TETRA TECH

December 8, 2021

Mr. Todd Richardson
On-Scene Coordinator
U.S. Environmental Protection Agency, Region 3
1650 Arch Street
Philadelphia, Pennsylvania 19103

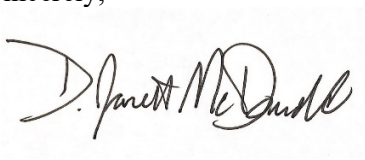
Subject: **Final Field Sampling Plan, Revision 1**
Exide Technologies Site
Laureldale, Berks County, Pennsylvania
EPA Contract No. 68-HE-0320-D0003
EPA Technical Direction No. T601-20-12-001
Document Tracking No. 0265

Dear Mr. Richardson:

The Tetra Tech, Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) is submitting the Final Field Sampling Plan (FSP) – Revision 1 for the Exide Technologies Site (the Site) located in Laureldale, Berks County, Pennsylvania for your review and comment. The FSP summarizes sampling to be completed in association with assessment activities at the Site.

Please call me at (302) 547-3876 if you have any questions or comments regarding this submittal.

Sincerely,



Jarett McDonald
Project Manager

Enclosure

cc: TD file
Maria Magilton, Tetra Tech

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TITLE AND APPROVAL PAGE

FINAL FIELD SAMPLING PLAN
EXIDE TECHNOLOGIES SITE
LAURELDALE, BERKS COUNTY, PENNSYLVANIA

REVISION 1

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Superfund and Emergency Management Division
Region 3
1650 Arch Street
Philadelphia, Pennsylvania 19103

TECHNICAL DIRECTION NO.:	T601-20-12-001	
EPA OSC:	Todd Richardson	
SITE NAME:	Exide Technologies Site	
SITE LOCATION:	3000 Montrose Avenue, Laureldale, PA	
SAMPLING ACTIVITIES:	Removal Assessment Sampling	
PROJECTED START DATE:	December 2021	
FSP PREPARER:	Eric Watt	
SIGNATURE/DATE		11/30/2021
QUALITY ASSURANCE OFFICER:		
SIGNATURE/DATE:		12/06/2021
EPA OSC APPROVAL SIGNATURE/DATE:	Todd Richardson	12/10/2021
EPA REGION 3 APPLIED SCIENCE AND QUALITY ASSURANCE BRANCH (ASQAB) DELEGATED APPROVING OFFICIAL SIGNATURE/DATE:		
DOCUMENT TRACKING NO.:	0265	

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1.0 INTRODUCTION

Under the Superfund Technical Assessment and Response Team (START) Contract No. 68-HE-0320-D0003, Technical Direction (TD) No. T601-20-12-001, the U.S. Environmental Protection Agency (EPA) Region 3 tasked Tetra Tech, Inc. (Tetra Tech) to conduct multi-media sampling in support of the assessment of the property and structures at the Exide Technologies Site (the Site) in Laureldale, Berks County, Pennsylvania (Figure 1, Appendix A). This Field Sampling Plan (FSP) identifies data collection and associated quality assurance and quality control (QA/QC) measures specific to the Site. Site-specific sampling, analytical, and QA/QC procedures described in this FSP are designed to accommodate the project scope of work and requirements specified by the EPA.

This FSP outlines the scope of work and project team in Sections 2.0 and 3.0; presents the Site location and description in Section 4.0; provides the proposed schedule in Section 5.0; and describes field activities, sample handling, sample nomenclature, QA/QC requirements, and decontamination procedures in Sections 6.0, 7.0, 8.0, 9.0, and 10.0, respectively. References cited in this FSP are listed in Section 11.0. Figures for this FSP are provided in Appendix A and the Building Structure ID and Component ID summary tables are provided in Appendix B. Tetra Tech standard operating procedures (SOP), including site-specific SOP to be applied during removal activities, are provided in Appendix C. Non-Tetra Tech SOP are provided as Attachments.

2.0 SCOPE OF WORK AND DATA QUALITY OBJECTIVES

The overall goal of the screening and sampling effort includes assessing to determine the presence and severity of contamination of sub-systems, sub-areas, and individual components throughout the Site, which may pose a potential or actual threat to human health and or the environment. Assessment work will include a combination of field screening using an x-ray fluorescence (XRF) analyzer and collection of wipe samples for laboratory analysis. Assessment of individual areas and systems will be completed systematically in the following order, unless otherwise specified by the On-Scene Coordinator (OSC) or if site conditions impact the work:

1. Air emissions systems including baghouses, duct work conveyors, scrubbers, and other ancillary equipment
2. Smelter and refining systems including furnaces, kettles, and ancillary equipment
3. Site buildings, structures, and surfaces including product and/or waste storage and handling areas

If the order above is impacted, this will be discussed with the OSC. Additional assessment efforts, such as targeted asbestos sampling may be required after discussion with the OSC based on the findings from activities listed above.

Specifically, the objectives of this sampling event are to:

- Identify which buildings and structures contain lead contamination at concentrations greater than 1,000 parts per million (ppm) using an XRF analyzer. These areas will be flagged for removal and subsequent decontamination of the structures by the Emergency and Rapid Response Services (ERRS) contractor.
- Identify asbestos containing material (ACM) building materials containing greater than or equal to one percent asbestos fibers through polarized light microscopy (PLM) analysis. These materials will be flagged as requiring abatement prior to any cleaning or other activities performed by the ERRS contractor.

3.0 PROJECT TEAM

The key project personnel listed in Table 1 will be involved in planning or technical activities for this Site. The EPA OSC and each field team member will receive a copy of this FSP, and a copy will be retained in the on-site and TD file.

TABLE 1
KEY PROJECT PERSONNEL

Personnel	Title	Organization	Phone No.	E-mail
Todd Richardson	EPA OSC	EPA	(215) 814-5264	richardson.todd@epa.gov
Jarett McDonald	Project Manager	Tetra Tech	(302) 547-3876	jarett.mcdonald@tetratech.com
Justin Smith	Field Staff	Tetra Tech	(540) 878-8966	justin.smith@tetratech.com
Hayden Martin	Field Staff	Tetra Tech	(267) 471-1772	hayden.martin@tetratech.com
John Lorenzon	Field Staff	Tetra Tech	(484) 844-1294	john.lorenzon@tetratech.com
Carla Buriks	QA Officer	Tetra Tech	(303) 312-8855	carla.buriks@tetratech.com
Chris Draper	H&S Officer	Tetra Tech	(615) 969-1334	chris.draper@tetratech.com

Notes:
EPA U.S. Environmental Protection Agency
H&S Health and Safety
OSC On-Scene Coordinator
QA Quality Assurance

4.0 SITE LOCATION AND DESCRIPTION

The Exide Technologies (Exide) facility is located partially in Muhlenberg Township and partially in the Borough of Laureldale, about 0.75 mile north of the City of Reading in Berks County, Pennsylvania (Figure 1, Appendix A). The Site is approximately 42 acres in size and was most recently owned and operated by Exide Technologies (EPA 2020a). A layout of the facility is presented in Figure 2, Appendix A.

The facility began operations in the 1930s as the Bowers Battery Company. By 1958, General Battery assumed ownership. They continued operations until Exide acquired the facility in 1980 and performed battery recycling and manufacturing operations until 2013. From 2013 to 2020, Exide used the facility exclusively for non-hazardous plastics recycling. When the facility operated as a battery recycling and manufacturing plant, lead and acid were removed from old batteries and were disposed of, recycled, or stored on-site. Lead was processed through furnaces as part of smelting operations and acids were stored in an acid storage area. Lead dust and emissions from smelting operations were primary sources of contamination at, and around, the facility. Contamination at the facility and portions of the surrounding area have been addressed through Resource Conservation and Recovery Act (RCRA) corrective actions since 1988 (EPA 2020a). However, several areas of the facility and surrounding properties remain areas of concern. Investigations of surface soil and sediment related to the Site are described below.

4.1 ON-SITE SURFACE SOIL INVESTIGATION

Given the Site's history, on-site surface soils have been impacted by fugitive dust from air emissions associated with the secondary lead smelter and battery recycling operations (EPA 2020a). On-site open surface soil areas are present in the former railroad right-of-way and drainage ditches, the Convent Landfill, the eastern and northern slopes of the Reading Landfill, steep slopes along the western edge of the Site, and a several isolated lawn and landscaped areas.

The former railroad right-of-way runs approximately north-south through the center of the Site and is approximately 50 to 60 feet wide. The former railroad bed has a nominal width of 24 feet. The on-site drainage ditches consist of two individual ditches that each run along either side of the railroad bed. Neither ditch runs the entire length of the railroad bed. Two drainage ditches bisect the Site from south to north as shown in Figure 2. The drainage ditches are typically dry throughout the year. However, after stormwater events, the drainage ditches may flow for several days and drain the stormwater south to Bernhart Creek or to a culvert that discharges to an unnamed tributary. The unnamed tributary is an intermittent stream that only flows during periods of precipitation and in the event of an emergency discharge/bypass from the dedicated stormwater treatment plant. It runs along a portion of the western side of the Site and connects downstream to Bernhart Creek.

Previous sampling results were compared to Pennsylvania Department of Environmental Protection (PADEP) Direct Contact Nonresidential Medium Specific Concentrations (MSC) for lead in surface soil (0- to 2-feet below ground surface [bgs]) of 1,000 milligrams per kilogram (mg/kg) and the site-specific residential soil standard of 650 mg/kg. Previous sampling events have found the highest lead concentrations in the soil at 0- to 6-inches bgs in the drainage ditches, and at 12 inches bgs in the railroad bed. As presented

below, lead (Pb) concentrations in the Site soil ranges from 62 - 10,100 mg/kg and 276 - 14,900 mg/kg in the drainage ditches and railroad bed, respectively (EPA 2020a).

Drainage Ditches	
Sampling Depth Intervals (inches below ground surface)	Range of Lead (Pb) Concentrations (mg/kg)
0-6	62 - 10,100

Railroad Bed	
Sampling Depth Intervals (inches below ground surface)	Range of Lead (Pb) Concentrations (mg/kg)
12	276 -14,900

4.2 SEDIMENT INVESTIGATION

Prior to the installation of the on-site stormwater management system, surface water runoff that contained particulate contaminants flowed from the Site into Bernhart Creek and the unnamed tributary.

