by a snake. Time is of the essence. If possible, call ahead to the emergency room so antivenom can be ready when the victim arrives.

Provide First Aid Until Emergency Help Arrives:
Keep the victim calm, restrict movement, and keep the affected area below heart level to reduce the flow of venom.
- Wash the bite with soap and water.
- Remove any rings or constricting items; the affected area may swell.
- Cover the bite with a clean, cool compress or a clean, moist dressing to reduce swelling and discomfort.
- Monitor the vital signs (temperature, pulse , rate of breathing, blood pressure) of the victim. If there are signs of shock lay the victim flat, raise the feet about a foot, and cover the victim with a blanket.
  DO NOT allow the victim to move about. If necessary, carry the victim to safety.
  DO NOT apply a tourniquet.
  DO NOT apply cold compresses to a snake bite.

DO NOT cut into a snake bite.
DO NOT give the victim stimulants or pain medications unless instructed to do so by a doctor.
DO NOT give the victim anything by mouth.
DO NOT raise the site of the bite above the level of the victim's heart.
DO NOT try to suction the venom--doing so may cause more harm than good.

Major Identification Features



Non-venomous snake

1. Round pupils
2. No sensing pit
3. Head slightly wider than neck
4. Divided anal plate
5. Double row of scales on the underside of the tail

Venomous snake

1. Elliptical pupils
2. Sensing pit between eye and nostril
3. Head much wider than neck
4. Single anal plate
5. Single scales on the underside of tail

APPENDIX G
TRAINING DOCUMENTATION FORM

Training Documentation Form
Health and Safety Plan

Dewey Loeffel Route 203 Property
Nassau, New York

This training documentation form must be completed by all personnel engaged in performing work at the above referenced site. All personnel must complete and document initial training, and then complete and document refresher training on an annual basis. Training documentation must be maintained on file at the site.

The following training items have been completed by the undersigned (check all applicable):

☐ OSHA 40-hour Training (attach certificate) Completion Date (MM/YYYY): _____

☐ OSHA 8-hour Refresher Training (attach certificate) Completion Date (MM/YYYY): _____

☐ USDOT Hazardous Materials Transportation Training (if applicable, attach certificate) Completion Date (MM/YYYY): _____

☐ DOT Flagger Training Completion Date (MM/YYYY): _____

☐ Review of Site-Specific Health and Safety Plan Completion Date (MM/YYYY): _____

Your signature below acknowledges your completion of the above checked training and that your referenced training is current.

Completed Training:

_____
Printed Name

_____
Signature

_____
Company

_____
Date

APPENDIX H
SITE VISITOR SIGNATURE FORM

RAMBOLL

Dewey Loeffel Route 203 Property

Nassau, New York

Site Visitor Signature Form

By signing this form, the visitor acknowledges O'Brien & Gere is not responsible for use of this Health and Safety Plan (HASP) by visitors, nor guarantees the health and/or safety of any person working on or visiting this site. The visitor may use this HASP as guidance, however the visitor shall be solely responsible for his/her health and safety during performance of work at or visit to the Site. Strict adherence to the health and safety guidelines provided herein will reduce, but not eliminate, the potential for injury at this Site. To this end, health and safety becomes the inherent responsibility of personnel working at or visiting the site.

Printed Name	Affiliation	Signature/Position	Date	Onsite Time	Offsite Time

EXHIBITS

EXHIBIT A
EDR CHAIN OF TITLE

DEWEY LOEFFEL - ROUTE 203
5225-5239 ROUTE 203
NASSAU, NY 12123

Inquiry Number: 05764982.13R
AUGUST 31, 2019

The EDR 1940 Chain of Title

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Chain of Title

The EDR Chain of Title Report tracks a line of successive owners from the present back to 1940 of a particular parcel of property, linked together by recorded transactions which pass title. Available nationwide, this report provides a summary of a property's ownership history and is a valuable source for determining the prior uses of a property.

A network of professional abstractors following established procedures, uses client supplied address information to locate:

• Historical Chain of Title research

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EDR Chain of Title

TARGET PROPERTY INFORMATION

ADDRESS

DEWEY LOEFFEL - ROUTE 203
5225-5239 ROUTE 203
NASSAU, NY 12123

RESEARCH SOURCE

SOURCE 1:	RENSSELAER COUNTY RECORDER'S OFFICE
SOURCE 2:	RENSSELAER COUNTY ASSESSOR'S OFFICE
EXAMINER'S NOTE:	PUBLIC RECORDS OF RENSSELAER COUNTY, NY WERE SEARCHED FROM JANUARY 1, 1940 TO AUGUST 2, 2019, AND NO OTHER DEEDS VESTING TITLE IN THE SUBJECT PROPERTY WERE FOUND OF RECORD DURING THE PERIOD SEARCHED.

PROPERTY DESCRIPTION

CURRENT OWNER:	CAROL P LOEFFEL
LEGAL DESCRIPTION:	COM GAR HOUSE
PROPERTY IDENTIFIERS:	3089-221-6-24
GENERAL COMMENTS:	NA

HISTORICAL CHAIN OF TITLE

SEE EXHIBIT "A"

MISCELLANEOUS

SEE EXHIBIT "B"

EDR Chain of Title

CHAIN OF TITLE

EXHIBIT "A"

EDR Chain of Title

HISTORICAL CHAIN OF TITLE

PARCEL 3089-221-6-24

CHAIN 1

TYPE OF DEED:	QUIT CLAIM DEED
TITLE IS VESTED IN:	CAROL P LOEFFEL
TITLE RECEIVED FROM:	DEWEY P LOEFFEL
DATE EXECUTED:	06/07/1978
DATE RECORDED:	06/13/1978
BOOK:	1302
PAGE:	963
VOLUME:	NA
INSTRUMENT #:	NA
DOCKET:	NA
LAND RECORD COMMENTS:	NA

CHAIN 2

TYPE OF DEED:	DEED
TITLE IS VESTED IN:	FLORENCE HOWELY, DEWEY P LOEFFEL AND CARL M LOEFFEL
TITLE RECEIVED FROM:	FLORENCE HOWLEY, FORMERLY FLORENCE LOEFFEL
DATE EXECUTED:	12/24/1975
DATE RECORDED:	01/08/1976
BOOK:	1277
PAGE:	606
VOLUME:	NA
INSTRUMENT #:	NA
DOCKET:	NA
LAND RECORD COMMENTS:	NA

EDR Chain of Title

CHAIN 3

TYPE OF DEED:	DEED
TITLE IS VESTED IN:	RICHARD L LOEFFEL AND FLORENCE LOEFFEL
TITLE RECEIVED FROM:	HAROLD T WILES AND MARY K WILIS
DATE EXECUTED:	06/21/1955
DATE RECORDED:	06/22/1955
BOOK:	981
PAGE:	403
VOLUME:	NA
INSTRUMENT #:	NA
DOCKET:	NA
LAND RECORD COMMENTS:	NA

CHAIN 4

TYPE OF DEED:	DEED
TITLE IS VESTED IN:	HAROLD T WILIS AND MARY K WILIS
TITLE RECEIVED FROM:	JOHN A LYND AND DOROTHEA A LYND
DATE EXECUTED:	09/13/1950
DATE RECORDED:	09/14/1950
BOOK:	863
PAGE:	241
VOLUME:	NA
INSTRUMENT #:	NA
DOCKET:	NA
LAND RECORD COMMENTS:	NA

CHAIN 5

TYPE OF DEED:	DEED
TITLE IS VESTED IN:	JOHN A LYND AND DOROTHEA A LYND
TITLE RECEIVED FROM:	ALBERT E MCDONNELL AND RUTH M MCDONNELL
DATE EXECUTED:	07/15/1939
DATE RECORDED:	07/25/1939
BOOK:	611
PAGE:	242
VOLUME:	NA
INSTRUMENT #:	NA
DOCKET:	NA
LAND RECORD COMMENTS:	NA

EDR Chain of Title

MISCELLANEOUS

EXHIBIT "B"

EDR Chain of Title

MISCELLANEOUS

TYPE OF INSTRUMENT: NONE IDENTIFIED
FIRST PARTY:
SECOND PARTY:
DATE EXECUTED:
DATE RECORDED:
PAGE:
BOOK:
INSTRUMENT #:
COMMENTS:

FORM 681 ½ DEED—QUIT CLAIM
(Laws of 1917, Chap. 681, Statutory Form D)

Published by NATIONAL LEGAL SUPPLY, INC., Albany, N. Y. 12207

This Indenture,

Made the 7TH *day of* May June *Nineteen Hundred and* Seventy-Eight

Between

DEWEY P. LOEFFEL, presently residing in the Town of Nassau, County of Rensselaer, State of New York,

party Y *of the first part, and*

CAROL P. LOEFFEL, presently residing at P.O. Box 431, Town of Nassau, County of Rensselaer, State of New York

TAX BILLING ADDRESS: P.O. Box 431, Nassau, NY 12123

party Y *of the second part,*

Witnesseth *that the party of the first part, in consideration of* ----------ONE---------- *Dollar* ($ 1.00)

lawful money of the United States, paid by the party of the second part, does hereby remise, release and quitclaim unto the party of the second part, her heirs *and assigns forever, all*

that tract or parcel of land situate in the Town of Nassau, Rensselaer County, New York, bounded and described as follows:

BEGINNING at an iron pipe in the westerly boundary of the right-of-way of the Valatie-Nassau Road (Part 2 County Highway 1875) distant 76 feet westerly measured at a right angle from 68 plus 40 of the survey base line of said Highway; thence South 35° 55' West 629.3 feet along the westerly boundary of the right-of-way of said highway to a concrete monument; thence continued along said boundary of the said highway right-of-way South 35° 55' West 34.4 feet to an iron pipe; thence South 75° 12' West 72 feet along the said boundary of the said highway right-of-way to a concrete monument referenced as being 87 feet westerly measured at a right angle from station 61 plus 42 of the survey base line of the aforesaid highway; thence North 72° 16' West 416.5 feet along the Sweet's Crossing Road to a point in the right-of-way of the Eastern New York Utilities Corporation, said point being marked by an iron pipe; thence North 24° 14' East 724.6 feet along the said Eastern New York Utilities Corporation right-of-way to a point in the southerly boundary of the lands of Roger Dunphy, said point being marked by an iron pipe; thence along the lands of the said Roger Dunphy South 67° 28' East 604.3 feet to the place of beginning, containing 8.4 acres, more or less.

BEING the same premises conveyed to the grantor and others by Florence Howley formerly Florence Loeffel, by warranty deed dated the 24th day of December, 1975 and recorded in the Rensselaer County Clerk's Office on January 8, 1976 in Book 1277 of Deeds at Page 606 thereof.

The actual consideration for this transfer is less than $100.00.

RECEIVED
$ .....0.....
REAL ESTATE
JUN 13 1978
TRANSFER TAX
RENSSELAER
COUNTY

3616

3616

Together *with the appurtenances and all the estate and rights of the party of the first part in and to said premises,*

To have and to hold *the premises herein granted unto the party of the second part,* her heirs *and assigns forever.*

In Witness Whereof, *the party of the first part has hereunto set* his *hand and seal the day and year first above written.*

In Presence of

Dewey P. Loeffel (L.S.)
DEWEY P. LOEFFEL

(L.S.)

(L.S.)

(L.S.)

State of New York
County of ~~ALBANY~~ RENSS } ss.

On this 7th *day of* ~~May~~ JUNE *Nineteen Hundred and* Seventy-Eight *before me, the subscriber, personally appeared*

DEWEY P. LOEFFEL

to me personally known and known to me to be the same person described in and who executed the within Instrument, and he *acknowledged to me that* he *executed the same.*

William C. Hoff Jr.

WILLIAM C. HOFF, Jr.
Notary Public in the State of New York
Residing in Renss County
My Commission Expires March 30, 1975

BOOK 1302 PAGE 564

RECORDED Jan 13 1978 9 17 A.M.
Francis J. Flynn
RENSSELAER COUNTY CLERK

EXHIBIT B
EDR HISTORICAL ARIAL PHOTOGRAPHS

Dewey Loeffel - Route 203

5225-5239 Route 203

Nassau, NY 12123

Inquiry Number: 5764982.11

August 26, 2019

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

08/26/19

Site Name:

Dewey Loeffel - Route 203
5225-5239 Route 203
Nassau, NY 12123
EDR Inquiry # 5764982.11

Client Name:

Ramboll
333 W. Washington Street
Syracuse, NY 13221-0000
Contact: Jesse J. Vollick

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	*Scale*	*Details*	*Source*
2017	1"=500'	Flight Year: 2017	USDA/NAIP
2013	1"=500'	Flight Year: 2013	USDA/NAIP
2009	1"=500'	Flight Year: 2009	USDA/NAIP
2006	1"=500'	Flight Year: 2006	USDA/NAIP
1994	1"=500'	Acquisition Date: April 23, 1994	USGS/DOQQ
1985	1"=500'	Flight Date: March 16, 1985	USDA
1978	1"=1000'	Flight Date: May 11, 1978	USGS
1960	1"=500'	Flight Date: May 01, 1960	USGS
1952	1"=500'	Flight Date: April 16, 1952	USGS