Exide conducted a sediment investigation to determine the impact of stormwater runoff and fugitive emissions to Bernhart Creek and the unnamed tributary. The initial investigation was conducted from 1994 to 1996 under the oversight of PADEP. As a result of the investigation, Exide implemented interim remedial measures to address high-risk areas with lead concentrations in sediment greater than 10,000 mg/kg. Approximately 180 linear feet of sediment in the unnamed tributary was remediated in 1996. Remediation consisted primarily of excavation and restoration, except for a small section of the unnamed tributary that required capping.

As part of an EPA Request for Information (RFI), Exide resampled the two areas in 2014 and 2018 to confirm lead levels in the sediment and to further delineate any areas that exceeded the site-specific residential soil standard (650 mg/kg), a cleanup standard that is applied to sediments to ensure that any potential contaminant levels in sediment runoff will not threaten human health. Samples in the unnamed tributary and Bernhart Creek consisted of composite sampling at each location at a depth of 0- to 3-inches bgs. Twenty (20) sediment samples were collected throughout the unnamed tributary, and 26 samples were systematically collected from locations along Bernhart Creek to the confluence of the unnamed tributary.

Lead concentrations in the unnamed tributary ranged from 1,070 to 11,300 mg/kg, which exceed the Site-specific residential soil standard (650 mg/kg). The sediment lead concentrations in Bernhart Creek ranged from 30 to 2,400 mg/kg. Elevated lead levels were primarily observed in the vicinity of the confluence of Bernhart Creek and the drainage ditches and further downstream near the confluence of Bernhart Creek and

the unnamed tributary. It is suspected that lead contaminants in the stormwater runoff discharged into the drainage ditches and the unnamed tributary and were transported and deposited at the confluence points of Bernhart Creek. The lead levels in sediment collected in the vicinity of the two confluences were greater than 650 mg/kg. The highest lead levels were detected at the confluence of Bernhart Creek and the drainage ditches (EPA 2020a).

5.0 PROPOSED SCHEDULE

Assessment activities are scheduled to start the week of December 27, 2021 and include: (1) XRF screenings and wipe sampling; and (2) potential bulk asbestos sampling if suspected asbestos containing materials are identified during assessment activities. Tentative project milestones and deliverables are presented in Table 2.

TABLE 2

PROPOSED SCHEDULE

Task	Completion Timeframe
Draft Field Sampling Plan	November 2021
Mobilization to Site	December 27, 2021
Final Field Sampling Plan	10 business days after receipt of comments from EPA
Field work	December 27, 2021 / Daily
Review and evaluate data	
Laboratory analysis	Within 3 weeks after submittal of samples
Data validation	21 days after receipt of the final laboratory analytical report
Draft Removal Site Evaluation Report	Two weeks after receipt of the final Data Validation Report(s) or completion of removal activities
Final Removal Site Evaluation Report	Two weeks after receipt of EPA comments

Notes:
EPA = U.S. Environmental Protection Agency

6.0 FIELD ACTIVITIES

Tetra Tech will document Site conditions and acquire data to support the removal Site evaluation of building structures, baghouses, and drainage areas that contain lead and other forms of contamination. Data acquisition will involve XRF screening, wipe sampling, and bulk asbestos sampling during assessment activities. Tetra Tech will document sampling activities using electronic forms when available and will store this information in the Scribe database. Tetra Tech will perform all other documentation in accordance with Tetra Tech SOP No. 024-3, "Recording of Notes in Field Logbook" (Appendix C). Tetra Tech will record each screening and sampling location via a handheld global positioning system (GPS) device and update the existing layout figure to be included in the removal Site evaluation report. If samples cannot be collected where planned due to accessibility or other issues, efforts will be made to collect them as close as possible to the intended location. Any inaccessible areas will be documented in the field logbook.

The following sections discuss field activities in more detail.

6.1 XRF SCREENING

Tetra Tech will use a handheld XRF instrument along with ghost wipes to perform in situ screening of selected areas of the Site. Per the EPA Action Memo "Request for Funding, 12-Month and $2 Million Exemptions for a Removal Action at the Exide Technologies Site, Laureldale, Pennsylvania" (EPA 2021a), a primary goal of XRF screening activities will be to identify which buildings and structures contain lead contamination at concentrations greater than 1,000 ppm. These areas will be flagged for removal of all contaminated materials and subsequent decontamination of the structures by the ERRS contractor. Confirmation wipe samples will be collected and submitted for laboratory analysis for comparison with the XRF results. The XRF instrument is capable of functioning in multiple modes, including soil and wipe modes.

Tetra Tech will conduct all screening in accordance with EPA's Environmental and Industrial Measurements Divisions SOP Field X-Ray Fluorescence Measurement (EPA 2017) (Attachment 1). Operational and quality control checks consistent with the guidance presented in Attachment 1 will be conducted on the XRF instrument each day prior to use. A summary of the analyses, analytical methods, containers, QA/QC samples, and technical holding times for the samples collected for laboratory analysis during the sampling event is provided in Table 3 in Section 7.0. XRF screening activities to be performed in various locations throughout the Site are described in the following sections.

6.1.1 Baghouses, Ductwork, Conveyors, and Scrubbers

Tetra Tech and EPA identified baghouses, ductwork, conveyors, and scrubbers to assess the presence of lead via XRF. These components are outlined in the Component ID Table presented in Appendix B and the buildings/structures they are located within are shown on Figure 2, Building ID Map.

Thin layers of dust will be collected via wipe from an area of at least 144 square inches in general accordance with Brookhaven National Laboratory (BNL) Safety & Health Services Division – Industrial Hygiene Group SOP Surface Wipe Sampling for Metals (BNL 2017) (Attachment 2). The dust will be collected onto the wipe using an S-shaped path. First moved in a side-to-side motion, the wipe will then be folded in half, then used to wipe the surface in an S-shaped path in a back to front motion. Finally, the wipe will be folded one more time, and wiped around the perimeter of the area from which the sample was taken. The wipe will then be screened using an XRF instrument in wipe mode to determine lead concentrations. The lead wipe samples will be collected and submitted for laboratory analysis for comparison with the XRF screening results, if requested by the OSC.

6.1.2 Smelter and Refining Systems

Tetra Tech and EPA identified several components of the smelter and refining systems to assess for the presence of lead via XRF. These components are outlined in the Component ID Table presented in Appendix B.

Where dust is present in layers greater than 1-inch thick, the dust will be screened in situ using the XRF on soil mode.

Thin layers of dust will be collected via wipe, from an area of at least 144 square inches. The dust will be collected onto the wipe using an S-shaped path, as described in Section 6.1.1. The wipe will then be screened using an XRF instrument in wipe mode to determine lead concentration. The lead wipe samples will be collected and submitted for laboratory analysis for comparison with the XRF screening results, if requested by the OSC.

6.1.3 Site Buildings and Structures

Tetra Tech and EPA identified several key buildings and structures to assess for the presence of lead via XRF. These structures are outlined in the Building Structure ID Table presented in Appendix B and the shown on Figure 2, Building ID Map.

6.1.3.1 Product and Waste Storage/Handling Areas and Warehouses

A handheld XRF instrument will be used to perform screening on selected representative surfaces within accessible areas of the product and waste storage/handling areas and warehouse structures, as well as any areas specifically outlined in the Building Structure ID Table (Appendix B).

Where dust is present in layers greater than 1-inch thick, the dust will be screened in situ using the XRF instrument on soil mode.

Thin layers of dust will be collected via a wipe, from an area of at least 144 square inches. The dust will be collected onto the wipe using an S-shaped path, as described previously. The wipe will then be screened using an XRF instrument in wipe mode to determine lead concentrations. The lead wipe samples will be collected and submitted for laboratory analysis for comparison with the XRF screening results if requested by the OSC.

6.1.3.2 Laboratory

A handheld XRF instrument will be used to perform screening on selected representative surfaces, any large concentrations of dust within accessible areas of the laboratory, as well as any areas specifically outlined in the Building Structure ID Table (Appendix B). Thin layers of dust will be collected via a wipe, from an area of at least 144 square inches. The dust will be collected onto the wipe using an S-shaped path, as

previously described. The wipe will then be screened using an XRF instrument in wipe mode to determine lead concentration. The lead wipe samples will be collected and submitted for laboratory analysis for comparison with the XRF screening results, if requested by the OSC.

6.2 BULK ASBESTOS SAMPLING

Bulk asbestos samples will be collected as directed by OSC from structures and components identified as part of the components discussed in the Building Structure ID Table, and Component ID Table. The bulk samples will be collected with dedicated disposable sampling equipment. Prior to sample collection, the material will be dampened with de-ionized water using a spray bottle. The sample will then be collected into a 4-millimeter (mm)-thick plastic zipper bag and submitted for asbestos analysis.

Tetra Tech will collect bulk asbestos samples in general accordance with EPA's Science and Ecosystem Support Division guidance document No. SESDGUID-104-R1, "Bulk Sampling for Asbestos" (EPA 2013) (Attachment 3). Samples being submitted for laboratory analysis will be collected in the sample containers and for the analyses described in Table 3. Samples that contain greater than or equal to 1-percent asbestos will be considered asbestos containing per National Emission Standards for Hazardous Air Pollutants standards (EPA 2021b).

7.0 SAMPLE HANDLING

Samples submitted for laboratory analysis will be collected in the sample containers and sent to the laboratory (using the procedures discussed in Section 9.3) for the analyses listed in Table 3.

TABLE 3
ANALYTICAL METHODS

Matrix	Parameter	Analytical Method(s)	No. of Samples	Blanks	Volumes and Containers	Preservation	Holding Time
Bulk sample (building materials)	Asbestos	EPA 600/R-93/116	TBD	None	Ziploc bag	None	N/A
Wipe	Lead	Modified SW-846 3050 digestion; SW-846-6020 for analysis	TBD	None	Laboratory provided wipe	None	180 days

Notes:
EPA U.S. Environmental Protection Agency
N/A Not applicable
TBD To be determined

8.0 SAMPLE NOMENCLATURE

Each sample will be labeled with the Site ID (Exide Technologies [ET]), sampling location (Building # [#]), sample description (bulk asbestos [BA], lead wipe [LW]), sequential sample order (01, 02, 03, etc.), and sampling date (YYYYMMDD). An example ID for a bulk asbestos sample would be ET-01-BA01-20211227 for a sample taken at the Exide Technologies Site at SLI Plant 1 South Formation building and is the first sample of bulk asbestos on December 27, 2021.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

This section describes the QA/QC procedures for the sampling/monitoring activities at the Site. Specifically, this section addresses responsibilities, sample QC procedures, field QC procedures, and data evaluation and management.