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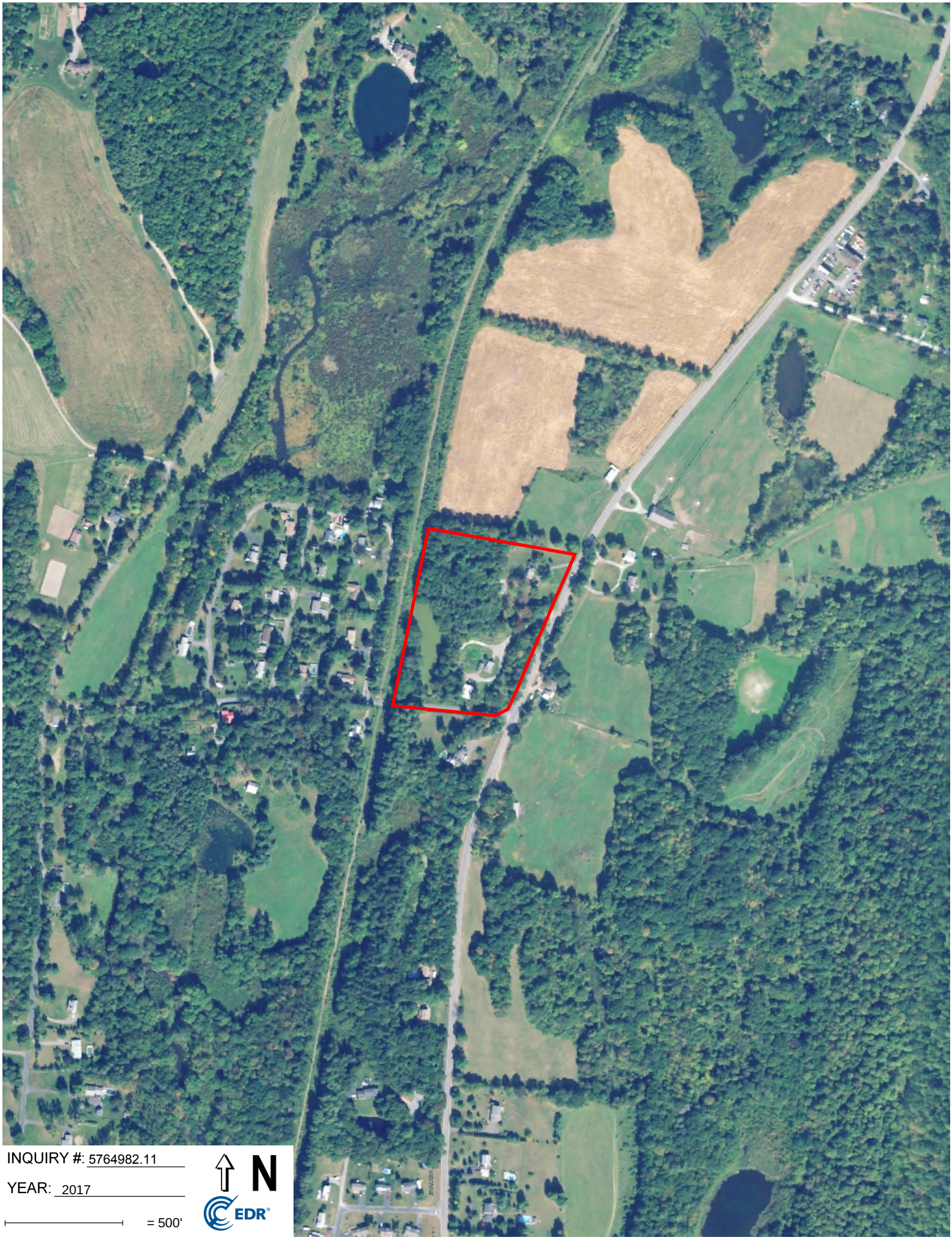
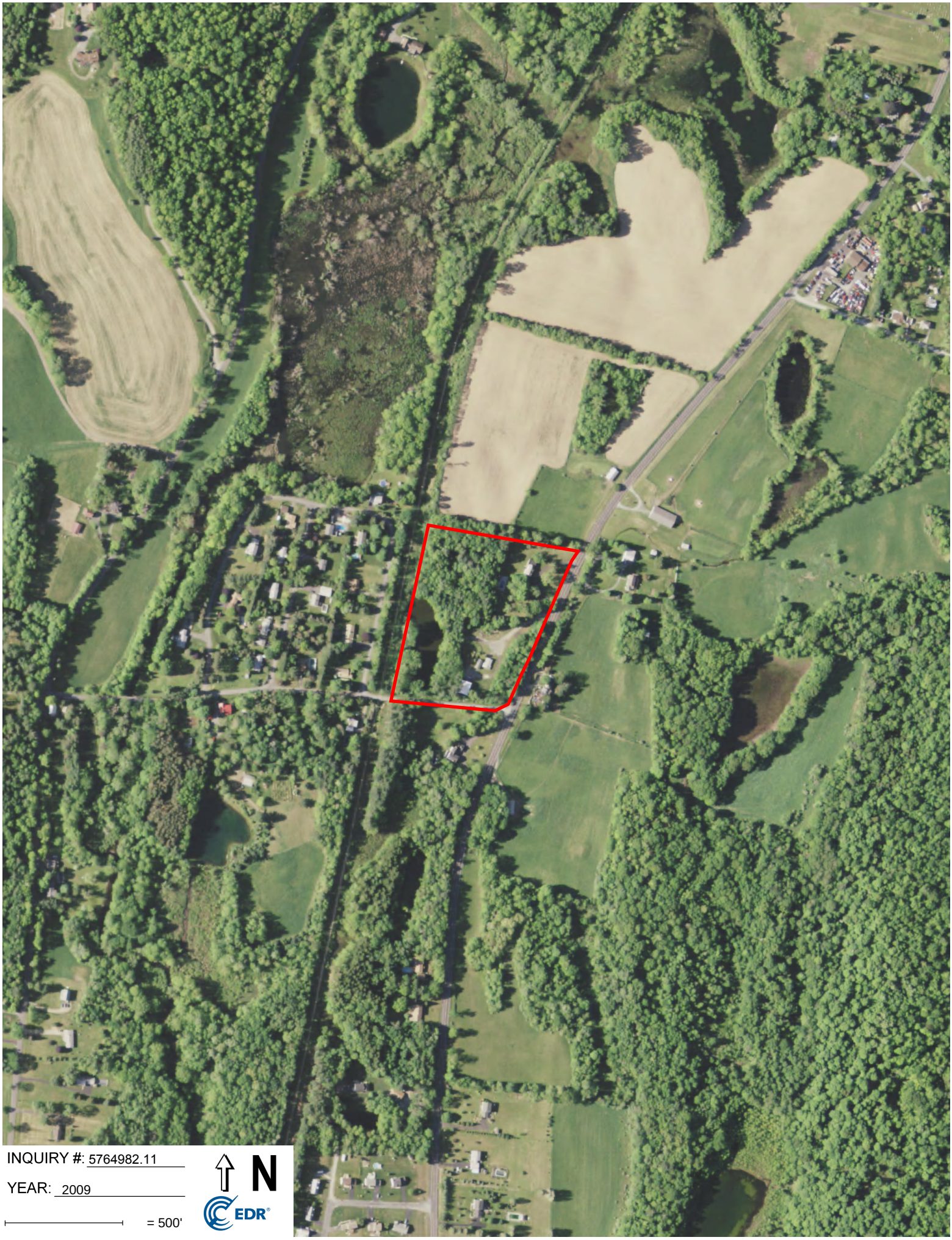

INQUIRY #: 5764982.11
YEAR: 2017
= 500'
N
EDR

INQUIRY #: 5764982.11
YEAR: 2013
= 500'
N
EDR



INQUIRY #: 5764982.11

YEAR: 2009

= 500'

N

EDR

INQUIRY #: 5764982.11

YEAR: 2006

= 500'

N

EDR

INQUIRY #: 5764982.11

YEAR: 1994

= 500'

N

EDR

Subject boundary not shown because it exceeds image extent or image is not georeferenced.

INQUIRY #: 5764982.11
YEAR: 1985
= 500'
N
EDR

INQUIRY #: 5764982.11

YEAR: 1978

= 1000'

N

EDR

Subject boundary not shown because it exceeds image extent or image is not georeferenced.

INQUIRY #: 5764982.11
YEAR: 1960
= 500'
N
EDR

INQUIRY #: 5764982.11

YEAR: 1952

= 500'

N

EDR

EXHIBIT C
EDR RADIUS MAP

Dewey Loeffel - Route 203
5225-5239 Route 203
Nassau, NY 12123

Inquiry Number: 05764982.2r
August 26, 2019

The EDR Radius Map™ Report with GeoCheck®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

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Thank you for your business.
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with any questions or comments.

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EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

5225-5239 ROUTE 203
NASSAU, NY 12123

COORDINATES

Latitude (North):	42.4953490 - 42° 29' 43.25''
Longitude (West):	73.6242960 - 73° 37' 27.46''
Universal Tranverse Mercator:	Zone 18
UTM X (Meters):	613048.8
UTM Y (Meters):	4705479.5
Elevation:	362 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5935493 EAST CHATHAM, NY
Version Date:	2013
Northeast Map:	5935509 NASSAU, NY
Version Date:	2013
Southwest Map:	5935505 KINDERHOOK, NY
Version Date:	2013
Northwest Map:	5935495 EAST GREENBUSH, NY
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20150607
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
5225-5239 ROUTE 203
NASSAU, NY 12123

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1	ROUTE 203	5225-5239 ROUTE 203	SEMS		TP
A2	PLASTIC EXTRUDED PAR	5229 NY STATE ROUTE	FINDS		TP
B3	LOEFFEL REFINING PRO	RTE 203 & SWEETS CRO	RCRA NonGen / NLR, MANIFEST	Higher	45, 0.009, SSE
B4	WATERBURY RD GRAVEL	WATERBURY RD NEAR SW	NY Spills	Higher	65, 0.012, SSE
5	JIM ERTEL'S GARAGE	5308 ROUTE 203	SWF/LF	Higher	1528, 0.289, NE

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was identified in the following records. For more information on this property see page 8 of the attached EDR Radius Map report:

Site	Database(s)	EPA ID
ROUTE 203 5225-5239 ROUTE 203 NASSAU, NY 12123	SEMS	NYN000203244
PLASTIC EXTRUDED PAR 5229 NY STATE ROUTE NASSAU, NY 12123	FINDS Registry ID:: 110070275737	N/A

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL ---------- National Priority List
Proposed NPL ---------- Proposed National Priority List Sites
NPL LIENS ---------- Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ---------- National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY ---------- Federal Facility Site Information listing

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE ---------- Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS ---------- Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF ---------- RCRA - Treatment, Storage and Disposal

EXECUTIVE SUMMARY

Federal RCRA generators list

RCRA-LQG ..... RCRA - Large Quantity Generators
RCRA-SQG ..... RCRA - Small Quantity Generators
RCRA-CESQG ..... RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS ..... Land Use Control Information System
US ENG CONTROLS ..... Engineering Controls Sites List
US INST CONTROL ..... Sites with Institutional Controls

Federal ERNS list

ERNS ..... Emergency Response Notification System

State- and tribal - equivalent CERCLIS

SHWS ..... Inactive Hazardous Waste Disposal Sites in New York State

State and tribal leaking storage tank lists

INDIAN LUST ..... Leaking Underground Storage Tanks on Indian Land
LTANKS ..... Spills Information Database
HIST LTANKS ..... Listing of Leaking Storage Tanks

State and tribal registered storage tank lists

FEMA UST ..... Underground Storage Tank Listing
UST ..... Petroleum Bulk Storage (PBS) Database
CBS UST ..... Chemical Bulk Storage Database
MOSF UST ..... Major Oil Storage Facilities Database
CBS ..... Chemical Bulk Storage Site Listing
MOSF ..... Major Oil Storage Facility Site Listing
AST ..... Petroleum Bulk Storage
CBS AST ..... Chemical Bulk Storage Database
MOSF AST ..... Major Oil Storage Facilities Database
INDIAN UST ..... Underground Storage Tanks on Indian Land
TANKS ..... Storage Tank Faciliy Listing

State and tribal institutional control / engineering control registries

RES DECL ..... Restrictive Declarations Listing
ENG CONTROLS ..... Registry of Engineering Controls
INST CONTROL ..... Registry of Institutional Controls

State and tribal voluntary cleanup sites

VCP ..... Voluntary Cleanup Agreements
INDIAN VCP ..... Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS ..... Brownfields Site List

ERP ---------- Environmental Restoration Program Listing

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS ---------- A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

SWTIRE ---------- Registered Waste Tire Storage & Facility List
SWRCY ---------- Registered Recycling Facility List
INDIAN ODI ---------- Report on the Status of Open Dumps on Indian Lands
ODI ---------- Open Dump Inventory
DEBRIS REGION 9 ---------- Torres Martinez Reservation Illegal Dump Site Locations
IHS OPEN DUMPS ---------- Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL ---------- Delisted National Clandestine Laboratory Register
DEL SHWS ---------- Delisted Registry Sites
US CDL ---------- National Clandestine Laboratory Register
PFAS ---------- PFAS Contamination Site Location Listing

Local Lists of Registered Storage Tanks

HIST UST ---------- Historical Petroleum Bulk Storage Database
HIST AST ---------- Historical Petroleum Bulk Storage Database

Local Land Records

LIENS ---------- Spill Liens Information
LIENS 2 ---------- CERCLA Lien Information

Records of Emergency Release Reports

HMIRS ---------- Hazardous Materials Information Reporting System
NY Hist Spills ---------- SPILLS Database
SPILLS 90 ---------- SPILLS 90 data from FirstSearch
SPILLS 80 ---------- SPILLS 80 data from FirstSearch

Other Ascertainable Records

FUDS ---------- Formerly Used Defense Sites
DOD ---------- Department of Defense Sites
SCRD DRYCLEANERS ---------- State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR ---------- Financial Assurance Information
EPA WATCH LIST ---------- EPA WATCH LIST
2020 COR ACTION ---------- 2020 Corrective Action Program List
TSCA ---------- Toxic Substances Control Act
TRIS ---------- Toxic Chemical Release Inventory System
SSTS ---------- Section 7 Tracking Systems
ROD ---------- Records Of Decision
RMP ---------- Risk Management Plans

RAATS	RCRA Administrative Action Tracking System
PRP	Potentially Responsible Parties
PADS	PCB Activity Database System
ICIS	Integrated Compliance Information System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
ABANDONED MINES	Abandoned Mines
ECHO	Enforcement & Compliance History Information
DOCKET HWC	Hazardous Waste Compliance Docket Listing
UXO	Unexploded Ordnance Sites
FUELS PROGRAM	EPA Fuels Program Registered Listing
AIRS	Air Emissions Data
COAL ASH	Coal Ash Disposal Site Listing
DRYCLEANERS	Registered Drycleaners
E DESIGNATION	E DESIGNATION SITE LISTING
Financial Assurance	Financial Assurance Information Listing
HSWDS	Hazardous Substance Waste Disposal Site Inventory
SPDES	State Pollutant Discharge Elimination System
VAPOR REOPENED	Vapor Intrusion Legacy Site List
UIC	Underground Injection Control Wells
COOLING TOWERS	Registered Cooling Towers

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants
EDR Hist Auto	EDR Exclusive Historical Auto Stations
EDR Hist Cleaner	EDR Exclusive Historical Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS	Recovered Government Archive State Hazardous Waste Facilities List
RGA LF	Recovered Government Archive Solid Waste Facilities List

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

EXECUTIVE SUMMARY

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: The Solid Waste Facilities/Landfill Sites records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. The data come from the list.