9.1 RESPONSIBILITIES

QA/QC requirements will be adapted to project-specific conditions. The Tetra Tech project manager will be responsible for ensuring that sample quality and integrity are maintained, and that sample labeling and documentation procedures are conducted in accordance with this FSP and the START Program Uniform Federal Policy Quality Assurance Project Plan (QAPP) (Tetra Tech 2021).

All QA/QC activities will be conducted in accordance with this FSP. A copy of this FSP will be maintained by the field sampling team for immediate reference in resolving any QA/QC issues that might arise during field activities.

9.2 SAMPLE QUALITY CONTROL

QC samples will be collected to evaluate the field sampling and decontamination methods and the overall reproducibility of the laboratory analytical results. Specifically, QC samples will be collected at the frequencies described below.

Field duplicate samples will be collected at a rate of one per 20 samples for wipe samples and will be used to test the reproducibility of sampling procedures and analytical results.

Contract Laboratory Program (CLP) laboratory results will be validated by representatives of the EPA Environmental Services Assistance Team (ESAT) in accordance with EPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (EPA 2020b). Corrective actions may include resampling, reassessment of the laboratory's methods, or assignment of data qualifiers to the laboratory results. The findings of the validation will be summarized in a data validation report, as shown in Section 5.0.

9.3 FIELD QUALITY CONTROL

Samples will be shipped in accordance with Tetra Tech SOP No. 019-8, "Packaging and Shipping Samples." All Sampling, XRF screening, and field quality control activities will be documented in the Site logbook as described in the Tetra Tech SOP No. 024-3, "Recording of Notes in Field Logbook." Appendix C provides Tetra Tech SOPs cited in this FSP.

To maintain accuracy of XRF screening conducted, the XRF instrument will be subject to operational and quality control checks prior to each operational period as is outlined in EPA's Environmental and Industrial Measurements Divisions SOP "Field X-Ray Fluorescence Measurement" (Attachment 1). Operational and QC checks will include an internal calibration performed by the instrument on startup, a performance check using a National Institute of Standards and Technology (NIST) standard reference material with a known concentration of lead, and an instrument blank screen will be conducted to verify that the instrument is not recording false positive results. These operational and QC checks will be repeated if the ambient temperature changes by more than 10°F, every 4 to 5 hours of analysis time, if the instrument is turned off for more than 2 hours, after battery changes, and prior to turning the instrument off. For every 20 samples or at least once per day, a duplicate XRF analysis will be conducted, and once per day, the instrument's precision will be checked by analyzing one of the Site samples at least seven times sequentially (EPA 2017).

9.4 DATA EVALUATION AND MANAGEMENT

The intent of this FSP is to obtain a complete data set that is representative of Site conditions. Data will be reviewed for completeness. The actual number of samples collected in accordance with this FSP may vary based on a variety of factors including, but not limited to: sample location accessibility or observations of field conditions indicative of potential contamination. Sample collection locations will be selected from areas that will allow for a representative sample to meet the data quality objectives of the project. If samples collected or received/analyzed by the laboratory result in less than 100% completeness, the reason for the data gaps will be identified in the removal site evaluation report. If any data are rejected, the reason for the data rejection will also be discussed in the Removal Site Evaluation Report. If sampling activities or procedures vary significantly from this FSP as a result of unexpected conditions in the field or other unforeseeable factors, Tetra Tech will discuss these deviations in the Removal Site Evaluation Report and whether changes affect data representativeness.

Digital data collected during Site activities will be subject to routine QA/QC checks. These QA/QC checks will be performed daily, at a minimum, and will be implemented any time data are transitioned from one operating platform to another. For example, data entered on a tablet computer will be subject to a QA/QC check when they are downloaded from Collector or a similar application. The same data will then be subject

to a QA/QC check when they are uploaded to the central project Scribe database, and a final QA/QC check will be performed as the central project Scribe database is populated with analytical results. The Scribe database will be published to Scribe.net to ensure data accessibility. Other data management options may include the EPA's ArcGIS web application viewer and GeoPlatform. Table 4 presents calibration and maintenance information for field equipment used during this sampling event.

TABLE 4

FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

Field Equipment	Calibration Activity	Maintenance Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action
XRF capable of operating in soil mode and wipe mode	Per manufacturer's instruction	Check calibration date in internal computer system; cycle battery when discharge rate becomes frequent	Check against NIST Standard, test battery, inspect cords and wire, ensure zipper bag is intact	Daily, before first measurement, and after last measurement	Service if calibration issues persist	Equipment vendor (EPA)

Notes:
EPA U.S. Environmental Protection Agency
NIST National Institute of Standards and Technology
XRF X-ray Fluorescence

10.0 DECONTAMINATION

Any disposable sampling equipment and personal protective equipment (PPE) will be double-bagged for disposal as dry, industrial waste.

11.0 REFERENCES

Brookhaven National Laboratory (BNL). 2017. "Surface Wipe Sampling for Metals" SOP IH75190. Safety & Health Services Division – Industrial Hygiene Group. June.

Tetra Tech, Inc. (Tetra Tech). 2021. "Final Uniform Federal Policy Quality Assurance Project Plan (QAPP)." EPA Region III Superfund Technical Assessment and Response Team (START) VI Contract. Revision 1. August.

U.S. Environmental Protection Agency (EPA). 2013. "Bulk Sampling for Asbestos." EPA's Science and Ecosystem Support Division. Guidance Document No. SESDGUID-104-R1.

EPA. 2017. "Field X-Ray Fluorescence Measurement SOP." EPA's Environmental and Industrial Measurements Divisions.

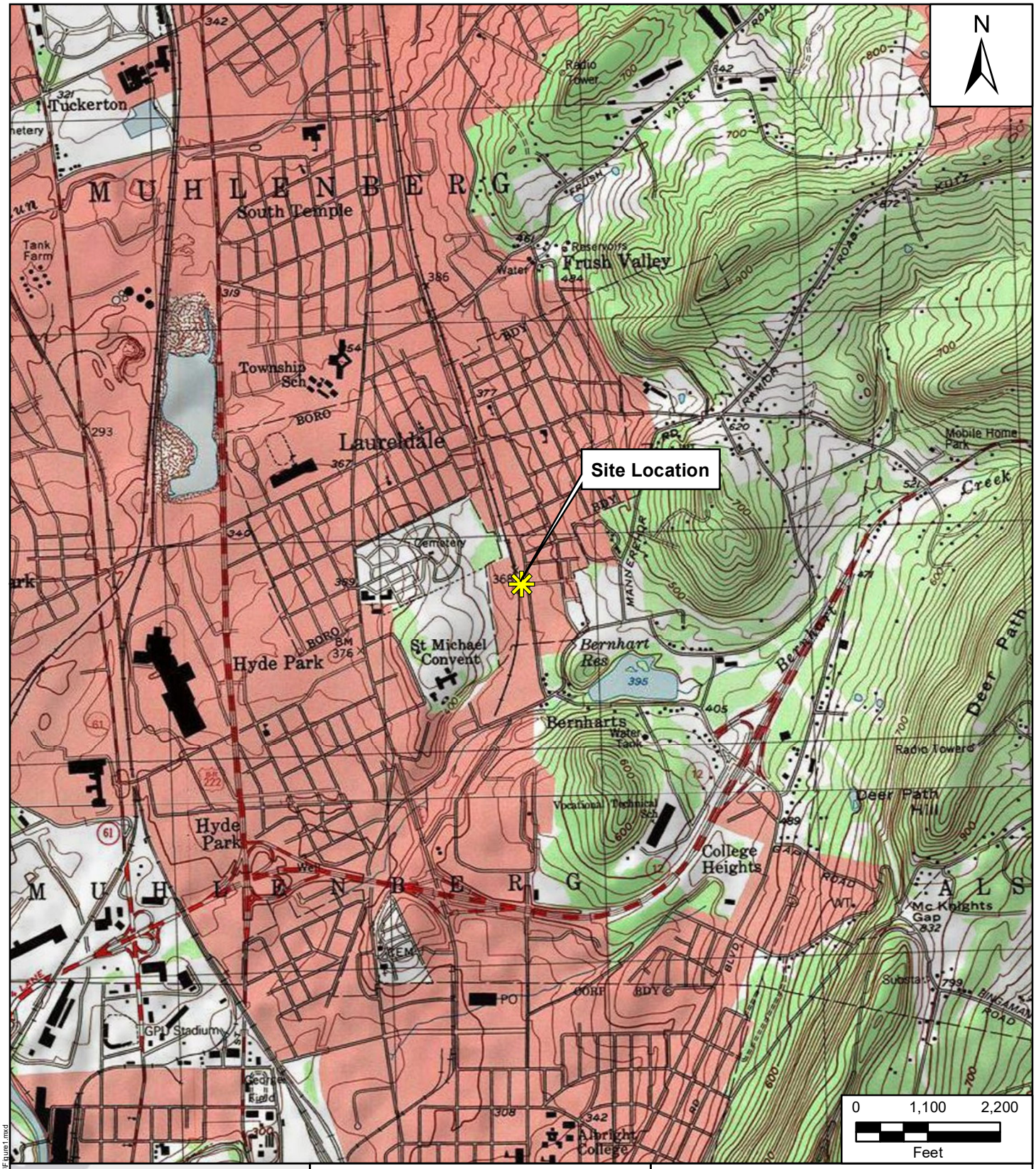
EPA. 2020a. "Statement of Basis" Exide Technologies. Office of Remediation. Land, Chemicals, and Redevelopment Division. May.