A review of the SWF/LF list, as provided by EDR, and dated 04/02/2019 has revealed that there is 1 SWF/LF site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
JIM ERTEL'S GARAGE	5308 ROUTE 203	NE 1/4 - 1/2 (0.289 mi.)	5	13

ADDITIONAL ENVIRONMENTAL RECORDS

Records of Emergency Release Reports

NY Spills: Data collected on spills reported to NYSDEC. is required by one or more of the following: Article 12 of the Navigation Law, 6 NYCRR Section 613.8 (from PBS regs), or 6 NYCRR Section 595.2 (from CBS regs). It includes spills active as of April 1, 1986, as well as spills occurring since this date.

A review of the NY Spills list, as provided by EDR, and dated 05/13/2019 has revealed that there is 1 NY Spills site within approximately 0.125 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
WATERBURY RD GRAVEL Spill Number/Closed Date: 9011950 / 1991-02-08 Site ID: 75520 Spill Date: 1991-02-02	WATERBURY RD NEAR SW	SSE 0 - 1/8 (0.012 mi.)	B4	12

Other Ascertainable Records

RCRA NonGen / NLR: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

A review of the RCRA NonGen / NLR list, as provided by EDR, and dated 03/25/2019 has revealed that

there is 1 RCRA NonGen / NLR site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
LOEFFEL REFINING PRO EPA ID:: NYD980642912	***RTE 203 & SWEETS CRO***	***SSE 0 - 1/8 (0.009 mi.)***	***B3***	***8***

MANIFEST: Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

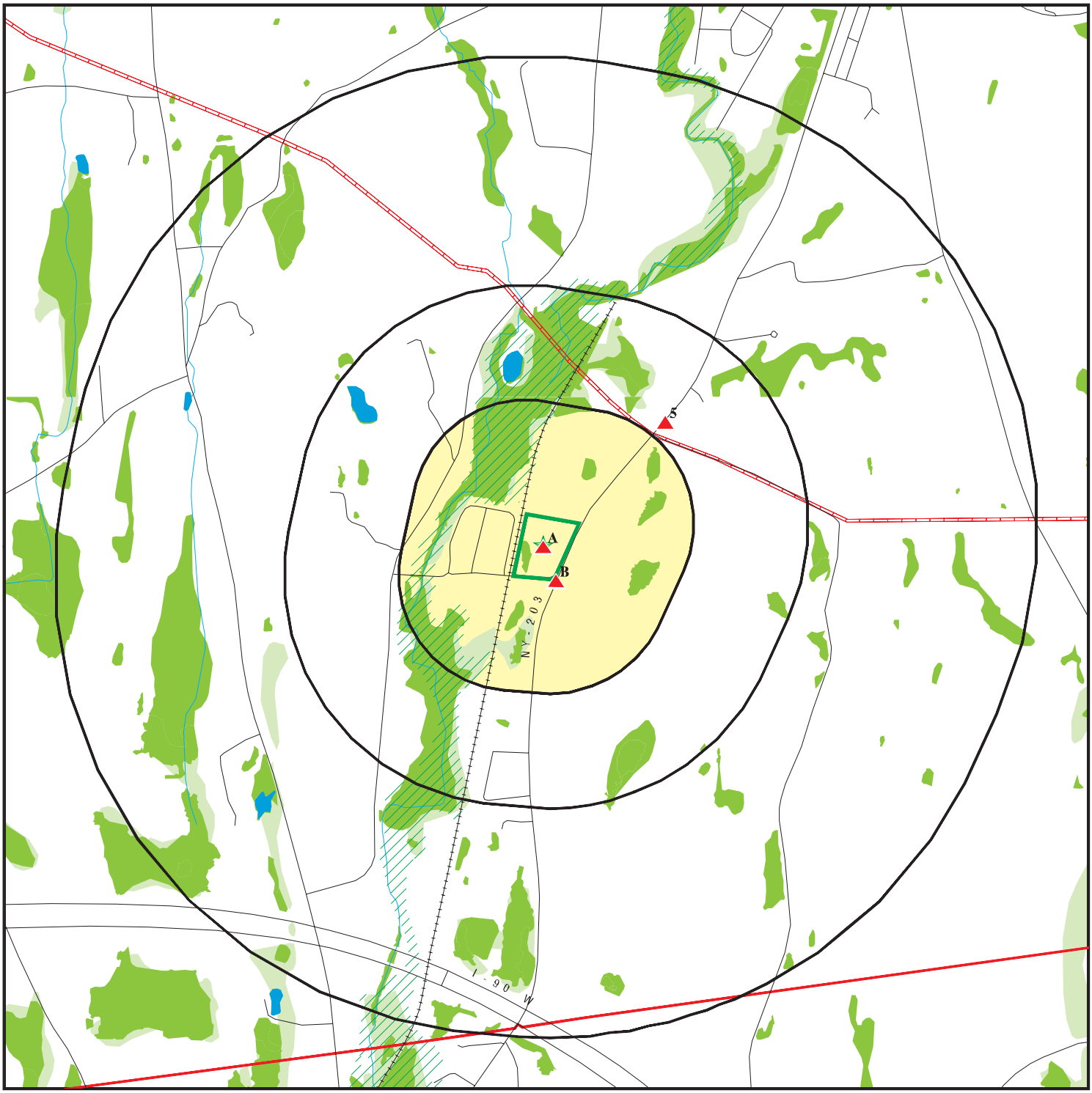
A review of the MANIFEST list, as provided by EDR, and dated 01/01/2019 has revealed that there is 1 MANIFEST site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
LOEFFEL REFINING PRO EPA ID: NYD980642912	***RTE 203 & SWEETS CRO***	***SSE 0 - 1/8 (0.009 mi.)***	***B3***	***8***

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 05764982.2R



0 1/4 1/2 1 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- County Boundary
- Pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Dewey Loeffel - Route 203	CLIENT: Ramboll
ADDRESS: 5225-5239 Route 203	CONTACT: Jesse J. Vollick
Nassau NY 12123	INQUIRY #: 05764982.2r
LAT/LONG: 42.495349 / 73.624296	DATE: August 26, 2019 1:56 pm

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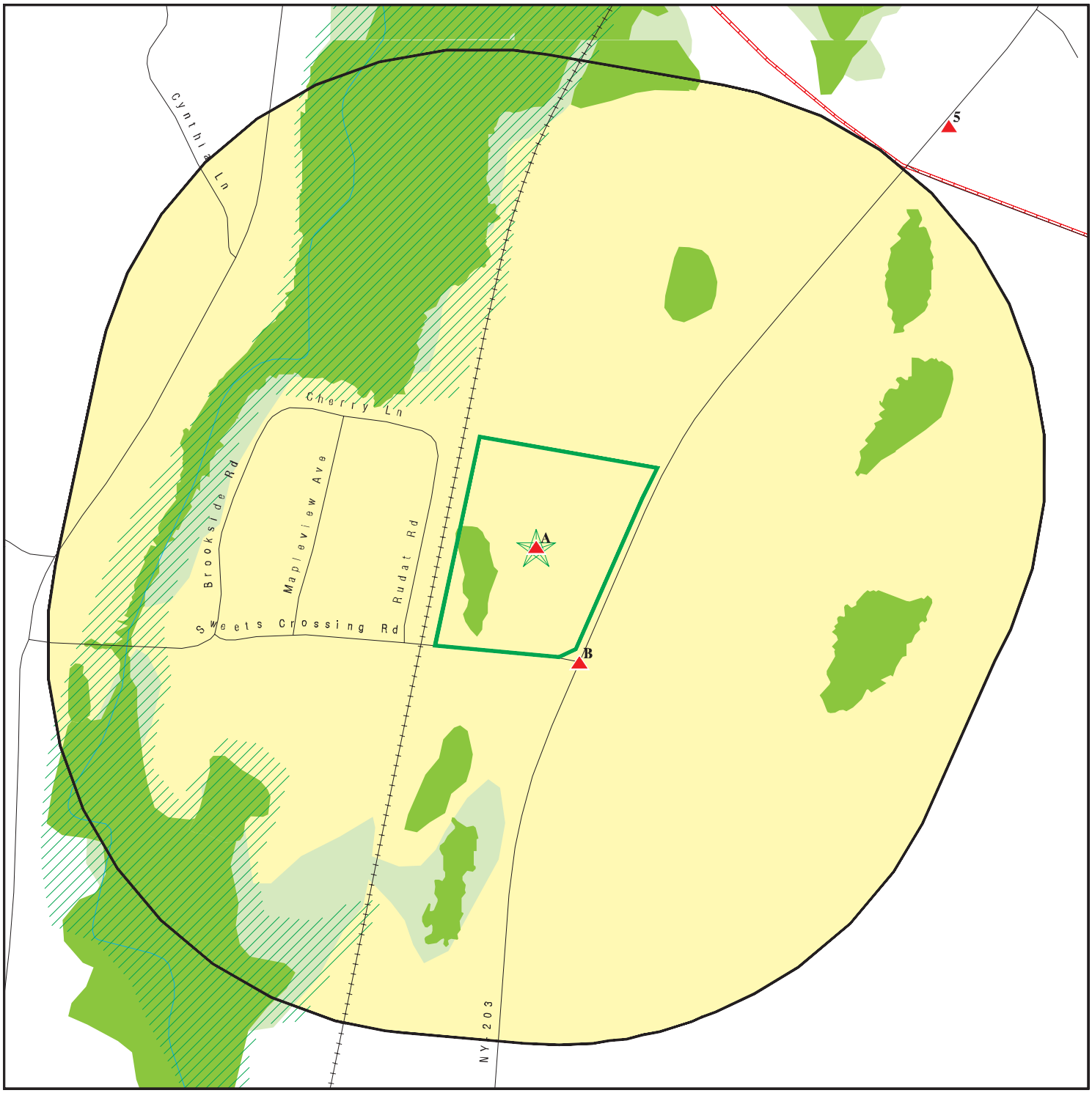
DETAIL MAP - 05764982.2R



0 1/16 1/8 1/4 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Dewey Loeffel - Route 203	CLIENT:	Ramboll
ADDRESS:	5225-5239 Route 203 Nassau NY 12123	CONTACT:	Jesse J. Vollick
		INQUIRY #:	05764982.2r
LAT/LONG:	42.495349 / 73.624296	DATE:	August 26, 2019 1:56 pm

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MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	1.000		0	0	0	0	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500	1	0	0	0	NR	NR	1
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	1	NR	NR	1
State and tribal leaking storage tank lists								
INDIAN LUST	0.500		0	0	0	NR	NR	0
LTANKS	0.500		0	0	0	NR	NR	0
HIST LTANKS	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
UST	0.250		0	0	NR	NR	NR	0
CBS UST	0.250		0	0	NR	NR	NR	0
MOSF UST	0.500		0	0	0	NR	NR	0
CBS	0.250		0	0	NR	NR	NR	0
MOSF	0.500		0	0	0	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
CBS AST	0.250		0	0	NR	NR	NR	0
MOSF AST	0.500		0	0	0	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
TANKS	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
RES DECL	0.125		0	NR	NR	NR	NR	0
ENG CONTROLS	0.500		0	0	0	NR	NR	0
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ERP	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
SWTIRE	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
DEL SHWS	1.000		0	0	0	0	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
PFAS	0.500		0	0	0	NR	NR	0
Local Lists of Registered Storage Tanks								
HIST UST	0.250		0	0	NR	NR	NR	0
HIST AST	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
NY Spills	0.125		1	NR	NR	NR	NR	1
NY Hist Spills	0.125		0	NR	NR	NR	NR	0
SPILLS 90	0.125		0	NR	NR	NR	NR	0
SPILLS 80	0.125		0	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		1	0	NR	NR	NR	1
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP	1	NR	NR	NR	NR	NR	1
ECHO	TP		NR	NR	NR	NR	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
AIRS	TP		NR	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
E DESIGNATION	0.125		0	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
Financial Assurance	TP		NR	NR	NR	NR	NR	0
HSWDS	0.500		0	0	0	NR	NR	0
MANIFEST	0.250		1	0	NR	NR	NR	1
SPDES	TP		NR	NR	NR	NR	NR	0
VAPOR REOPENED	0.500		0	0	0	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
COOLING TOWERS	TP		NR	NR	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	TP		NR	NR	NR	NR	NR	0
RGA LF	TP		NR	NR	NR	NR	NR	0
- Totals --		2	3	0	1	0	0	6

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

A1 **ROUTE 203** **SEMS** **1024363954**
Target **5225-5239 ROUTE 203** **NYN000203244**
Property **NASSAU, NY 12123**

Site 1 of 2 in cluster A

Actual: **362 ft.**

SEMS:

Site ID:	0203244
EPA ID:	NYN000203244
Cong District:	19
FIPS Code:	36083
Latitude:	Not reported
Longitude:	Not reported
FF:	N
NPL:	Not on the NPL
Non NPL Status:	Removal Only Site (No Site Assessment Work Needed)

A2 **PLASTIC EXTRUDED PARTS INC** **FINDS** **1024373014**
Target **5229 NY STATE ROUTE 203** **N/A**
Property **NASSAU, NY 12123**

Site 2 of 2 in cluster A

Actual: **362 ft.**

FINDS:

Registry ID: 110070275737

Environmental Interest/Information System
OSHA ESTABLISHMENT

Click this hyperlink while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

B3 **LOEFFEL REFINING PRODUCTS INC** **RCRA NonGen / NLR** **1000228805**
SSE **RTE 203 & SWEETS CROSSING RD** **MANIFEST** **NYD980642912**
< 1/8 **NASSAU, NY 12123**
0.009 mi.
45 ft.