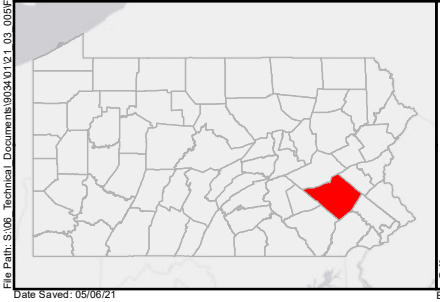
EPA. 2020b. "National Functional Guidelines for Inorganic Superfund Methods Data Review." Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, D.C. EPA-542-R-20-006. November.

EPA. 2021a. "Request for Funding, 12-Month and $2 Million Exemptions for a Removal Action at the Exide Technologies Site, Laureldale, Pennsylvania." March 16.

EPA. 2021b. "Subpart M - National Emission Standard for Asbestos." Electronic Code of Federal Regulations (ECFR). June 16. Available On-Line: www.ecfr.gov/cgi-bin/text-idx?SID=d1cb7551b7d66a7b8955d3fa83ae2c14&mc=true&node=sp40.9.61.m&rgn=div6.

APPENDIX A
FIGURES





Legend

Site Location

Source: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Copyright:© 2013 National Geographic Society, i-cubed

Exide Technologies
Laureldale, Berks County, Pennsylvania

Figure 1

Site Location Map

TETRA TECH

Prepared For: EPA R3 START VI | Prepared By: Megan Kelly

Coordinate System: NAD 1983 2011 StatePlane Pennsylvania South FIPS 3702 Ft US

EPA Contract No: 68-HE-0320-D0003 TDNo: T601-20-12-001

Date Saved: 05/06/21

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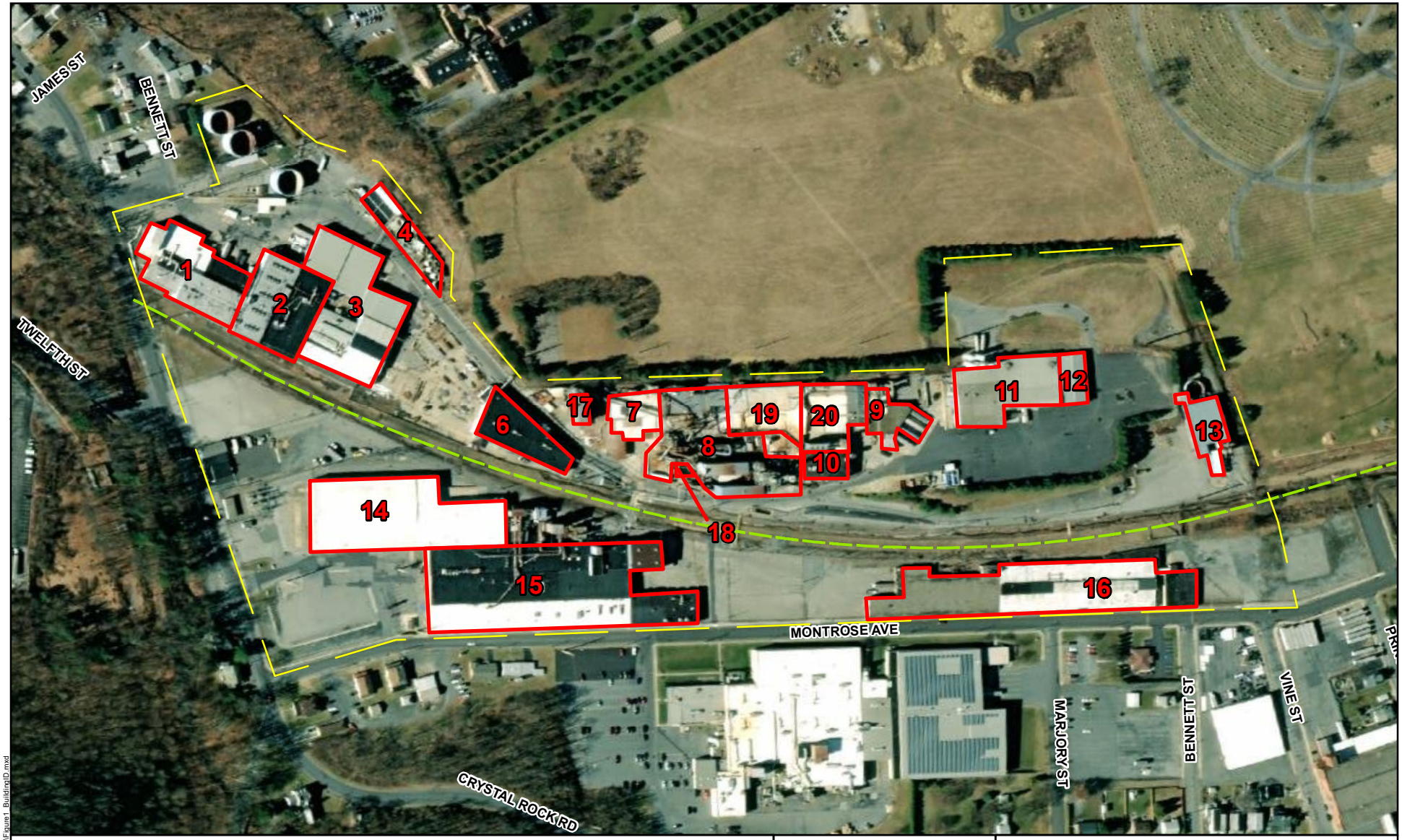

Legend

- Buildings
- Site Boundary
- Drainage Ditch

1. SLI Plant I South Formation
2. SLI Plant Battery Formation
3. SLI Plant I Storage
4. Wastewater Treatment Facility
5. Demolished Machine Shop – no longer exists
6. DUF & Lead Storage Building
7. Slag Stabilization and Storage
8. Smelter
9. Material Receiving Area/ Battery Breaking
10. Smelter Offices
11. Plastics Recycling Feed Pile Building
12. Trailer Repair
13. Sludge De-watering Facility
14. SLI Plant II Finishing and Shipping
15. SLI Plant II Administrative Offices
16. Warehouse
17. Lab
18. Electrical Control Room
19. Emissions Control Complex
20. Hazardous Materials Storage

N

0 190 380

Feet

Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Exide Technologies
Laureldale, Berks County, Pennsylvania

Figure 2

Building ID Map

TETRA TECH

Prepared For: EPA R3 START VI | Prepared By: Aidan Tierney

Coordinate System: NAD 1983 2011 StatePlane Pennsylvania South FIPS 3702 Ft US

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APPENDIX B
TABLES

Table 1

BUILDING STRUCTURE ID TABLE

Building Number ID	Building Name/ Description	Location Description	Notes:
1	SLI Plant I South Formation	South westernmost building, nearest entrance on Nolan Street. Connected to buildings 2 and 3.	Noticeable dust and debris on ground and work surfaces. Check for asbestos and lead. EPA expects lead wipe samples of floor will likely be homogenous throughout building so fewer samples will be needed to generate contamination estimates.
2	SLI Plant Battery Formation	Connected to buildings 1 and 3.	Noticeable dust and debris on ground and work surfaces. Check for asbestos and lead. EPA expects lead wipe samples of floor will likely be homogenous throughout building so fewer samples will be needed to generate contamination estimates.
3	SLI Plant I Storage	Connected to buildings 1 and 2.	Noticeable dust and debris on ground and work surfaces. Check for asbestos and lead. EPA expects lead wipe samples of floor will likely be homogenous throughout building so fewer samples will be needed to generate contamination estimates.
4	Wastewater Treatment Facility	West side of main Site access road, several large tanks.	Will be continually operating past removal action.
5	Demolished machine shop - no longer exists	Empty lot where field trailers are now.	Nothing to assess.
6	DUF & Lead Storage Building	Adjacent to trailers, across from lab.	Contains several components to be assessed inside. Significant dust on floor. Identify gas cylinders outside building.
7	Slag stabilization and storage	Tall building on central west side of lot. Integrated into smelter and emissions control complex.	Contains filter bags with high levels of lead dust, but building is in good condition - not to be demolished any time soon.

Building Number ID	Building Name/ Description	Location Description	Notes:
8	Smelter	Main work area containing baghouses and multiple connected buildings.	Many subcomponents to identify and assess. Asbestos likely in several places, specifically the casting pits. Verify tanks are empty.
9	Material Receiving Area/ Battery Breaking	Smaller building connected to northern side of building 20.	One room in building was not easily accessible but a large volume of unidentified battery-related waste was observed on the ground.
10	Smelter Offices	Left hand side at fork in access road.	Did not enter during mapping walk.
11	Plastics Recycling Feed Pile Building	Northwest side - building is split into two parts, 11a and 11b.	EPA recommended Tetra Tech sample material in floor grate drains in 11a and in drum vacuum in 11b.
12	Trailer Repair	Northwest side.	Drums of waste oil, hydraulic oil, solvent, paint, and unmarked drums that may need to be identified.
13	Sludge De-Watering Facility	Northwestern most building. Adjacent to powerline easement and cemetery.	EPA requested Tetra Tech sample liquid in exterior catchment grate.
14	SLI Plant II Finishing and Shipping	Southeast corner.	Lower priority than SLI Plant I, significantly less dust. Furnace component in eastern section should be identified and assessed.
15	SLI Plant II Administrative Offices	Southeast corner.	Lower priority than SLI Plant I, significantly less dust and debris.
16	Warehouse	Northeastern most building, parallels Montrose Avenue.	Lowest priority building, no evidence of dust or other contamination.
17	Lab	Corner of smelter complex.	Fume hood labeled "Grinder" should be assessed. Any unmarked chemicals should be hazardous categorized.
18	Electrical Control Room	Small room built in smelter complex.	Conduit panels may have transite backing.

Building Number ID	Building Name/ Description	Location Description	Notes:
19	Emissions Control Complex	Area of smelter complex with tall A and U tubes.	Several subcomponents to identify and assess.
20	Hazardous Materials Storage	Building connected to battery breaking section.	Emergency and Rapid Response Service crew (ERRS) is storing containerized material known to be contaminated in two containment bays here.

Table 2

COMPONENT ID TABLE

Component ID	Component Name	Location and Building ID	Notes
C1	South Formation Make-Up Air Heater	South exterior of 1	
C2	Rotocyclone #1	West interior of 6	
C3	Small parts casting pot	North interior of 6	Potential ACM observed
C4	Casting Rotocyclone	Southwest interior of 6	
C5	Grinder/fume hood	East interior of 17	
C6	Conveyor system	South interior of 20	
C7	Furnace (?)	Southwest interior of 14	Unmarked, not definitively identified
C8	Collection of several baghouses (?)	West exterior of 15	Unmarked, not definitively identified

APPENDIX C

TETRA TECH STANDARD OPERATING PROCEDURES

1. SOP No. 019-8, “Packaging and Shipping Samples”
2. SOP No. 024-3, “Recording of Notes in Field Logbook”

SOP APPROVAL FORM

TETRA TECH, INC.

EMI OPERATING UNIT

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

PACKAGING AND SHIPPING SAMPLES

SOP NO. 019

REVISION NO. 8

Last Reviewed: August 2020

Quality Assurance Approved

August 11, 2020

Date

1.0 BACKGROUND

In any sampling program, the integrity of a sample must be ensured from its point of collection to its final disposition. This standard operating procedure (SOP) describes procedures for packaging and shipping samples. Steps in the procedures should be followed to ensure sample integrity and to protect the welfare of persons involved in shipping and receiving samples.

1.1 PURPOSE

This SOP establishes the requirements and procedures for packaging and shipping nonhazardous environmental samples. It has been prepared in accordance with the U.S. Environmental Protection Agency (EPA) "Contract Laboratory Program Guidance for Field Samplers." Procedures described in this SOP should be followed for all routine sample packaging and shipping of nonhazardous samples. If procedures are to be modified for particular contract- or laboratory-specific requirements, modified procedures should be clearly described in site-specific plans such as work plans, field sampling plans (FSP), or quality assurance project plans (QAPP). Deviations from the procedures in this SOP must be documented in a field logbook. This SOP assumes that samples are already in the appropriate sample jars and that the sample jars are labeled.

This SOP does not cover the packaging and shipment of Dangerous Goods or Hazardous Materials. The shipment of Dangerous Goods (by air) and Hazardous Materials (by ground) requires specialized training. If you have NOT received this training in the last 2 years, you are NOT qualified to package or ship these materials and may be personally liable for any damages or fines. Contact one of Tetra Tech's shipping experts for assistance. Instructions to access the training course, shipping experts, and health and safety (H&S) contacts, and general information on packaging and shipping hazardous substances and dangerous goods can be obtained by checking the links provided in Section 1.4 (References) and communicating with appropriate Tetra Tech H&S contacts listed on the EMI Operating unit internal H&S web site.

1.2 SCOPE

This SOP applies to packaging and shipping of environmental and nonhazardous samples. This SOP does not address shipping dangerous goods or hazardous materials.

1.3 DEFINITIONS

Airbill: An airbill is a shipping form (such as a FedEx shipping form) acquired from the commercial shipper and is used to document shipment of the samples from the sampler to the designated analytical laboratory (see Figure 1).

Blank: A blank is any sample that is used to assess cross-contamination from sampling and sample management procedures. A typical blank sample will consist of distilled or deionized (DI) water (water sampling) or an air filter cartridge (air sampling) that is then analyzed by the laboratory to evaluate whether cross-contamination has been introduced. Each blank is assigned its own unique sample number. Blanks collected in the field include trip blanks, field blanks, and equipment blanks, all intended to assess potential cross-contamination. For example, a trip blank checks for contamination during sample handling, storage, and shipment from the field to the laboratory. Field blanks assess the contamination of water or soil from ambient air. Equipment blanks (also known as rinse blanks) assess contamination from incomplete decontamination procedures.

Chain-of-Custody form: A chain-of-custody form is used to document the transfer of custody of samples from the field to the designated analytical laboratory (see Figure 2). The chain-of-custody form is critical to the chain-of-custody process and is used to identify the samples in each shipping container to be shipped or delivered to the laboratory for chemical or physical (geotechnical) analysis. A copy of the chain-of-custody form is shipped with the samples and accompanies them from sampler to laboratory (see Figure 3).

Custody seal: A custody seal is a tape-like seal and is used to indicate that samples are intact and have not been disturbed during shipping or transport after the samples have been released from the sampler to the shipper (see Figure 4). The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been packaged for shipping (see Figure 5).

Environmental samples: Environmental samples include drinking water, groundwater, surface water, soil, sediment, treated municipal and industrial wastewater effluent, indoor and ambient air, nonhazardous bulk materials, soil gas, dust, asbestos, and biological specimens. Environmental samples typically contain low concentrations of contaminants and, when handled, require only limited precautionary procedures.

Nonhazardous samples: Nonhazardous samples are those samples that do not meet the definition of a hazardous sample AND do not need to be packaged and shipped in accordance with the International Air Travel Association's (IATA) "Dangerous Goods Regulations" (DGR) or U.S. Department of Transportation's "Hazardous Materials Regulations" defined in Title 49 *Code of Federal Regulations* (CFR).

The following definitions are provided to further distinguish environmental and nonhazardous samples from dangerous goods and hazardous samples:

Dangerous goods: Dangerous goods are articles or substances that can pose a significant risk to health, safety, or property when transported by air; they are classified as defined in Section 3 of the DGR (IATA 2020).

Hazardous samples: Hazardous samples include dangerous goods and hazardous substances. Hazardous samples shipped by air should be packaged and labeled in accordance with procedures specified by the DGR; ground shipments should be packaged and labeled in accordance with the Hazardous Material Regulations.

Hazardous substance: A hazardous substance is any material, including its mixtures and solutions, that is listed in 49 CFR 172.101 and its quantity, in one package, equals or exceeds the reportable quantity listed in Table 1 to Appendix A of 49 CFR 172.101.

1.4 REFERENCES

General Awareness, H&S Contacts, and Course Training Information (Tetra Tech, Inc., EMI Operating Unit. Intranet) On-line address: https://int.tetratech.com/sites/EMI/hs/Pages/Dangerous-Goods-Shipping.aspx

International Air Transport Association (IATA). 2020. "Dangerous Goods Regulations. 2020." For sale at: https://www.iata.org/en/publications/dgr/. Updated annually, with new edition available late in year.

U.S. Environmental Protection Agency (EPA). 40 CFR, 763 Subpart F, Asbestos Hazards Emergency Response Act (AHERA).

EPA. 2014. "Contract Laboratory Program Guidance for Field Samplers." EPA 540-R-014-013. October. On-line address: https://www.epa.gov/sites/production/files/2015-03/documents/samplers_guide.pdf.

EPA. 2020. "Packing, Marking, Labeling and Shipping of Environmental and Waste Samples." EPA Region 4, LSASDPROC-209-R4. February 23. On-line address: https://www.epa.gov/sites/production/files/2015-06/documents/Shipping-Environmental-and-Waste-Samples.pdf

1.5 REQUIREMENTS AND RESOURCES

The procedures for packaging and shipping samples require the following:

- Coolers (insulated ice chest) or other shipping containers appropriate to sample type
- Ice
- Bubble wrap or similar cushioning material
- Chain-of-custody forms and seals
- Airbills

- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)
- Large plastic garbage bags for lining the cooler
- Temperature blank sample bottle filled with distilled water can be included in the cooler if appropriate to sample type
- Trip blank samples used to check for volatile contamination during sample handling in the field should accompany sample containers during shipment from laboratory to field (empty containers) and from field to laboratory (filled containers). It should remain in the cooler with sample containers during the sampling event. Trip blanks should be requested from the laboratory when containers are initially ordered.

2.0 PROCEDURES

The following procedures apply to packaging and shipping nonhazardous and environmental samples.

2.1 PACKAGING SAMPLES

After they have been appropriately containerized and labeled, environmental samples should be packaged as described in this section. This section covers procedures for packing samples for delivery by commercial carrier (air or ground) and hand delivery of environmental samples (by employee or courier), as well as shipping asbestos and air quality samples. Note that these instructions are general; samplers also should be aware of client-specific requirements concerning the placement of custody seals or other packaging provisions.

2.1.1 Packaging Samples for Delivery by Commercial Carrier (Air or Ground)

Samples shipped by commercial carriers should be packed for shipment using the following procedures and in compliance with all carrier requirements:

Preparing the sample:

1. Allow a small amount of headspace in all bottles, or as instructed by the laboratory (except volatile organic compound [VOC] containers with a septum seal) to compensate for any changes in pressure and temperature during transfer.
2. Be sure the lids on all bottles are tight (will not leak). Lids maybe taped or sealed with custody seals as added protection or as required. For any sample containers that are not marked with a tare weight by the laboratory, cover the completed sample label on the container with clear tape to protect the label.
3. Place sample containers in resealable plastic bags.

Preparing the cooler:

1. Secure and tape the drain plug of the cooler with fiber or duct tape.
2. Line the cooler with a large plastic garbage bag before samples, ice, and absorbent packing material are placed in the cooler.
3. Wrap the sample containers in bubble wrap or line the cooler (bottom and sides) with a cushioning material to prevent breakage of bottles or jars during shipment.
4. If required by the laboratory for the analytical method, add a sufficient quantity of ice to the cooler to cool samples to 4 °C (± 2 °C). Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. If required, include one temperature blank (a sample bottle filled with distilled water) per cooler.

5. For VOC samples only, include one trip blank for VOC analysis per shipment matrix in each cooler.

6. Fill all remaining space between the bottles or jars with bubble wrap.

7. As each container is placed in the cooler, verify the sample information on the chain-of-custody form. The samples listed on the chain-of-custody form must match exactly with the contents of the cooler.

8. Securely fasten the top of the large garbage bag with tape (preferably plastic electrical tape).

9. If more than one cooler is being shipped, mark each cooler as “1 of 2,” “2 of 2,” and so forth.

10. Place the chain-of-custody forms (see Figure 2) into a resealable plastic bag, and tape the bag to the inner side of the cooler lid (see Figure 3). If you are shipping more than one cooler, copy the chain-of-custody form so that there is one copy of all forms in each cooler. The samples listed on the chain-of-custody form must match exactly with the contents of the cooler. Tape any instructions for returning the cooler to the inside of the lid.

11. Close the lid of the cooler and tape it shut by wrapping strapping tape around both ends and hinges of the cooler at least once.