Site 1 of 2 in cluster B

Relative: **Higher**

Actual: **367 ft.**

RCRA NonGen / NLR:

Date form received by agency:	01/01/2007
Facility name:	LOEFFEL REFINING PRODUCTS INC
Facility address:	RTE 203 & SWEETS CROSSING RD NASSAU, NY 12123
EPA ID:	NYD980642912
Mailing address:	RD #2 NASSAU, NY 12123
Contact:	Not reported
Contact address:	RD #2 NASSAU, NY 12123
Contact country:	US
Contact telephone:	Not reported
Contact email:	Not reported
EPA Region:	02
Land type:	Facility is not located on Indian land. Additional information is not known.
Classification:	Non-Generator
Description:	Handler: Non-Generators do not presently generate hazardous waste

LOEFFEL REFINING PRODUCTS INC (Continued) **1000228805**

Owner/Operator Summary:
- Owner/operator name: Not reported
- Owner/operator address: NOT REQUIRED
  NOT REQUIRED, WY 99999
- Owner/operator country: US
- Owner/operator telephone: 212-555-1212
- Owner/operator email: Not reported
- Owner/operator fax: Not reported
- Owner/operator extension: Not reported
- Legal status: Private
- Owner/Operator Type: Operator
- Owner/Op start date: Not reported
- Owner/Op end date: Not reported

- Owner/operator name: Not reported
- Owner/operator address: NOT REQUIRED
  NOT REQUIRED, WY 99999
- Owner/operator country: US
- Owner/operator telephone: 212-555-1212
- Owner/operator email: Not reported
- Owner/operator fax: Not reported
- Owner/operator extension: Not reported
- Legal status: Private
- Owner/Operator Type: Owner
- Owner/Op start date: Not reported
- Owner/Op end date: Not reported

Handler Activities Summary:
- U.S. importer of hazardous waste: No
- Mixed waste (haz. and radioactive): No
- Recycler of hazardous waste: No
- Transporter of hazardous waste: No
- Treater, storer or disposer of HW: No
- Underground injection activity: No
- On-site burner exemption: No
- Furnace exemption: No
- Used oil fuel burner: No
- Used oil processor: No
- User oil refiner: No
- Used oil fuel marketer to burner: No
- Used oil Specification marketer: No
- Used oil transfer facility: No
- Used oil transporter: No

Historical Generators:
- Date form received by agency: 01/01/2006
- Site name: LOEFFEL REFINING PRODUCTS INC
- Classification: Not a generator, verified

- Date form received by agency: 07/08/1999
- Site name: LOEFFEL REFINING PRODUCTS INC
- Classification: Not a generator, verified

- Date form received by agency: 06/18/1982
- Site name: LOEFFEL REFINING PRODUCTS INC
- Classification: Large Quantity Generator

LOEFFEL REFINING PRODUCTS INC (Continued) **1000228805**

Hazardous Waste Summary:

. Waste code: D000
. Waste name: Not Defined

. Waste code: D008
. Waste name: LEAD

Facility Has Received Notices of Violations:
Regulation violated: Not reported
Area of violation: Generators - General
Date violation determined: 03/25/1987
Date achieved compliance: 09/09/1987
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/23/1987
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Evaluation Action Summary:
Evaluation date: 04/08/1988
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 03/25/1987
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 09/09/1987
Evaluation lead agency: State

Evaluation date: 07/15/1986
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: EPA

NY MANIFEST:
Name: SAVOCO INC.
Address: RTE 203 & SWEETS CROSSING RD
City,State,Zip: NASSAU, NY 12123
Country: USA
EPA ID: NYD980642912
Facility Status: Not reported
Location Address 1: ROUTE-203 RD#1 BOX-431
Code: BP
Location Address 2: Not reported
Total Tanks: Not reported
Location City: NASSAU
Location State: NY
Location Zip: 12123

LOEFFEL REFINING PRODUCTS INC (Continued) **1000228805**

Location Zip 4:	Not reported

NY MANIFEST:

EPAID:	NYD980642912
Mailing Name:	SAVOCO INC.
Mailing Contact:	DEWEY LOEFFEL
Mailing Address 1:	ROUTE 203
Mailing Address 2:	Not reported
Mailing City:	NASSAU
Mailing State:	NY
Mailing Zip:	12123
Mailing Zip 4:	Not reported
Mailing Country:	USA
Mailing Phone:	5187663233

NY MANIFEST:

Document ID:	NYO2981817
Manifest Status:	K
seq:	Not reported
Year:	1983
Trans1 State ID:	4A021
Trans2 State ID:	JA075
Generator Ship Date:	04/13/1983
Trans1 Recv Date:	04/13/1983
Trans2 Recv Date:	04/13/1983
TSD Site Recv Date:	04/13/1983
Part A Recv Date:	05/24/2003
Part B Recv Date:	05/24/2003
Generator EPA ID:	NYD980642912
Trans1 EPA ID:	NJD096844204
Trans2 EPA ID:	Not reported
TSDF ID 1:	PAD084876457
TSDF ID 2:	Not reported
Manifest Tracking Number:	Not reported
Import Indicator:	Not reported
Export Indicator:	Not reported
Discr Quantity Indicator:	Not reported
Discr Type Indicator:	Not reported
Discr Residue Indicator:	Not reported
Discr Partial Reject Indicator:	Not reported
Discr Full Reject Indicator:	Not reported
Manifest Ref Number:	Not reported
Alt Facility RCRA ID:	Not reported
Alt Facility Sign Date:	Not reported
MGMT Method Type Code:	Not reported
Waste Code:	D008 - LEAD 5.0 MG/L TCLP
Waste Code:	Not reported
Waste Code:	Not reported
Waste Code:	Not reported
Waste Code:	Not reported
Waste Code:	Not reported
Quantity:	07000
Units:	G - Gallons (liquids only)* (8.3 pounds)
Number of Containers:	001
Container Type:	TT - Cargo tank, tank trucks
Handling Method:	Not reported
Specific Gravity:	100

LOEFFEL REFINING PRODUCTS INC (Continued) **1000228805**

Click this hyperlink while viewing on your computer to access
-1 additional NY MANIFEST: record(s) in the EDR Site Report.

B4 **WATERBURY RD GRAVEL PIT** **NY Spills** **S102157957**
SSE **WATERBURY RD NEAR SWEETS CROSSING RD** **N/A**
< 1/8 **SCHODACK, NY**
0.012 mi.
65 ft. **Site 2 of 2 in cluster B**

Relative:
Higher

Actual:
369 ft.

SPILLS:

Name:	WATERBURY RD GRAVEL PIT
Address:	WATERBURY RD NEAR SWEETS CROSSING RD
City,State,Zip:	SCHODACK, NY
Spill Number/Closed Date:	9011950 / 1991-02-08
Facility ID:	9011950
Facility Type:	ER
DER Facility ID:	70680
Site ID:	75520
DEC Region:	4
Spill Cause:	Deliberate
Spill Class:	C3
SWIS:	4244
Spill Date:	1991-02-02
Investigator:	WEBLAIN
Referred To:	Not reported
Reported to Dept:	1991-02-08
CID:	Not reported
Water Affected:	Not reported
Spill Source:	Commercial/Industrial
Spill Notifier:	Citizen
Cleanup Ceased:	1991-02-08
Cleanup Meets Std:	True
Last Inspection:	1991-02-08
Recommended Penalty:	False
UST Trust:	False
Remediation Phase:	0
Date Entered In Computer:	1991-02-15
Spill Record Last Update:	2012-08-21
Spiller Name:	Not reported
Spiller Company:	UNK @ GRAVEL PIT
Spiller Address:	Not reported
Spiller Company:	999
Contact Name:	Not reported
DEC Memo:	"Prior to Sept, 2004 data translation this spill Lead_DEC Field was BLAIN "
Remarks:	"IN GRAVEL BANK, PIT NEAR CRANE W/OIL, ANTIFREEZE, RUNNING TO VALATIEKILL. BLAIN ON SITE 2/8,16:00-OIL CHANGE WAS DONE ON SITE. GREEN WATER DUE TO ALGAE."

All Materials:

Site ID:	75520
Operable Unit ID:	951879
Operable Unit:	01
Material ID:	428459
Material Code:	0022
Material Name:	waste oil/used oil
Case No.:	Not reported
Material FA:	Petroleum

WATERBURY RD GRAVEL PIT (Continued) **S102157957**

Quantity:	2.00
Units:	G
Recovered:	.00
Oxygenate:	Not reported

5
NE
1/4-1/2
0.289 mi.
1528 ft.

JIM ERTEL'S GARAGE **SWF/LF** **S123680473**
5308 ROUTE 203 **N/A**
NASSAU, NY 12123

Relative:
Higher

Actual:
376 ft.

SWF/LF:

Name:	JIM ERTEL'S GARAGE
Address:	5308 ROUTE 203
City,State,Zip:	NASSAU, NY 12123
Flag:	INACTIVE
Region Code:	4
Phone Number:	5187664010
Owner Name:	James Ertel
Owner Type:	Private
Owner Address:	5308 Route 203
Owner Addr2:	Not reported
Owner City,St,Zip:	Nassau, NY 12123
Owner Email:	Not reported
Owner Phone:	5187664010
Contact Name:	James Ertel
Contact Address:	Not reported
Contact Addr2:	Not reported
Contact City,St,Zip:	Not reported
Contact Email:	Not reported
Contact Phone:	5187664010
Activity Desc:	Vehicle Dismantling Facility
Activity Number:	[3110157]
Active:	No
East Coordinate:	613470
North Coordinate:	4706123
Accuracy Code:	Not reported
Regulatory Status:	Not reported
Waste Type:	Not reported
Authorization #:	Not reported
Authorization Date:	Not reported
Expiration Date:	Not reported
Operator Name:	James Ertel
Operator Type:	Private
Laste Date:	Not reported

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: EPA
Telephone: N/A
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: EPA
Telephone: N/A
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: EPA
Telephone: N/A
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

Federal CERCLIS list

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 04/03/2019
Date Data Arrived at EDR: 04/05/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 07/03/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Varies

SEMS: Superfund Enterprise Management System

SEMS (Superfund Enterprise Management System) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA's Superfund Program across the United States. The list was formerly know as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE: Superfund Enterprise Management System Archive

SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that. based upon available information, the location is not judged to be potential NPL site.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 02/22/2019
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 41

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 05/10/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 01/31/2019
Date Data Arrived at EDR: 02/04/2019
Date Made Active in Reports: 03/08/2019
Number of Days to Update: 32

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 05/29/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 01/31/2019
Date Data Arrived at EDR: 02/04/2019
Date Made Active in Reports: 03/08/2019
Number of Days to Update: 32

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 05/29/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/26/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 36

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

State- and tribal - equivalent CERCLIS

SHWS: Inactive Hazardous Waste Disposal Sites in New York State

Referred to as the State Superfund Program, the Inactive Hazardous Waste Disposal Site Remedial Program is the cleanup program for inactive hazardous waste sites and now includes hazardous substance sites

Date of Government Version: 05/13/2019
Date Data Arrived at EDR: 05/15/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 29

Source: Department of Environmental Conservation
Telephone: 518-402-9622
Last EDR Contact: 05/15/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Annually

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Facility Register

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 04/02/2019
Date Data Arrived at EDR: 04/04/2019
Date Made Active in Reports: 06/19/2019
Number of Days to Update: 76

Source: Department of Environmental Conservation
Telephone: 518-457-2051
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

State and tribal leaking storage tank lists

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 10/17/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 10/10/2018
Date Data Arrived at EDR: 03/08/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 10/16/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 02/19/2019
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 11/01/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 09/24/2018
Date Data Arrived at EDR: 03/12/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 50

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 07/23/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 10/13/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 10/12/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

LTANKS: Spills Information Database
Leaking Storage Tank Incident Reports. These records contain an inventory of reported leaking storage tank incidents reported from 4/1/86 through the most recent update. They can be either leaking underground storage tanks or leaking aboveground storage tanks. The causes of the incidents are tank test failures, tank failures or tank overfills.

Date of Government Version: 05/13/2019
Date Data Arrived at EDR: 05/14/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 30

Source: Department of Environmental Conservation
Telephone: 518-402-9549
Last EDR Contact: 05/14/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Varies

HIST LTANKS: Listing of Leaking Storage Tanks

A listing of leaking underground and aboveground storage tanks. The causes of the incidents are tank test failures, tank failures or tank overfills. In 2002, the Department of Environmental Conservation stopped providing updates to its original Spills Information Database. This database includes fields that are no longer available from the NYDEC as of January 1, 2002. Current information may be found in the NY LTANKS database. Department of Environmental Conservation.

Date of Government Version: 01/01/2002
Date Data Arrived at EDR: 07/08/2005
Date Made Active in Reports: 07/14/2005
Number of Days to Update: 6

Source: Department of Environmental Conservation
Telephone: 518-402-9549
Last EDR Contact: 07/07/2005
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

State and tribal registered storage tank lists

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 05/15/2017
Date Data Arrived at EDR: 05/30/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 136

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 07/10/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Varies

UST: Petroleum Bulk Storage (PBS) Database

Facilities that have petroleum storage capacities in excess of 1,100 gallons and less than 400,000 gallons.

Date of Government Version: 03/26/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 78

Source: Department of Environmental Conservation
Telephone: 518-402-9549
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: No Update Planned

CBS UST: Chemical Bulk Storage Database

Facilities that store regulated hazardous substances in underground tanks of any size

Date of Government Version: 01/01/2002
Date Data Arrived at EDR: 02/20/2002
Date Made Active in Reports: 03/22/2002
Number of Days to Update: 30

Source: NYSDEC
Telephone: 518-402-9549
Last EDR Contact: 10/24/2005
Next Scheduled EDR Contact: 01/23/2006
Data Release Frequency: No Update Planned

MOSF UST: Major Oil Storage Facilities Database

Facilities that may be onshore facilities or vessels, with petroleum storage capacities of 400,000 gallons or greater.

Date of Government Version: 01/01/2002
Date Data Arrived at EDR: 02/20/2002
Date Made Active in Reports: 03/22/2002
Number of Days to Update: 30

Source: NYSDEC
Telephone: 518-402-9549
Last EDR Contact: 07/25/2005
Next Scheduled EDR Contact: 10/24/2005
Data Release Frequency: No Update Planned

CBS: Chemical Bulk Storage Site Listing

These facilities store regulated hazardous substances in aboveground tanks with capacities of 185 gallons or greater, and/or in underground tanks of any size

Date of Government Version: 03/26/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 78

Source: Department of Environmental Conservation
Telephone: 518-402-9549
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

MOSF: Major Oil Storage Facility Site Listing

These facilities may be onshore facilities or vessels, with petroleum storage capacities of 400,000 gallons or greater.

Date of Government Version: 03/26/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 78

Source: Department of Environmental Conservation
Telephone: 518-402-9549
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

AST: Petroleum Bulk Storage

Registered Aboveground Storage Tanks.

Date of Government Version: 03/26/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 78

Source: Department of Environmental Conservation
Telephone: 518-402-9549
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: No Update Planned

CBS AST: Chemical Bulk Storage Database

Facilities that store regulated hazardous substances in aboveground tanks with capacities of 185 gallons or greater, and/or in underground tanks of any size.

Date of Government Version: 01/01/2002
Date Data Arrived at EDR: 02/20/2002
Date Made Active in Reports: 03/22/2002
Number of Days to Update: 30

Source: NYSDEC
Telephone: 518-402-9549
Last EDR Contact: 07/25/2005
Next Scheduled EDR Contact: 10/24/2005
Data Release Frequency: No Update Planned

MOSF AST: Major Oil Storage Facilities Database

Facilities that may be onshore facilities or vessels, with petroleum storage capacities of 400,000 gallons or greater.

Date of Government Version: 01/01/2002
Date Data Arrived at EDR: 02/20/2002
Date Made Active in Reports: 03/22/2002
Number of Days to Update: 30

Source: NYSDEC
Telephone: 518-402-9549
Last EDR Contact: 07/25/2005
Next Scheduled EDR Contact: 10/24/2005
Data Release Frequency: No Update Planned

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 09/24/2018
Date Data Arrived at EDR: 03/12/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 50

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 07/23/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 10/17/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 10/10/2018
Date Data Arrived at EDR: 03/08/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 54

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 10/16/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 11/07/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 11/01/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 10/12/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 10/03/2018
Date Data Arrived at EDR: 03/07/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 55

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 07/24/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

TANKS: Storage Tank Faciliy Listing

This database contains records of facilities that are or have been regulated under Bulk Storage Program. Tank information for these facilities may not be releasable by the state agency.

Date of Government Version: 03/26/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 78

Source: Department of Environmental Conservation
Telephone: 518-402-9543
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

State and tribal institutional control / engineering control registries

ENV RES DECL: Environmental Restrictive Declarations

The Environmental Restrictive Declarations (ERD) listed were recorded in connection with a zoning action against the noted Tax Blocks and Tax Lots, or portion thereof, and are available in the property records on file at the Office of the City Register for Bronx, Kings, New York and Queens counties or at the Richmond County Clerk's office. They contain environmental requirements with respect to hazardous materials, air quality and/or noise in accordance with Section 11-15 of this Resolution.

Date of Government Version: 02/13/2019
Date Data Arrived at EDR: 03/22/2019
Date Made Active in Reports: 06/14/2019
Number of Days to Update: 84

Source: New York City Department of City Planning
Telephone: 212-720-3300
Last EDR Contact: 06/21/2019
Next Scheduled EDR Contact: 09/30/2019
Data Release Frequency: Varies

RES DECL: Restrictive Declarations Listing

A restrictive declaration is a covenant running with the land which binds the present and future owners of the property. As a condition of certain special permits, the City Planning Commission may require an applicant to sign and record a restrictive declaration that places specified conditions on the future use and development of the property. Certain restrictive declarations are indicated by a D on zoning maps.

Date of Government Version: 11/18/2010
Date Data Arrived at EDR: 06/30/2014
Date Made Active in Reports: 07/21/2014
Number of Days to Update: 21

Source: NYC Department of City Planning
Telephone: 212-720-3401
Last EDR Contact: 06/21/2019
Next Scheduled EDR Contact: 09/30/2019
Data Release Frequency: Varies

ENG CONTROLS: Registry of Engineering Controls

Environmental Remediation sites that have engineering controls in place.

Date of Government Version: 05/13/2019
Date Data Arrived at EDR: 05/15/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 29

Source: Department of Environmental Conservation
Telephone: 518-402-9553
Last EDR Contact: 05/15/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Quarterly

INST CONTROL: Registry of Institutional Controls

Environmental Remediation sites that have institutional controls in place.

Date of Government Version: 05/13/2019
Date Data Arrived at EDR: 05/15/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 29

Source: Department of Environmental Conservation
Telephone: 518-402-9553
Last EDR Contact: 05/15/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Quarterly

State and tribal voluntary cleanup sites

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

VCP NYC: Voluntary Cleanup Program Listing NYC
New York City voluntary cleanup program sites.

Date of Government Version: 12/14/2018
Date Data Arrived at EDR: 12/19/2018
Date Made Active in Reports: 02/13/2019
Number of Days to Update: 56

Source: New York City Office of Environmental Protection
Telephone: 212-788-8841
Last EDR Contact: 06/17/2019
Next Scheduled EDR Contact: 09/30/2019
Data Release Frequency: Varies

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 07/27/2015
Date Data Arrived at EDR: 09/29/2015
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 142

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 06/20/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Varies

VCP: Voluntary Cleanup Agreements
New York established its Voluntary Cleanup Program (VCP) to address the environmental, legal and financial barriers that often hinder the redevelopment and reuse of contaminated properties. The Voluntary Cleanup Program was developed to enhance private sector cleanup of brownfields by enabling parties to remediate sites using private rather than public funds and to reduce the development pressures on "greenfield" sites.

Date of Government Version: 05/13/2019
Date Data Arrived at EDR: 05/15/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 29

Source: Department of Environmental Conservation
Telephone: 518-402-9711
Last EDR Contact: 05/15/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Semi-Annually

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Site List
A Brownfield is any real property where redevelopment or re-use may be complicated by the presence or potential presence of a hazardous waste, petroleum, pollutant, or contaminant.

Date of Government Version: 05/13/2019
Date Data Arrived at EDR: 05/15/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 29

Source: Department of Environmental Conservation
Telephone: 518-402-9764
Last EDR Contact: 05/15/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Semi-Annually

ERP: Environmental Restoration Program Listing
In an effort to spur the cleanup and redevelopment of brownfields, New Yorkers approved a $200 million Environmental Restoration or Brownfields Fund as part of the $1.75 billion Clean Water/Clean Air Bond Act of 1996 (1996 Bond Act). Enhancements to the program were enacted on October 7, 2003. Under the Environmental Restoration Program, the State provides grants to municipalities to reimburse up to 90 percent of on-site eligible costs and 100% of off-site eligible costs for site investigation and remediation activities. Once remediated, the property may then be reused for commercial, industrial, residential or public use.

Date of Government Version: 05/13/2019
Date Data Arrived at EDR: 05/15/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 29

Source: Department of Environmental Conservation
Telephone: 518-402-9622
Last EDR Contact: 05/15/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 12/17/2018
Date Data Arrived at EDR: 12/18/2018
Date Made Active in Reports: 01/11/2019
Number of Days to Update: 24

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 06/04/2019
Next Scheduled EDR Contact: 09/30/2019
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

SWTIRE: Registered Waste Tire Storage & Facility List

A listing of facilities registered to accept waste tires.

Date of Government Version: 02/27/2018
Date Data Arrived at EDR: 04/06/2018
Date Made Active in Reports: 06/08/2018
Number of Days to Update: 63

Source: Department of Environmental Conservation
Telephone: 518-402-8694
Last EDR Contact: 06/10/2019
Next Scheduled EDR Contact: 09/23/2019
Data Release Frequency: No Update Planned

SWRCY: Registered Recycling Facility List

A listing of recycling facilities.

Date of Government Version: 04/02/2019
Date Data Arrived at EDR: 04/04/2019
Date Made Active in Reports: 06/19/2019
Number of Days to Update: 76

Source: Department of Environmental Conservation
Telephone: 518-402-8705
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Varies

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 07/19/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: No Update Planned

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

IHS OPEN DUMPS: Open Dumps on Indian Land

A listing of all open dumps located on Indian Land in the United States.

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 08/06/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 176

Source: Department of Health & Human Serivces, Indian Health Service
Telephone: 301-443-1452
Last EDR Contact: 04/23/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations that have been removed from the DEAs National Clandestine Laboratory Register.

Date of Government Version: 02/24/2019
Date Data Arrived at EDR: 02/26/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 50

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: No Update Planned

DEL SHWS: Delisted Registry Sites

A database listing of sites delisted from the Registry of Inactive Hazardous Waste Disposal Sites.

Date of Government Version: 05/13/2019
Date Data Arrived at EDR: 05/15/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 29

Source: Department of Environmental Conservation
Telephone: 518-402-9622
Last EDR Contact: 05/15/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Quarterly

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 02/24/2019
Date Data Arrived at EDR: 02/26/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 50

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Quarterly

PFAS: PFAS Contamination Site Location Listing

DEC surveyed select businesses, fire departments, fire training centers, bulk storage facilities, airports, and Department of Defense (DoD) facilities. The responses to the survey have helped to determine if these entities used or stored materials containing PFOA/PFOS including AFFF and dispersants used in Teflon coating operations. The results of this survey will be updated periodically as additional responses are received..

Date of Government Version: 01/16/2019
Date Data Arrived at EDR: 05/08/2019
Date Made Active in Reports: 06/24/2019
Number of Days to Update: 47

Source: Department of Environmental Conservation
Telephone: 518-402-9020
Last EDR Contact: 05/08/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Varies

Local Lists of Registered Storage Tanks

SUFFOLK CO TANKS: Storage Tank Database
Facilities that have no tank information

Date of Government Version: 06/28/2018
Date Data Arrived at EDR: 02/05/2019
Date Made Active in Reports: 03/08/2019
Number of Days to Update: 31

Source: Department of Health Services
Telephone: 631-854-2516
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Varies

HIST UST: Historical Petroleum Bulk Storage Database
These facilities have petroleum storage capacities in excess of 1,100 gallons and less than 400,000 gallons. This database contains detailed information per site. It is no longer updated due to the sensitive nature of the information involved. See UST for more current data.

Date of Government Version: 01/01/2002
Date Data Arrived at EDR: 06/02/2006
Date Made Active in Reports: 07/20/2006
Number of Days to Update: 48

Source: Department of Environmental Conservation
Telephone: 518-402-9549
Last EDR Contact: 10/23/2006
Next Scheduled EDR Contact: 01/22/2007
Data Release Frequency: Varies

HIST AST: Historical Petroleum Bulk Storage Database
These facilities have petroleum storage capabilities in excess of 1,100 gallons and less than 400,000 gallons. This database contains detailed information per site. No longer updated due to the sensitive nature of the information involved. See AST for more current data.

Date of Government Version: 01/01/2002
Date Data Arrived at EDR: 06/02/2006
Date Made Active in Reports: 07/20/2006
Number of Days to Update: 48

Source: Department of Environmental Conservation
Telephone: 518-402-9549
Last EDR Contact: 10/23/2006
Next Scheduled EDR Contact: 01/22/2007
Data Release Frequency: No Update Planned

Local Land Records

LIENS: Spill Liens Information
Lien information from the Oil Spill Fund.

Date of Government Version: 05/02/2019
Date Data Arrived at EDR: 05/02/2019
Date Made Active in Reports: 06/19/2019
Number of Days to Update: 48

Source: Office of the State Comptroller
Telephone: 518-474-9034
Last EDR Contact: 05/01/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Quarterly

LIENS 2: CERCLA Lien Information
A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 07/02/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/26/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 49

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

SPILLS: Spills Information Database

Data collected on spills reported to NYSDEC as required by one or more of the following: Article 12 of the Navigation Law, 6 NYCRR Section 613.8 (from PBS regs), or 6 NYCRR Section 595.2 (from CBS regs). It includes spills active as of April 1, 1986, as well as spills occurring since this date.

Date of Government Version: 05/13/2019
Date Data Arrived at EDR: 05/14/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 30

Source: Department of Environmental Conservation
Telephone: 518-402-9549
Last EDR Contact: 05/14/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Varies

HIST SPILLS: SPILLS Database

This database contains records of chemical and petroleum spill incidents. Under State law, petroleum and hazardous chemical spills that can impact the waters of the state must be reported by the spiller (and, in some cases, by anyone who has knowledge of the spills). In 2002, the Department of Environmental Conservation stopped providing updates to its original Spills Information Database. This database includes fields that are no longer available from the NYDEC as of January 1, 2002. Current information may be found in the NY SPILLS database. Department of Environmental Conservation.

Date of Government Version: 01/01/2002
Date Data Arrived at EDR: 07/08/2005
Date Made Active in Reports: 07/14/2005
Number of Days to Update: 6

Source: Department of Environmental Conservation
Telephone: 518-402-9549
Last EDR Contact: 07/07/2005
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 12/14/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 02/12/2013
Number of Days to Update: 40

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SPILLS 80: SPILLS80 data from FirstSearch

Spills 80 includes those spill and release records available from FirstSearch databases prior to 1990. Typically, they may include chemical, oil and/or hazardous substance spills recorded before 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 80.

Date of Government Version: 11/02/2010
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 03/07/2013
Number of Days to Update: 63

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/27/2019
Date Made Active in Reports: 04/17/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: (212) 637-3660
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 03/07/2019
Date Data Arrived at EDR: 04/03/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 50

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 05/21/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 07/09/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Semi-Annually

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 07/10/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 01/01/2017
Date Data Arrived at EDR: 02/03/2017
Date Made Active in Reports: 04/07/2017
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 05/13/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 03/25/2019
Date Data Arrived at EDR: 03/26/2019
Date Made Active in Reports: 05/07/2019
Number of Days to Update: 42

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 05/06/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 09/30/2017
Date Data Arrived at EDR: 05/08/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 73

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 05/10/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 06/21/2017
Date Made Active in Reports: 01/05/2018
Number of Days to Update: 198

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 06/18/2019
Next Scheduled EDR Contact: 09/30/2019
Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 01/10/2018
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 2

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 04/24/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 04/25/2019
Date Data Arrived at EDR: 05/02/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 07/22/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 03/20/2019
Date Data Arrived at EDR: 04/10/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 34

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 07/12/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 11/18/2016
Date Data Arrived at EDR: 11/23/2016
Date Made Active in Reports: 02/10/2017
Number of Days to Update: 79

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 07/03/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Quarterly

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: No Update Planned

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: No Update Planned

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 08/30/2016
Date Data Arrived at EDR: 09/08/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 43

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 07/22/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 06/07/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 09/10/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 06/07/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 05/24/2017
Date Data Arrived at EDR: 11/30/2017
Date Made Active in Reports: 12/15/2017
Number of Days to Update: 15
Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 04/26/2019
Next Scheduled EDR Contact: 08/05/2019
Data Release Frequency: Varies

RADINFO: Radiation Information Database
The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 04/02/2019
Date Data Arrived at EDR: 04/02/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 42
Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing
A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40
Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing
A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40
Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data
Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 12/03/2018
Date Data Arrived at EDR: 01/29/2019
Date Made Active in Reports: 03/21/2019
Number of Days to Update: 51
Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 04/30/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Quarterly

CONSENT: Superfund (CERCLA) Consent Decrees
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 03/31/2019
Date Data Arrived at EDR: 04/23/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 30

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 07/08/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2015
Date Data Arrived at EDR: 02/22/2017
Date Made Active in Reports: 09/28/2017
Number of Days to Update: 218

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/07/2019
Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 07/14/2015
Date Made Active in Reports: 01/10/2017
Number of Days to Update: 546

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 07/10/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Semi-Annually

FUSRAP: Formerly Utilized Sites Remedial Action Program

DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations.