12. Place two signed custody seals (see Figure 4) on opposite sides of the cooler, ensuring that each one covers the cooler lid and side of the cooler (see Figure 5; note that in contrast to the figure, the seals should be placed on the opposite sides of the cooler and offset from each other, rather than directly across from each other as shown in Figure 5). Place clear plastic tape over the custody seals so that the cooler cannot be opened without breaking the seal.

13. Shipping containers should be marked "THIS END UP.” Arrow labels, which indicate the proper upward position of the container, may also be affixed to the container. As appropriate, the containers should also be labeled for Saturday delivery or other special requirements.

14. Ship samples overnight using a commercial carrier such as FedEx. As a best practice, electronic sample shipping labels should be prepared by the shipping agency’s employees, at the direction of Tetra Tech employees or sampling personnel. This allows the sampling personnel to confirm special shipping requirements, such as Saturday delivery, and verify that samples will be shipped that day (that is, the last shipment of the day has not already occurred). If this is not possible, the airbill can be prepared by hand (see Figure 1), but samples should still be handed over directly to shipping agency employees and shipping details should be verified. The shipping label should be placed on the outside of the container.

15. A copy of the receipt with sample tracking number should be retained by the sampling personnel and delivery should be verified the next day.

2.1.2 Hand Delivery of Environmental Samples (by Employee or Courier)

Samples hand-delivered to the laboratory should be packed for shipment using the following procedures:

Preparing the sample:

1. Bottles can be filled completely with sample (required for VOC containers with a septum seal).

2. Be sure the lids on all bottles are tight (will not leak).

Preparing the cooler:

1. Secure and tape the drain plug of the cooler with fiber or duct tape.

2. Wrap the sample containers in bubble wrap or line the cooler (bottom and sides) with a cushioning material to prevent breakage of bottles or jars during shipment.

3. As each container is placed in the cooler, verify the sample information on the chain-of-custody form. The samples listed on the chain-of-custody form must match exactly with the contents of the cooler.

4. If required for by the laboratory for the analytical method, add a sufficient quantity of ice to the cooler to cool samples to 4 °C. Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. If required, include one temperature blank (a sample bottle filled with distilled water) per cooler.

5. For VOC samples only, include one trip blank for VOC analysis per shipment matrix in each cooler.

6. If more than one cooler is being shipped, mark each cooler as "1 of 2," "2 of 2," and so forth.

7. Place the chain-of-custody form (see Figure 2) in a resealable plastic bag and tape to the inside of the cooler lid (see Figure 3), close the lid, and seal with custody seals (see Figure 5; note that in contrast to the figure, the seals should be placed on the opposite sides of the cooler and offset from each other, rather than directly across from each other as shown in Figure 5). Place clear plastic tape over the custody seals so that the cooler cannot be opened without breaking the seal. Transfer the cooler to the courier. When samples will be delivered directly to the laboratory, it is sufficient to close the cooler and hand-deliver it with the chain-of-custody form.

8. Include any instructions for returning the cooler to the inside of the lid.

9. If the cooler is being transferred to a courier, the shipping containers should be marked "THIS END UP," and arrow labels, which indicate the proper upward position of the container should be affixed to the container.

2.1.3 Shipping Asbestos Samples

Asbestos samples shipped by commercial carriers should be packed for shipment using the following procedures and in compliance with all carrier requirements:

1. Place each asbestos sample in a small resealable plastic bag or Whirl-pak sealable bag. Seal the bags carefully and place the sample bags in a larger resealable plastic bag.

2. Select a rigid shipping container and pack the samples upright in a noncontaminating, nonfibrous medium such as a bubble pack to minimize excessive movement during shipping.

3. Avoid using expanded polystyrene because of its static charge potential. Also avoid using particle-based packaging materials because of possible contamination.

4. Affix custody seals to the samples or outer sample bag so that the bags cannot be opened without breaking the seal.

5. Insert the chain-of-custody form in the box. Include a shipping bill and a detailed listing of samples shipped, their descriptions and all identifying numbers or marks, sampling data, shipper's name, and contact information.

6. Ship bulk samples in a separate container from air samples. Bulk samples and air samples delivered to the analytical laboratory in the same container will be rejected.

7. For each sample set, designate which are the ambient samples, which are the abatement area samples, which are the field blanks, and which is the sealed blank if sequential analysis is to be performed.

8. Hand-carry samples to the laboratory in an upright position if possible; otherwise, choose that mode of transportation least likely to shake the samples in transit.

9. Address the package to the laboratory sample coordinator by name when known and alert him or her of the package description, shipment mode, and anticipated arrival as part of the chain-of-custody and sample tracking procedures. This information will also help the laboratory schedule timely analysis for the samples when they are received.

2.1.4 Shipping Air Samples

Packaging and shipping requirements for air samples vary depending on the media used to collect the samples and the analyses required. Sampling media typically include Summa canisters and Tedlar bags for whole air samples, filters for metals and particulate matter, and sorbent tubes for organic contaminants. This section of the SOP provides general guidelines for packaging and shipping air samples collected using these media. The project FSP or QAPP should also be reviewed for any additional project-specific requirements or instructions.

Summa Canister Samples

1. Close the canister valve by tightening the knob clockwise or flipping the toggle switch. Replace the brass cap on the canister inlet.

2. If a flow controller was used to collect the air sample over a specified time interval, the flow controller should be removed before replacing the brass cap.

3. Fill out the sample tag on the canister with the sample number and the date and time of collection. Include the identification number of the flow controller on the sample tag if one was used. Make sure the information on the sample tag matches the chain-of-custody form.

4. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final Summa canister vacuum readings; Summa canister identification number; and flow controller identification number.

5. Package the Summa canister (and flow controller) in its original shipping box with the original packaging material. Tape the box shut and apply custody seals if required. Note: Summa canisters should never be packaged with ice.

6. Summa canister shipments typically include several canisters, and may include more than one shipping box. The chain-of-custody form for the shipment should be sealed within one of the shipping boxes. If more than one box is being shipped, mark each box as "1 of 2," "2 of 2," and so forth.

7. Ship the samples by a method that will meet the holding time. Summa canister samples should be analyzed within 30 days of sample collection.

Tedlar Bag Samples

1. Before removing it from the sample port, close the Tedlar bag by tightening the valve clockwise. The bag should only be approximately half-full to allow for pressure changes during shipping and handling of the sample. Keep the Tedlar bag out of direct sunlight to preserve the sample.

2. Fill out the label on the bag with the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.

3. Complete the chain-of-custody form.

4. Package the Tedlar bag in a shipping box with appropriate packing material to prevent the bag from being punctured or damaged. Multiple bags can be packaged in the same box. Tape the box shut and apply custody seals if required. Note: Tedlar bag samples should not be cooled or packaged with ice, although they can be shipped in an ice chest to protect the samples.

5. Tedlar bag shipments may include more than one shipping box. The chain-of-custody form for the shipment should be sealed within one of the shipping boxes. If more than one box is being shipped, mark each box as "1 of 2," "2 of 2," and so forth.

6. Ship the samples using priority overnight delivery. Tedlar bag samples should be analyzed within 3 days of sample collection.

Filter Cassette Samples

1. Disconnect the filter cassette from the air sampling pump and replace the plastic caps on the inlet and outlet openings.

2. Attach a label to the sample that includes the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.

3. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final air flow rates (or average flow rate); volume of air sampled; and sampling pump identification number.

4. Package the filter cassettes in a shipping box (such as a FedEx box). Use an appropriate packing material (such as bubble wrap) to separate the samples and prevent damage.

5. Place the chain-of-custody form within the box, seal the box, and apply custody seals if required. Filter cassette samples typically do not need to be cooled, but check the field sampling plan (FSP) or Quality Assurance Project Plan (QAPP) for project-specific requirements.

6. Ship the samples by a method that will meet the holding time.

Sorbent Tube Samples

1. Disconnect the sample tube from the air sampling pump and seal both ends of the tube with plastic caps.

2. Complete a sample label that includes the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.

3. If the tube is small and the label cannot be attached to the tube, the tube can be placed in a small resealable plastic bag and the label can be attached to the bag or placed inside the bag with the tube.

4. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final air flow rates (or average flow rate); volume of air sampled; and sampling pump identification number.

5. Packaging requirements for the sample tubes will depend on the analysis required, and the sampler should check the FSP or QAPP for project-specific requirements (for example, tubes may need to be wrapped in aluminum foil to prevent exposure to light). Packaging containers and methods include (1) shipping boxes (as described under filter cassette samples), (2) small sample coolers filled with double-bagged ice, and (3) small sample coolers filled with blue (reusable) ice.

6. Place the chain-of-custody form within the box or container, seal the box or container, and apply a custody seal if required.

7. If coolers are used for shipping, tape instructions for returning the cooler to the inside of the lid.

8. Ship the samples by a method that will meet the holding time.

Polyurethane Foam (PUF) Tube Samples

1. Disconnect the PUF tube from the air sampling pump and wrap the tube in aluminum foil.

2. Attach a label to the wrapped sample tube that includes the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.

3. Wrap the PUF tube in bubble wrap and place the tube in a glass shipping jar.

4. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final air flow rates (or average flow rate); volume of air sampled; and sampling pump identification number.

5. Package the PUF tube jars in a cooler that is filled with double-bagged ice. Use bubble wrap or other cushioning material to separate the samples and prevent breakage.

6. Place the chain-of-custody form within the cooler, seal the cooler, and apply a custody seal if required.

7. If coolers are used for shipping, tape instructions for returning the cooler to the inside of the lid.

8. Ship the samples by a method that will meet the holding time. Samples collected in PUF tubes typically must be extracted within 7 days of collection.

2.2 SHIPPING DOCUMENTATION FOR SAMPLES

Airbills, chain-of-custody forms, and custody seals must be completed for each shipment of nonhazardous environmental samples.

Field staff collecting samples should also review their field work plans to confirm what documentation must be completed during each sampling event, including client-specific requirements. For example, some EPA programs have a specific requirement to use Scribe software, an environmental data management system, to create sample documentation, electronically input information into Traffic Report or chain-of-custody forms, and enter other data.