Date of Government Version: 08/08/2017
Date Data Arrived at EDR: 09/11/2018
Date Made Active in Reports: 09/14/2018
Number of Days to Update: 3

Source: Department of Energy
Telephone: 202-586-3559
Last EDR Contact: 05/02/2019
Next Scheduled EDR Contact: 08/19/2019
Data Release Frequency: Varies

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 06/23/2017
Date Data Arrived at EDR: 10/11/2017
Date Made Active in Reports: 11/03/2017
Number of Days to Update: 23

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 04/11/2019
Date Data Arrived at EDR: 04/18/2019
Date Made Active in Reports: 05/14/2019
Number of Days to Update: 26

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 07/01/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 11/27/2018
Date Data Arrived at EDR: 02/27/2019
Date Made Active in Reports: 04/01/2019
Number of Days to Update: 33

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 05/29/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Semi-Annually

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing

This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 12/05/2005
Date Data Arrived at EDR: 02/29/2008
Date Made Active in Reports: 04/18/2008
Number of Days to Update: 49

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 05/31/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing

Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011
Date Data Arrived at EDR: 06/08/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 97

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 05/31/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

ABANDONED MINES: Abandoned Mines

An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of AML impacts, as well as, information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Date of Government Version: 03/27/2019
Date Data Arrived at EDR: 03/28/2019
Date Made Active in Reports: 05/01/2019
Number of Days to Update: 34

Source: Department of Interior
Telephone: 202-208-2609
Last EDR Contact: 06/19/2019
Next Scheduled EDR Contact: 09/23/2019
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 02/15/2019
Date Data Arrived at EDR: 03/05/2019
Date Made Active in Reports: 03/15/2019
Number of Days to Update: 10

Source: EPA
Telephone: (212) 637-3000
Last EDR Contact: 06/05/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Quarterly

DOCKET HWC: Hazardous Waste Compliance Docket Listing

A complete list of the Federal Agency Hazardous Waste Compliance Docket Facilities.

Date of Government Version: 05/31/2018
Date Data Arrived at EDR: 07/26/2018
Date Made Active in Reports: 10/05/2018
Number of Days to Update: 71

Source: Environmental Protection Agency
Telephone: 202-564-0527
Last EDR Contact: 05/24/2019
Next Scheduled EDR Contact: 09/09/2019
Data Release Frequency: Varies

ECHO: Enforcement & Compliance History Information

ECHO provides integrated compliance and enforcement information for about 800,000 regulated facilities nationwide.

Date of Government Version: 04/07/2019
Date Data Arrived at EDR: 04/09/2019
Date Made Active in Reports: 05/23/2019
Number of Days to Update: 44

Source: Environmental Protection Agency
Telephone: 202-564-2280
Last EDR Contact: 07/09/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Quarterly

UXO: Unexploded Ordnance Sites

A listing of unexploded ordnance site locations

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 01/17/2019
Date Made Active in Reports: 04/01/2019
Number of Days to Update: 74

Source: Department of Defense
Telephone: 703-704-1564
Last EDR Contact: 07/15/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Varies

FUELS PROGRAM: EPA Fuels Program Registered Listing

This listing includes facilities that are registered under the Part 80 (Code of Federal Regulations) EPA Fuels Programs. All companies now are required to submit new and updated registrations.

Date of Government Version: 02/19/2019
Date Data Arrived at EDR: 02/21/2019
Date Made Active in Reports: 04/01/2019
Number of Days to Update: 39

Source: EPA
Telephone: 800-385-6164
Last EDR Contact: 05/21/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Quarterly

AIRS: Air Emissions Data
Point source emissions inventory data.

Date of Government Version: 05/06/2019
Date Data Arrived at EDR: 05/07/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 37

Source: Department of Environmental Conservation
Telephone: 518-402-8452
Last EDR Contact: 07/22/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: Annually

COAL ASH: Coal Ash Disposal Site Listing
A listing of coal ash disposal site locations.

Date of Government Version: 04/02/2019
Date Data Arrived at EDR: 04/04/2019
Date Made Active in Reports: 06/19/2019
Number of Days to Update: 76

Source: Department of Environmental Conservation
Telephone: 518-402-8660
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

DRYCLEANERS: Registered Drycleaners
A listing of all registered drycleaning facilities.

Date of Government Version: 11/05/2018
Date Data Arrived at EDR: 03/12/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 93

Source: Department of Environmental Conservation
Telephone: 518-402-8403
Last EDR Contact: 06/10/2019
Next Scheduled EDR Contact: 09/23/2019
Data Release Frequency: Annually

E DESIGNATION: E DESIGNATION SITE LISTING
The (E (Environmental)) designation would ensure that sampling and remediation take place on the subject properties, and would avoid any significant impacts related to hazardous materials at these locations. The (E) designations would require that the fee owner of the sites conduct a testing and sampling protocol, and remediation where appropriate, to the satisfaction of the NYCDEP before the issuance of a building permit by the Department of Buildings pursuant to the provisions of Section 11-15 of the Zoning Resolution (Environmental Requirements). The (E) designations also include a mandatory construction-related health and safety plan which must be approved by NYCDEP.

Date of Government Version: 02/28/2019
Date Data Arrived at EDR: 03/26/2019
Date Made Active in Reports: 06/18/2019
Number of Days to Update: 84

Source: New York City Department of City Planning
Telephone: 718-595-6658
Last EDR Contact: 06/21/2019
Next Scheduled EDR Contact: 09/30/2019
Data Release Frequency: Semi-Annually

Financial Assurance 1: Financial Assurance Information Listing
Financial assurance information.

Date of Government Version: 04/04/2019
Date Data Arrived at EDR: 04/09/2019
Date Made Active in Reports: 06/19/2019
Number of Days to Update: 71

Source: Department of Environmental Conservation
Telephone: 518-402-8660
Last EDR Contact: 06/26/2019
Next Scheduled EDR Contact: 10/14/2019
Data Release Frequency: Quarterly

Financial Assurance 2: Financial Assurance Information Listing
A listing of financial assurance information for hazardous waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 03/01/2019
Date Data Arrived at EDR: 03/19/2019
Date Made Active in Reports: 06/18/2019
Number of Days to Update: 91

Source: Department of Environmental Conservation
Telephone: 518-402-8712
Last EDR Contact: 06/10/2019
Next Scheduled EDR Contact: 09/23/2019
Data Release Frequency: Varies

HSWDS: Hazardous Substance Waste Disposal Site Inventory

The list includes any known or suspected hazardous substance waste disposal sites. Also included are sites delisted from the Registry of Inactive Hazardous Waste Disposal Sites and non-Registry sites that U.S. EPA Preliminary Assessment (PA) reports or Site Investigation (SI) reports were prepared. Hazardous Substance Waste Disposal Sites are eligible to be Superfund sites now that the New York State Superfund has been refinanced and changed. This means that the study inventory has served its purpose and will no longer be maintained as a separate entity. The last version of the study inventory is frozen in time. The sites on the study will not automatically be made Superfund sites, rather each site will be further evaluated for listing on the Registry. So overtime they will be added to the registry or not.

Date of Government Version: 01/01/2003
Date Data Arrived at EDR: 10/20/2006
Date Made Active in Reports: 11/30/2006
Number of Days to Update: 41

Source: Department of Environmental Conservation
Telephone: 518-402-9564
Last EDR Contact: 05/26/2009
Next Scheduled EDR Contact: 08/24/2009
Data Release Frequency: No Update Planned

NY MANIFEST: Facility and Manifest Data

Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 01/01/2019
Date Data Arrived at EDR: 05/01/2019
Date Made Active in Reports: 06/21/2019
Number of Days to Update: 51

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 05/01/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Quarterly

SPDES: State Pollutant Discharge Elimination System

New York State has a state program which has been approved by the United States Environmental Protection Agency for the control of wastewater and stormwater discharges in accordance with the Clean Water Act. Under New York State law the program is known as the State Pollutant Discharge Elimination System (SPDES) and is broader in scope than that required by the Clean Water Act in that it controls point source discharges to groundwaters as well as surface waters.

Date of Government Version: 04/22/2019
Date Data Arrived at EDR: 04/24/2019
Date Made Active in Reports: 06/24/2019
Number of Days to Update: 61

Source: Department of Environmental Conservation
Telephone: 518-402-8233
Last EDR Contact: 07/19/2019
Next Scheduled EDR Contact: 11/04/2019
Data Release Frequency: No Update Planned

VAPOR REOPENED: Vapor Intrusion Legacy Site List

New York is currently re-evaluating previous assumptions and decisions regarding the potential for soil vapor intrusion exposures at sites. As a result, all past, current, and future contaminated sites will be evaluated to determine whether these sites have the potential for exposures related to soil vapor intrusion.

Date of Government Version: 12/01/2018
Date Data Arrived at EDR: 02/13/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 120

Source: Department of Environmenal Conservation
Telephone: 518-402-9814
Last EDR Contact: 05/17/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: Varies

UIC: Underground Injection Control Wells

A listing of enhanced oil recovery underground injection wells.

Date of Government Version: 06/03/2019
Date Data Arrived at EDR: 06/05/2019
Date Made Active in Reports: 06/18/2019
Number of Days to Update: 13

Source: Department of Environmental Conservation
Telephone: 518-402-8056
Last EDR Contact: 06/05/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: Quarterly

COOLING TOWERS: Registered Cooling Towers

This data includes the location of cooling towers registered with New York State. The data is self-reported by owners/property managers of cooling towers in service in New York State. In August 2015, the New York State Department of Health released emergency regulations requiring the owners of cooling towers to register them with New York State.

Date of Government Version: 04/10/2019
Date Data Arrived at EDR: 04/17/2019
Date Made Active in Reports: 06/21/2019
Number of Days to Update: 65

Source: Department of Health
Telephone: 518-402-7650
Last EDR Contact: 07/17/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Varies

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historical Auto Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historical Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List
The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environmental Conservation in New York.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/30/2013
Number of Days to Update: 182

Source: Department of Environmental Conservation
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LF: Recovered Government Archive Solid Waste Facilities List
The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environmental Conservation in New York.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/10/2014
Number of Days to Update: 193

Source: Department of Environmental Conservation
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

COUNTY RECORDS

CORTLAND COUNTY:

AST - CORTLAND: Cortland County Storage Tank Listing
A listing of aboveground storage tank sites located in Cortland County.

Date of Government Version: 03/11/2019
Date Data Arrived at EDR: 03/12/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 93

Source: Cortland County Health Department
Telephone: 607-753-5035
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Quarterly

UST - CORTLAND: Cortland County Storage Tank Listing
A listing of underground storage tank sites located in Cortland County.

Date of Government Version: 03/11/2019
Date Data Arrived at EDR: 03/12/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 93

Source: Cortland County Health Department
Telephone: 607-753-5035
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Quarterly

NASSAU COUNTY:

AST - NASSAU: Registered Tank Database
A listing of aboveground storage tank sites located in Nassau County.

Date of Government Version: 01/09/2017
Date Data Arrived at EDR: 01/11/2017
Date Made Active in Reports: 02/15/2017
Number of Days to Update: 35

Source: Nassau County Health Department
Telephone: 516-571-3314
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: No Update Planned

AST NCFM: Storage Tank Database
A listing of aboveground storage tank sites located in Nassau County.

Date of Government Version: 02/15/2011
Date Data Arrived at EDR: 02/23/2011
Date Made Active in Reports: 03/29/2011
Number of Days to Update: 34

Source: Nassau County Office of the Fire Marshal
Telephone: 516-572-1000
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Varies

TANKS NASSAU: Registered Tank Database in Nassau County
A listing of facilities in Nassau County with storage tanks.

Date of Government Version: 01/09/2017
Date Data Arrived at EDR: 01/11/2017
Date Made Active in Reports: 02/15/2017
Number of Days to Update: 35

Source: Nassau County Department of Health
Telephone: 516-227-9691
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Varies

UST - NASSAU: Registered Tank Database
A listing of underground storage tank sites located in Nassau County.

Date of Government Version: 01/09/2017
Date Data Arrived at EDR: 01/11/2017
Date Made Active in Reports: 02/15/2017
Number of Days to Update: 35

Source: Nassau County Health Department
Telephone: 516-571-3314
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: No Update Planned

UST NCFM: Storage Tank Database
A listing of underground storage tank sites located in Nassau County.

Date of Government Version: 02/15/2011
Date Data Arrived at EDR: 02/23/2011
Date Made Active in Reports: 03/29/2011
Number of Days to Update: 34

Source: Nassau County Office of the Fire Marshal
Telephone: 516-572-1000
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Varies

ROCKLAND COUNTY:

AST - ROCKLAND: Petroleum Bulk Storage Database
A listing of aboveground storage tank sites located in Rockland County. Rockland County?s Petroleum Bulk Storage (PBS) program is no longer in service. All related operations/duties are now wholly overseen by the New York State Dept. of Environmental Conservation (NYSDEC).

Date of Government Version: 02/02/2017
Date Data Arrived at EDR: 03/17/2017
Date Made Active in Reports: 09/22/2017
Number of Days to Update: 189

Source: Rockland County Health Department
Telephone: 914-364-2605
Last EDR Contact: 06/03/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: No Update Planned

UST - ROCKLAND: Petroleum Bulk Storage Database
A listing of underground storage tank sites located in Rockland County. Rockland County?s Petroleum Bulk Storage (PBS) program is no longer in service. All related operations/duties are now wholly overseen by the New York State Dept. of Environmental Conservation (NYSDEC).

Date of Government Version: 02/02/2017
Date Data Arrived at EDR: 03/17/2017
Date Made Active in Reports: 09/22/2017
Number of Days to Update: 189

Source: Rockland County Health Department
Telephone: 914-364-2605
Last EDR Contact: 06/03/2019
Next Scheduled EDR Contact: 09/16/2019
Data Release Frequency: No Update Planned

SUFFOLK COUNTY:

AST - SUFFOLK: Storage Tank Database
A listing of aboveground storage tank sites located in Suffolk County.

Date of Government Version: 06/28/2018
Date Data Arrived at EDR: 12/06/2018
Date Made Active in Reports: 02/07/2019
Number of Days to Update: 63

Source: Suffolk County Department of Health Services
Telephone: 631-854-2521
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: No Update Planned

UST - SUFFOLK: Storage Tank Database
A listing of underground storage tank sites located in Suffolk County.

Date of Government Version: 06/28/2018
Date Data Arrived at EDR: 12/06/2018
Date Made Active in Reports: 02/07/2019
Number of Days to Update: 63

Source: Suffolk County Department of Health Services
Telephone: 631-854-2521
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: No Update Planned

WESTCHESTER COUNTY:

AST - WESTCHESTER: Listing of Storage Tanks
A listing of aboveground storage tank sites located in Westchester County.

Date of Government Version: 05/10/2019
Date Data Arrived at EDR: 05/17/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 27

Source: Westchester County Department of Health
Telephone: 914-813-5161
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Semi-Annually

UST - WESTCHESTER: Listing of Storage Tanks
A listing of underground storage tank sites located in Westchester County.

Date of Government Version: 05/10/2019
Date Data Arrived at EDR: 05/17/2019
Date Made Active in Reports: 06/13/2019
Number of Days to Update: 27

Source: Westchester County Department of Health
Telephone: 914-813-5161
Last EDR Contact: 04/29/2019
Next Scheduled EDR Contact: 08/12/2019
Data Release Frequency: Semi-Annually

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 02/11/2019
Date Data Arrived at EDR: 02/12/2019
Date Made Active in Reports: 03/04/2019
Number of Days to Update: 20

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 05/14/2019
Next Scheduled EDR Contact: 08/26/2019
Data Release Frequency: No Update Planned

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2018
Date Data Arrived at EDR: 04/10/2019
Date Made Active in Reports: 05/16/2019
Number of Days to Update: 36

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 07/09/2019
Next Scheduled EDR Contact: 10/21/2019
Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 10/23/2018
Date Made Active in Reports: 11/27/2018
Number of Days to Update: 35

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 07/15/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 02/23/2018
Date Made Active in Reports: 04/09/2018
Number of Days to Update: 45

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 05/17/2019
Next Scheduled EDR Contact: 09/02/2019
Data Release Frequency: Annually

VT MANIFEST: Hazardous Waste Manifest Data
Hazardous waste manifest information.

Date of Government Version: 04/22/2019
Date Data Arrived at EDR: 04/23/2019
Date Made Active in Reports: 06/25/2019
Number of Days to Update: 63

Source: Department of Environmental Conservation
Telephone: 802-241-3443
Last EDR Contact: 07/15/2019
Next Scheduled EDR Contact: 10/28/2019
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2017
Date Data Arrived at EDR: 06/15/2018
Date Made Active in Reports: 07/09/2018
Number of Days to Update: 24

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 06/10/2019
Next Scheduled EDR Contact: 09/23/2019
Data Release Frequency: Annually

Oil/Gas Pipelines
Source: PennWell Corporation
Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Electric Power Transmission Line Data
Source: PennWell Corporation
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GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Day Care Providers
Source: Department of Health
Telephone: 212-676-2444

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Freshwater Wetlands
Source: Department of Environmental Conservation
Telephone: 518-402-8961

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STREET AND ADDRESS INFORMATION

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GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

DEWEY LOEFFEL - ROUTE 203
5225-5239 ROUTE 203
NASSAU, NY 12123

TARGET PROPERTY COORDINATES

Latitude (North):	42.495349 - 42° 29' 43.26''
Longitude (West):	73.624296 - 73° 37' 27.47''
Universal Tranverse Mercator:	Zone 18
UTM X (Meters):	613048.8
UTM Y (Meters):	4705479.5
Elevation:	362 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5935493 EAST CHATHAM, NY
Version Date:	2013
Northeast Map:	5935509 NASSAU, NY
Version Date:	2013
Southwest Map:	5935505 KINDERHOOK, NY
Version Date:	2013
Northwest Map:	5935495 EAST GREENBUSH, NY
Version Date:	2013

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

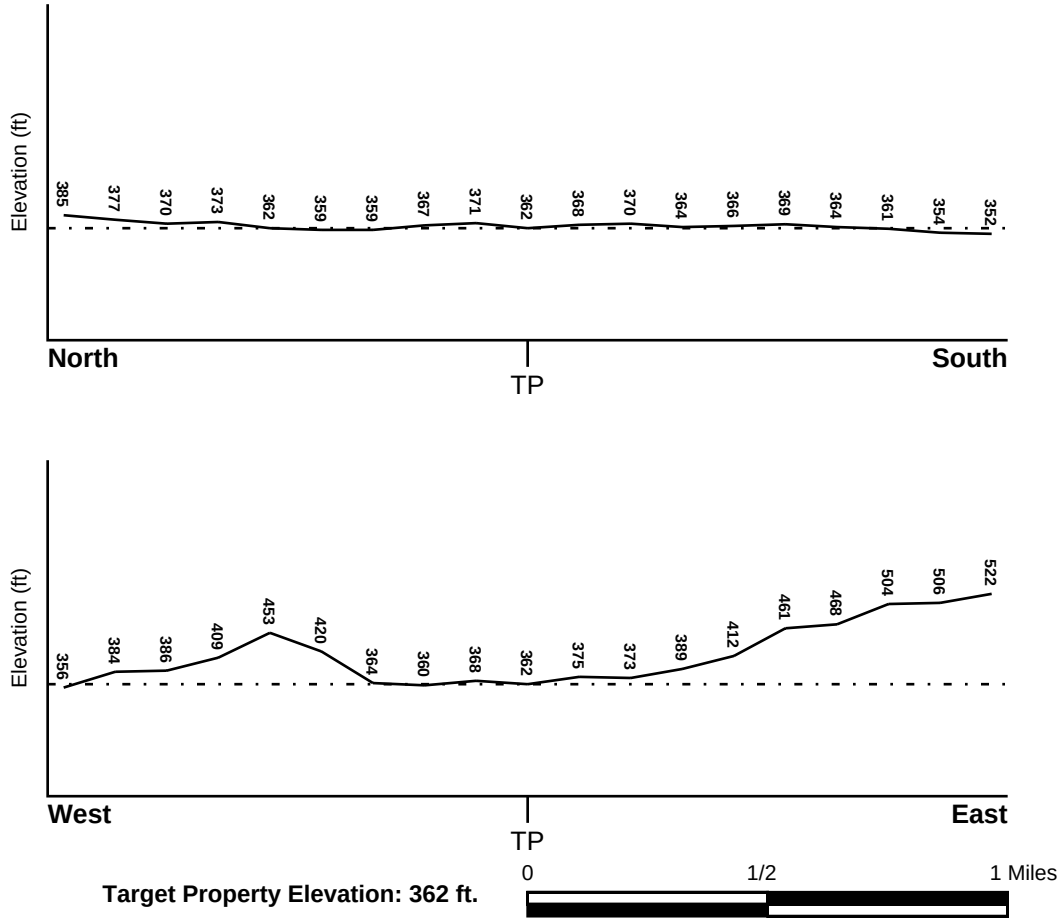
TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General WNW

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
3611550020A	FEMA Q3 Flood data

Additional Panels in search area:	FEMA Source Type
3611690025A	FEMA Q3 Flood data
3606750001C	FEMA Q3 Flood data
3611550005A	FEMA Q3 Flood data

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
EAST CHATHAM	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius:	1.25 miles
Status:	Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

* ©1996 Site−specific hydrogeological data gathered by CERCLIS Alerts, Inc., Bainbridge Island, WA. All rights reserved. All of the information and opinions presented are those of the cited EPA report(s), which were completed under a Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) investigation.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

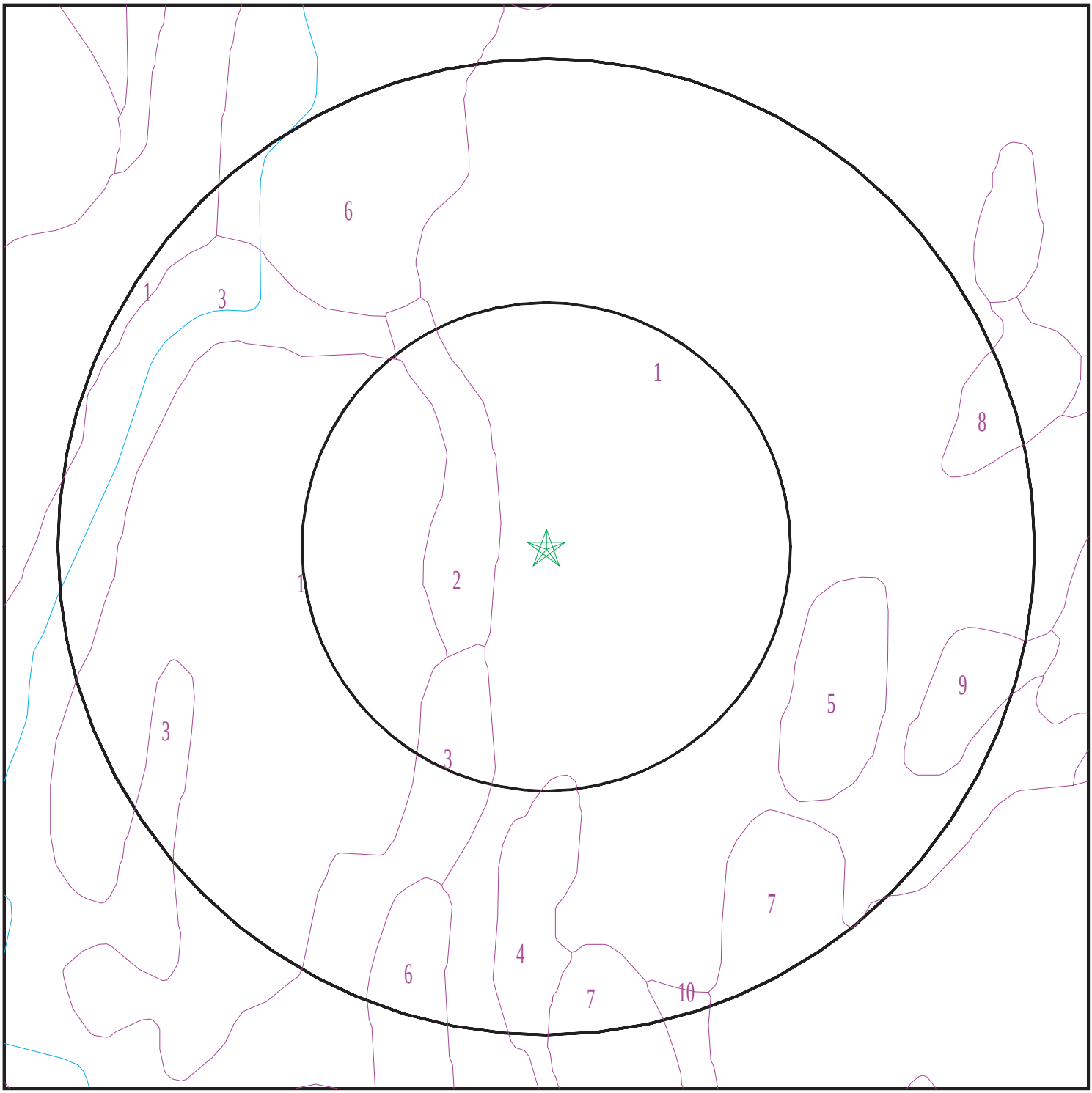
Era:	Paleozoic
System:	Cambrian
Series:	Cambrian
Code:	Ce *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Eugeosynclinal Deposits

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 05764982.2r



SITE NAME:	Dewey Loeffel - Route 203	CLIENT:	Ramboll
ADDRESS:	5225-5239 Route 203 Nassau NY 12123	CONTACT:	Jesse J. Vollick
LAT/LONG:	42.495349 / 73.624296	INQUIRY #:	05764982.2r
		DATE:	August 26, 2019 1:57 pm

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GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Hoosic

Soil Surface Texture: gravelly sandy loam

Hydrologic Group: Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel.	Max: 141 Min: 141	Max: 6 Min: 4.5
2	9 inches	22 inches	very gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel.	Max: 141 Min: 141	Max: 6 Min: 4.5
3	22 inches	59 inches	very gravelly sand	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel.	Max: 141 Min: 141	Max: 6 Min: 4.5

Soil Map ID: 2

Soil Component Name: Fluvaquents

Soil Surface Texture: silt loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Poorly drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	5 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand.	Max: 141 Min: 0.42	Max: 7.2 Min: 5.6
2	5 inches	59 inches	gravelly silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand.	Max: 141 Min: 0.42	Max: 7.2 Min: 5.6

Soil Map ID: 3

Soil Component Name: Limerick

Soil Surface Texture: silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Poorly drained

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: All hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 23 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 7.3 Min: 5.6
2	7 inches	59 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 7.3 Min: 5.6

Soil Map ID: 4

Soil Component Name: Nassau

Soil Surface Texture: very channery silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 38 inches

Depth to Watertable Min: > 0 inches

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	very channery silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:
2	7 inches	14 inches	very channery loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:
3	14 inches	18 inches	unweathered bedrock	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:

Soil Map ID: 5

Soil Component Name: Nassau

Soil Surface Texture: very channery silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 38 inches

Depth to Watertable Min: > 0 inches

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	very channery silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:
2	7 inches	14 inches	very channery loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:
3	14 inches	18 inches	unweathered bedrock	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:

Soil Map ID: 6

Soil Component Name: Carlisle

Soil Surface Texture: muck

Hydrologic Group: Class A/D - Drained/undrained hydrology class of soils that can be drained and are classified.