- The Scribe software can be accessed from the EPA Environmental Response Team (ERT) at the following address: http://www.ertsupport.org/scribe_home.htm
- The ERT User Manual for Scribe, reference, and training materials can be accessed from the Scribe Support Web site at the following address: http://www.epaosc.org/scribe

Note that some laboratories must routinely return sample shipping coolers within 14 calendar days after the shipment has been received. Therefore, the sampler should also include instructions for returning the cooler with each shipment, when possible. The sampler (not the laboratory) is responsible for paying for return of the cooler and should include shipping airbills bearing the sampler's shipping account number, as well as a return address to allow for return of the cooler. Samplers should use the least expensive option possible for returning coolers.

2.3 SHIPMENT DELIVERY AND NOTIFICATION

A member of the field sampling team must contact the laboratory to confirm it accepts deliveries on any given day, especially Saturdays. In addition, samplers should ensure the laboratory has been notified in advance of the pending shipment and notify any additional parties as required. The sampler needs to know the laboratory's contact name, address, and telephone number and be aware of the laboratory's requirements for receiving samples.

In addition, samplers should be aware of the sample holding times, shipping company's hours of operation, shipping schedule, and pick-up and drop-off requirements to avoid delays in analytical testing.

Priority Overnight Delivery

Priority overnight delivery is typically the best method for shipment. Delays caused by longer shipment times may cause the sample temperature to rise above the acceptable range of 4° C (± 2 ° C) and technical holding time may expire, which in turn may compromise sample integrity and require recollection of

samples. If sample delivery procedures are to be modified for particular contract- or laboratory-specific requirements, the procedures should be clearly described in site-specific plans such as work plans, FSPs, or QAPPs.

Saturday Delivery

If planning to ship samples for Saturday delivery, the laboratory must be contacted in advance to confirm it will accept deliveries on Saturdays or arrange for them to be accepted. In addition, samplers should ensure the laboratory has been notified in advance of the pending shipment and notify any additional parties as required.

2.4 HEALTH AND SAFETY CONSIDERATIONS

In addition to the procedures outlined in this SOP, all field staff must be aware of and follow the health and safety practices that result from the Activity Hazard Analyses (AHA) for the project. The AHAs include critical safety procedures, required controls, and minimum personal protective equipment necessary to address potential hazards. The hazards specific to project tasks must be identified and controlled to the extent practicable and communicated to all project personnel via the approved, project-specific health and safety plan (HASP).

3.0 POTENTIAL PROBLEMS

The following potential problems may occur during sample shipment:

- Leaking package. If a package leaks (either from broken sample containers or melting ice), the carrier may open the package and return the package. Special care should be taken during sample packaging to minimize potential leaks.

- Improper labeling and marking of package. If mistakes are made in labeling and marking the package, the carrier will most likely notice the mistakes and return the package to the shipper, thus delaying sample shipment. A good practice is to have labels, forms, and container markings double checked by a member of the field team.

- Bulk samples and air samples delivered to the analytical laboratory in the same container. If samples are combined in this way, they will be rejected. Always ship bulk samples in separate containers from air samples.

- Issues in packing asbestos samples. When asbestos samples are shipped, avoid using expanded polystyrene because of its static charge potential. Also avoid using particle-based packaging materials with asbestos samples because of possible contamination.

- Improper, misspelled, or missing information on the shipper's declaration. The carrier will most likely notice these errors as well and return the package to the shipper. A good practice is to have another field team member double check this information.

- Missed drop off time or wrong location. Missing the drop off time or having the wrong location identified for drop off will delay delivery to the laboratory and may cause technical holding times to expire. Establish the time requirements in advance of completing the field effort and be sure and provide some contingency time for potential delays such as traffic or checking and redoing paperwork.

- Incorrectly packaging samples for analysis at multiple laboratories. For example, inorganic samples may be shipped to one laboratory for analysis, while organic samples may need to be shipped to another laboratory. All field staff should be aware which samples are to be shipped to which laboratory when they package samples for multiple types of analysis.

- Holidays or weather-related delays. Be aware of holidays and weather forecasts that could cause delays in delivery. Delays caused by longer shipping times may cause technical holding times to expire, which in turn may compromise sample integrity or require recollection of samples.

- Not noting field variances in field logbook. Field variances should be noted in the field logbook and the project manager notified. Common field variances include:

    - Less sample volume collected than planned. Notify appropriate staff and the laboratory to ensure there is an adequate amount for analysis.

    - Sample collected into incorrect jar because of broken or missing bottle-ware. Notify appropriate laboratory staff to ensure there is no confusion regarding the analysis of the sample.

FIGURE 1

EXAMPLE OF A FEDEX US AIRBILL FOR LOW-LEVEL ENVIRONMENTAL SAMPLES

Filling Out the FedEx US Airbill

- The sender *must complete* the following fields on the pre-printed airbill:
  - Section 1: Date
  - Section 1: Sender's FedEx Account Number (available from your office administrator)
  - Section 1: Sender's Name, Company, Address, and Phone Number
  - Section 2: Internal Billing Reference (Project Number) (this field may not be present on newer airbills)
  - Section 3: Recipient's Name, Company, Address, and Phone Number
  - Section 4: Express Package or Freight Services (Priority Overnight)
  - Section 5: Packaging (usually "Other," your own packaging)
  - Section 6: Special Handling (Saturday delivery if prearranged with receiving laboratory; "No" dangerous goods contained in shipment)
  - Section 7: Payment ("Bill to Sender")
  - Section 7: Total Number of Packages
  - Section 7: Total Weight (completed by FedEx employee)
  - Section 8: Delivery Signature Options ("No Signature Required")

Completing a Sample Chain-of-Custody Form (See Also Section 2.2 on SCRIBE for Forms)

After samples have been collected, they will be maintained under chain-of-custody procedures. These procedures are used to document the transfer of custody of the samples from the field to the designated

analytical laboratory. The same chain-of-custody procedures will be used for the transfer of samples from one laboratory to another, if required.

The field sampling personnel will complete a Chain-of-Custody and Request for Analysis (CC/RA) form for each separate container of samples to be shipped or delivered to the laboratory for chemical or physical (geotechnical) analysis. These forms are often triplicate, carbonless forms. Care should be taken when completing the form that all copies are legible—PRESS FIRMLY WHEN WRITING. Information on the form will include:

1. Project identification (ID) (for example, contract and task order number);
2. Project Contract Task Order (CTO) number;
3. Laboratory Project Order (PO) number;
4. Tetra Tech Technical Contact;
5. Tetra Tech Project Manager;
6. Laboratory name;
7. Field sampler names;
8. Field sampler signature;
9. Sample ID;
10. Date and time of sampling;
11. Sample matrix type;
12. Sample preservation method; note “NONE” if no preservatives;
13. Number and types of containers per sample;
14. Sample hazards (if any);
15. Requested analysis;
16. Requested sample turnaround time or any special remarks (for example, possible presence of free product or high screening concentrations);
17. Page __ of __;
18. Method of shipment;
19. Carrier/waybill number (if any);
20. Signature, name, and company of the person relinquishing the samples and the person receiving the samples when custody is transferred;

21. Date and time of sample custody transfer;

22. Condition of samples when they are received by the laboratory.

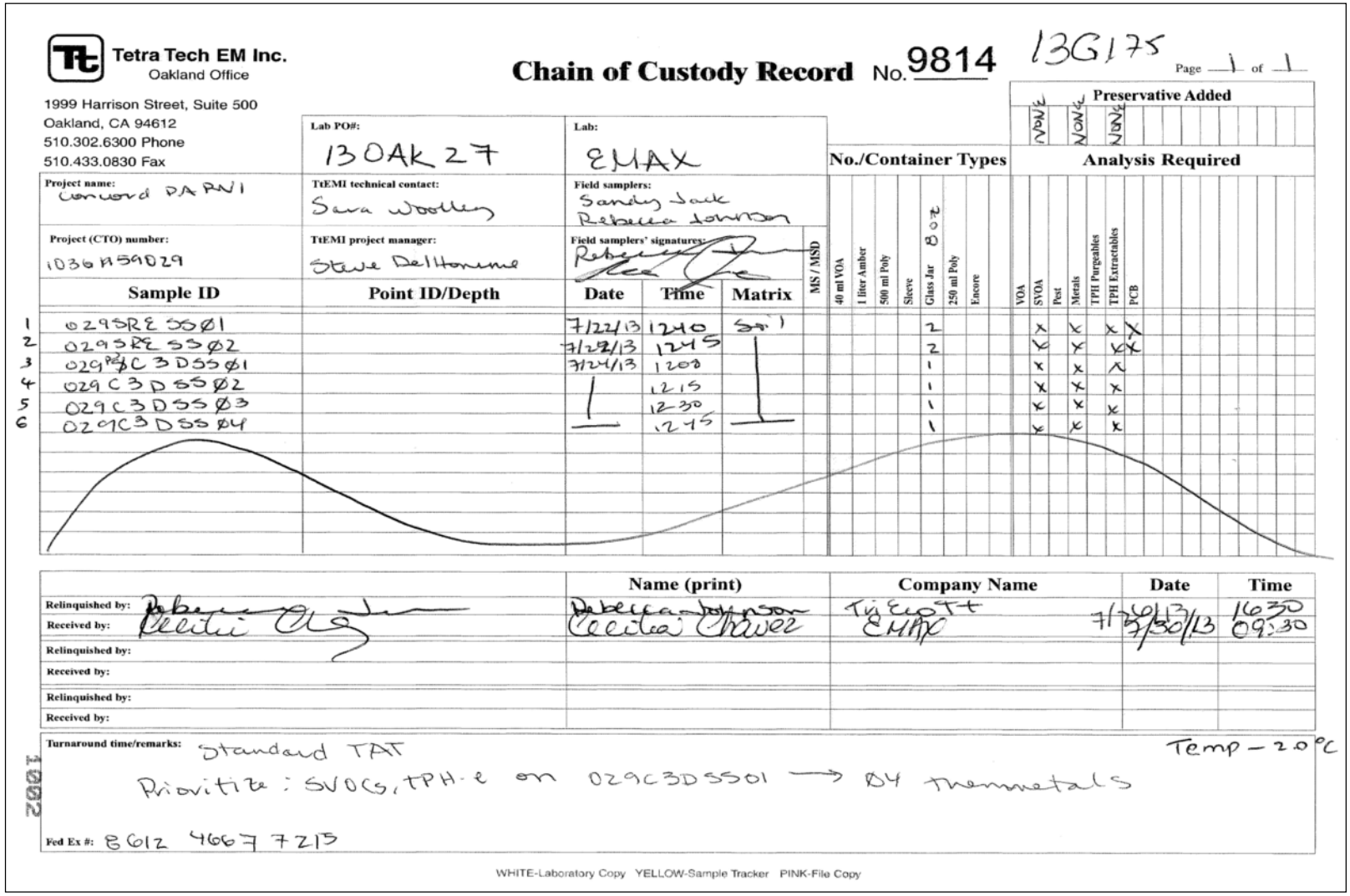
The sample collector will cross out any blank space on the CC/RA form below the last sample number listed on the part of the form where samples are listed.