Soil Drainage Class: Very poorly drained

Hydric Status: All hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	61 inches	muck	A-8	Highly organic soils, Peat.	Max: 42 Min: 1.4	Max: Min:

Soil Map ID: 7

Soil Component Name: Nassau

Soil Surface Texture: very channery silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 38 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	very channery silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:
2	7 inches	14 inches	very channery loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
3	14 inches	18 inches	unweathered bedrock	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:

Soil Map ID: 8

Soil Component Name: Aquents

Soil Surface Texture: mucky silt loam

Hydrologic Group: Class A/D - Drained/undrained hydrology class of soils that can be drained and are classified.

Soil Drainage Class: Very poorly drained

Hydric Status: All hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	mucky silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 0.42	Max: 7.2 Min: 5.1
2	7 inches	59 inches	gravelly silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 0.42	Max: 7.2 Min: 5.1

Soil Map ID: 9

Soil Component Name: Water

Soil Surface Texture: mucky silt loam

Hydrologic Group: Class A/D - Drained/undrained hydrology class of soils that can be drained and are classified.

Soil Drainage Class:
Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Not Reported

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

No Layer Information available.

Soil Map ID: 10

Soil Component Name: Nassau

Soil Surface Texture: very channery silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 38 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	very channery silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	7 inches	14 inches	very channery loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:
3	14 inches	18 inches	unweathered bedrock	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	Not reported	Max: 0.42 Min: 0	Max: Min:

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
7	USGS40000856971	1/2 - 1 Mile NE

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

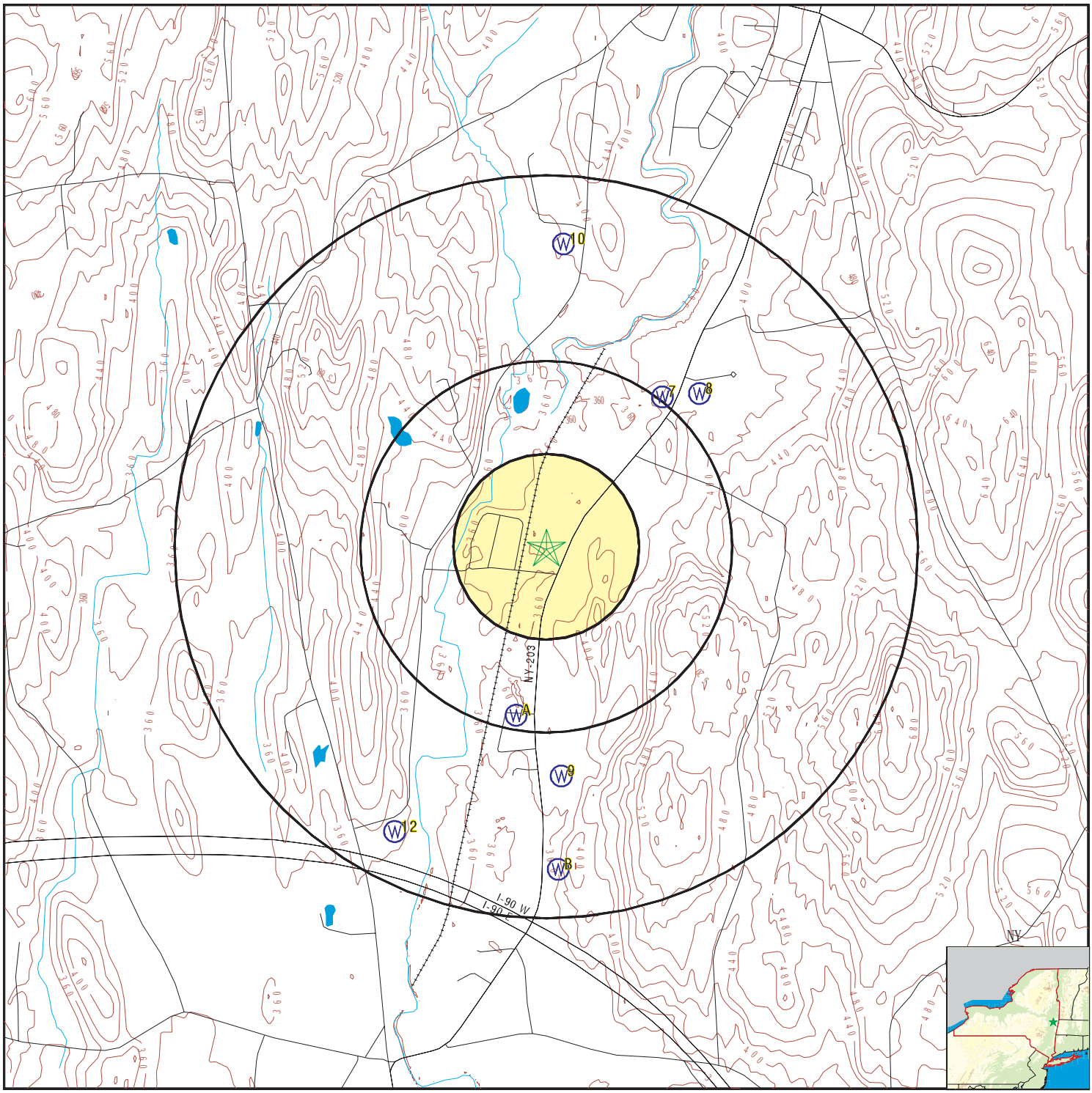
Note: PWS System location is not always the same as well location.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A1	NYWS30000014302	1/4 - 1/2 Mile SSW
A2	NYWS30000014303	1/4 - 1/2 Mile South
A3	NYWS30000014310	1/4 - 1/2 Mile South
A4	NYWS30000014307	1/4 - 1/2 Mile South
A5	NYWS30000014311	1/4 - 1/2 Mile South
A6	NYWS30000014312	1/4 - 1/2 Mile SSW
8	NYWS30000014282	1/2 - 1 Mile NE
9	NYWS30000014293	1/2 - 1 Mile South
10	NYWS30000015054	1/2 - 1 Mile North
B11	NYWS30000014339	1/2 - 1 Mile South
12	NYWS30000015143	1/2 - 1 Mile SSW
B13	NYWS30000014342	1/2 - 1 Mile South

PHYSICAL SETTING SOURCE MAP - 05764982.2r



- County Boundary
- Major Roads
- Contour Lines
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons
- Groundwater Flow Direction
- GI Indeterminate Groundwater Flow at Location
- GV Groundwater Flow Varies at Location
- HD Closest Hydrogeological Data
- Oil, gas or related wells

SITE NAME:	Dewey Loeffel - Route 203	CLIENT:	Ramboll
ADDRESS:	5225-5239 Route 203 Nassau NY 12123	CONTACT:	Jesse J. Vollick
		INQUIRY #:	05764982.2r
LAT/LONG:	42.495349 / 73.624296	DATE:	August 26, 2019 1:57 pm

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GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

A1
SSW
1/4 - 1/2 Mile
Higher

NY WELLS **NYWS30000014302**

DEC Well #:	RE1862	Location Description:	EVELYN DR
Well Depth (ft):	184	Bedrock Depth (ft):	44
Groundwater Depth (ft):	40	Casing Depth(ft):	42.5
Screened Well:	N	Avg Dischg Rate (g/m):	6
Driller Registration #:	NYRD10090		

A2
South
1/4 - 1/2 Mile
Lower

NY WELLS **NYWS30000014303**

DEC Well #:	RE1863	Location Description:	EVELYN DR
Well Depth (ft):	200	Bedrock Depth (ft):	44
Groundwater Depth (ft):	40	Casing Depth(ft):	42.5
Screened Well:	N	Avg Dischg Rate (g/m):	8
Driller Registration #:	NYRD10090		

A3
South
1/4 - 1/2 Mile
Higher

NY WELLS **NYWS30000014310**

DEC Well #:	RE1954	Location Description:	EVELYN DR
Well Depth (ft):	160	Bedrock Depth (ft):	44
Groundwater Depth (ft):	12	Casing Depth(ft):	44
Screened Well:	N	Avg Dischg Rate (g/m):	5
Driller Registration #:	NYRD10090		

A4
South
1/4 - 1/2 Mile
Higher

NY WELLS **NYWS30000014307**

DEC Well #:	RE1917	Location Description:	EVELYN DR
Well Depth (ft):	160	Bedrock Depth (ft):	40
Groundwater Depth (ft):	15	Casing Depth(ft):	40
Screened Well:	N	Avg Dischg Rate (g/m):	5
Driller Registration #:	NYRD10090		

A5
South
1/4 - 1/2 Mile
Higher

NY WELLS **NYWS30000014311**

DEC Well #:	RE1955	Location Description:	EVELYN DR
Well Depth (ft):	160	Bedrock Depth (ft):	40
Groundwater Depth (ft):	20	Casing Depth(ft):	40

Screened Well:	N	Avg Dischg Rate (g/m):	5
Driller Registration #:	NYRD10090		

A6
SSW **NY WELLS** **NYWS30000014312**
1/4 - 1/2 Mile
Higher

DEC Well #:	RE1956	Location Description:	EVELYN DR
Well Depth (ft):	160	Bedrock Depth (ft):	40
Groundwater Depth (ft):	15	Casing Depth(ft):	40
Screened Well:	N	Avg Dischg Rate (g/m):	5
Driller Registration #:	NYRD10090		

7
NE **FED USGS** **USGS40000856971**
1/2 - 1 Mile
Higher

Organization ID:	USGS-NY	Organization Name:	USGS New York Water Science Center
Monitor Location:	RE 547	Type:	Well
Description:	Not Reported	HUC:	Not Reported
Drainage Area:	Not Reported	Drainage Area Units:	Not Reported
Contrib Drainage Area:	Not Reported	Contrib Drainage Area Unts:	Not Reported
Aquifer:	Not Reported	Formation Type:	Not Reported
Aquifer Type:	Not Reported	Construction Date:	Not Reported
Well Depth:	162	Well Depth Units:	ft
Well Hole Depth:	Not Reported	Well Hole Depth Units:	Not Reported

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8
NE **NY WELLS** **NYWS30000014282**
1/2 - 1 Mile
Higher

DEC Well #:	RE1473	Location Description:	MARRA LN
Well Depth (ft):	420	Bedrock Depth (ft):	35
Groundwater Depth (ft):	12	Casing Depth(ft):	38
Screened Well:	N	Avg Dischg Rate (g/m):	5
Driller Registration #:	NYRD10005		

9
South **NY WELLS** **NYWS30000014293**
1/2 - 1 Mile
Higher

DEC Well #:	RE1720	Location Description:	RT 203
Well Depth (ft):	180	Bedrock Depth (ft):	15
Groundwater Depth (ft):	18	Casing Depth(ft):	38
Screened Well:	N	Avg Dischg Rate (g/m):	15
Driller Registration #:	NYRD10055		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation | Database | EDR ID Number

10
North
1/2 - 1 Mile
Higher

NY WELLS **NYWS30000015054**

DEC Well #:	RE1876	Location Description:	WATERBURY RD
Well Depth (ft):	180	Bedrock Depth (ft):	25
Groundwater Depth (ft):	30	Casing Depth(ft):	38.5
Screened Well:	N	Avg Dischg Rate (g/m):	10
Driller Registration #:	NYRD10055		

B11
South
1/2 - 1 Mile
Higher

NY WELLS **NYWS30000014339**

DEC Well #:	RE3402	Location Description:	N/A
Well Depth (ft):	305	Bedrock Depth (ft):	Not Reported
Groundwater Depth (ft):	40	Casing Depth(ft):	Not Reported
Screened Well:	N	Avg Dischg Rate (g/m):	10
Driller Registration #:	NYRD10010		

12
SSW
1/2 - 1 Mile
Higher

NY WELLS **NYWS30000015143**

DEC Well #:	RE3047	Location Description:	WATERBURY RD
Well Depth (ft):	160	Bedrock Depth (ft):	Not Reported
Groundwater Depth (ft):	20	Casing Depth(ft):	Not Reported
Screened Well:	N	Avg Dischg Rate (g/m):	10
Driller Registration #:	NYRD10001		

B13
South
1/2 - 1 Mile
Higher

NY WELLS **NYWS30000014342**

DEC Well #:	RE4907	Location Description:	N/A
Well Depth (ft):	265	Bedrock Depth (ft):	Not Reported
Groundwater Depth (ft):	Not Reported	Casing Depth(ft):	Not Reported
Screened Well:	N	Avg Dischg Rate (g/m):	9
Driller Registration #:	NYRD10010		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: NY Radon

Radon Test Results

County	Town	Num Tests	Avg Result	Geo Mean	Max Result
RENSSELAER	BERLIN	19	7.79	5.55	25
RENSSELAER	BRUNSWICK	96	7.37	3.67	92.2
RENSSELAER	E. GREENBUSH	220	7.13	3.36	56.1
RENSSELAER	GRAFTON	31	3.83	2.13	17.7
RENSSELAER	HOOSICK	40	3.68	2.57	19.6
RENSSELAER	NASSAU	76	6.56	3.17	38.1
RENSSELAER	NO. GREENBUSH	211	9.06	4.28	130.6
RENSSELAER	PETERSBURG	36	4.69	3.6	22.1
RENSSELAER	PITTSTOWN	27	6.43	2.92	74.2
RENSSELAER	POESTENKILL	48	6.45	4.19	31.4
RENSSELAER	RENSSELAER	122	5.72	2.69	65.3
RENSSELAER	SAND LAKE	169	6.23	3.1	37.7
RENSSELAER	SCHAGHTICOKE	42	5.59	4.02	19.3
RENSSELAER	SCHODACK	247	8.3	4.2	103.2
RENSSELAER	STEPHENTOWN	29	5.35	3.23	23.3
RENSSELAER	TROY	498	5.97	3.08	134.7

Federal EPA Radon Zone for RENSSELAER County: 1

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for RENSSELAER COUNTY, NY

Number of sites tested: 85

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area	1.570 pCi/L	87%	13%	0%
Basement	2.890 pCi/L	66%	31%	4%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Freshwater Wetlands
Source: Department of Environmental Conservation
Telephone: 518-402-8961

HYDROGEOLOGIC INFORMATION

AQUIFLOW^{R} Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

New York Public Water Wells
Source: New York Department of Health
Telephone: 518-458-6731

OTHER STATE DATABASE INFORMATION

Oil and Gas Well Database
Source: Department of Environmental Conservation
Telephone: 518-402-8072
These files contain records, in the database, of wells that have been drilled.

RADON

State Database: NY Radon
Source: Department of Health
Telephone: 518-402-7556
Radon Test Results

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

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