The sampling personnel whose signature appears on the CC/RA form is responsible for the custody of a sample from time the sample is collected until the custody of the sample is transferred to a designated laboratory, a courier, or to another Tetra Tech employee for transporting a sample to the designated laboratory. A sample is considered to be in custody when the custodian: (1) has direct possession of it; (2) has plain view of it; or (3) has securely locked it in a restricted access area.

Custody is transferred when both parties to the transfer complete the portion of the CC/RA form under "Relinquished by" and "Received by" or a sample is left at a FedEx facility pending shipment. Signatures, printed names, company names, and date and time of custody transfer are required. When custody is transferred, the Tetra Tech sampling personnel who relinquished the samples will retain the third sheet (pink copy) of the CC/RA form. When the samples are shipped by a common carrier, a Bill of Lading supplied by the carrier will be used to document the sample custody, and its identification number will be entered on the CC/RA form. Receipts of Bills of Lading will be retained as part of the permanent documentation in the Tetra Tech project file.

FIGURE 2

EXAMPLE OF A CHAIN-OF-CUSTODY FORM (WHITE COPY)



Tetra Tech EM Inc.
Oakland Office
1999 Harrison Street, Suite 500
Oakland, CA 94612
510.302.6300 Phone
510.433.0830 Fax

Chain of Custody Record No. 9814 13G175 Page 1 of 1

Lab PO#: 130Ak27 | Lab: EMAX

Project name: Concord PA PN1 | TtEMI technical contact: Sara Woolley | Field samplers: Sandy Jack, Rebecca Johnson

Project (CTO) number: 103G159029 | TtEMI project manager: Steve DeHoratius | Field samplers' signatures:

	Sample ID	Point ID/Depth	Date	Time	Matrix	MS / MSD	No./Container Types: 40 ml VOA	1 liter Amber	500 ml Poly	Sleeve	Glass Jar 8 oz	250 ml Poly	Encore	Preservative Added: NONE	NONE	NONE	Analysis Required: VOA	SVOA	Pest	Metals	TPH Purgeables	TPH Extractables	PCB
1	029SRE SS01		7/22/13	1240	Soil						2						X	X	X		X	X	
2	029SRE SS02		7/22/13	1245							2						X	X	X		X	X	
3	029PBC 3D SS01		7/24/13	1200							1						X	X	X		X		
4	029 C 3D SS02			1215							1						X	X	X		X		
5	029C3D SS03			1230							1						X	X	X		X		
6	029C3D SS04			1245							1						X	X	X		X		

	Name (print)	Company Name	Date	Time
Relinquished by:	Rebecca Johnson	TtEMI	7/26/13	1630
Received by:	Cecilia Chavez	EMAX	7/30/13	09:30
Relinquished by:				
Received by:				
Relinquished by:				
Received by:				

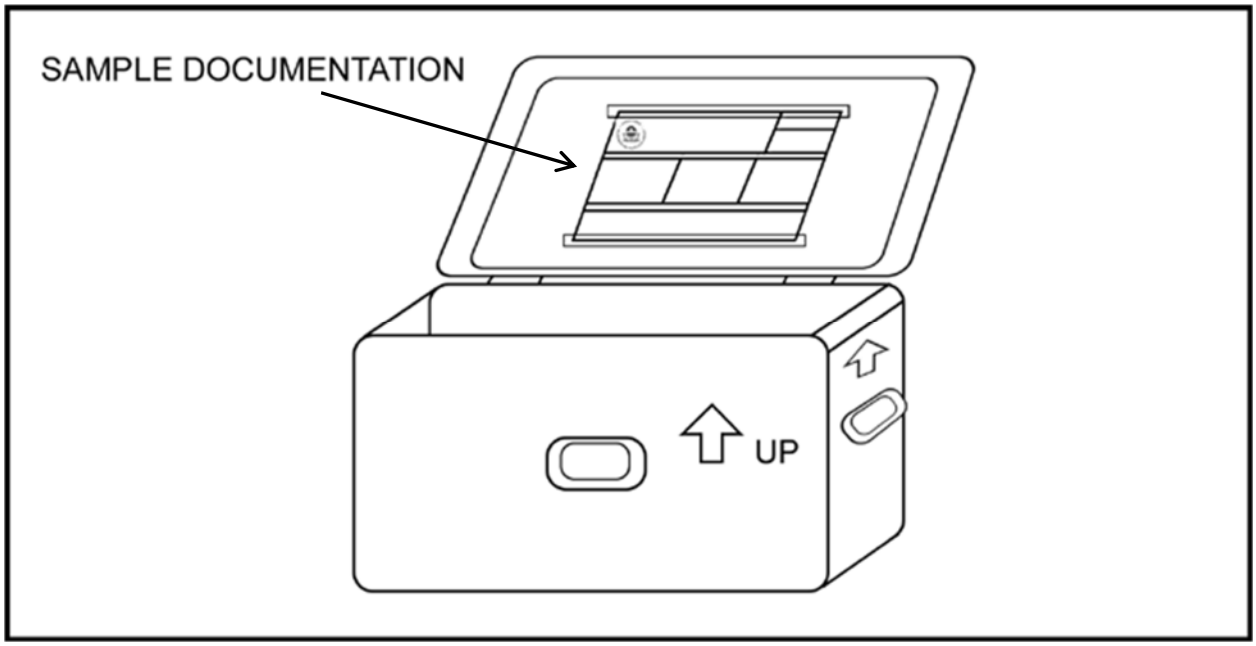
Turnaround time/remarks: Standard TAT Temp – 20°C
Prioritize: SVOCs, TPH-e on 029C3DSS01 → 04 thenmetals

Fed Ex #: 8612 4667 7215

WHITE-Laboratory Copy YELLOW-Sample Tracker PINK-File Copy

FIGURE 3

EXAMPLE OF A SAMPLE COOLER WITH ATTACHED DOCUMENTATION



Source: U.S. Environmental Protection Agency. 2014.

Place the necessary paperwork (chain-of-custody form, cooler return instructions, and associated paperwork) in the shipping cooler or acceptable container. All paperwork must be placed in a plastic bag or pouch and then secured to the underside of the shipping container lid.

FIGURE 4

EXAMPLE OF A CUSTODY SEAL

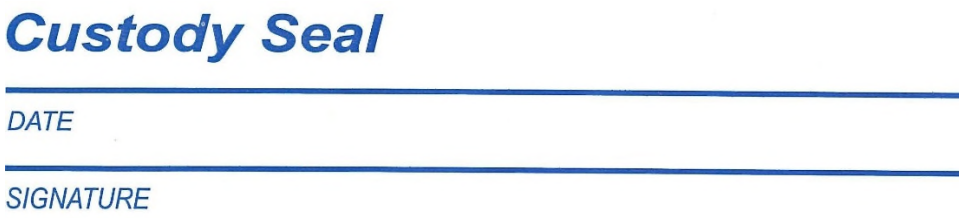
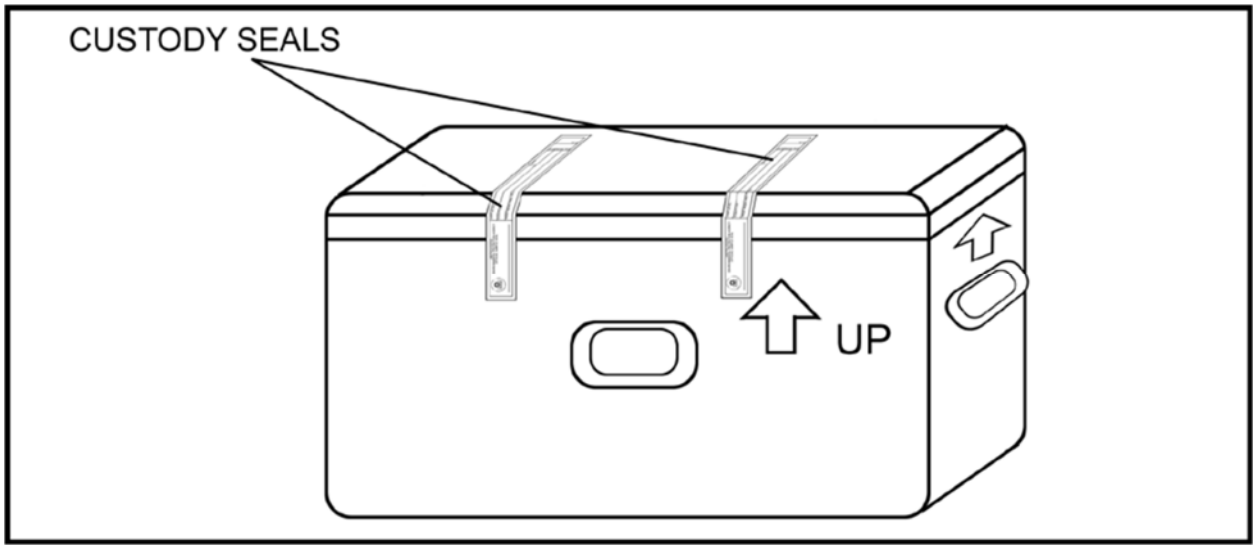


FIGURE 5

EXAMPLE OF SHIPPING COOLER WITH CUSTODY SEALS



Source: U.S. Environmental Protection Agency. 2014.

Please note that the two seals typically are affixed to opposite sides of the cooler and offset from each other, although the offset is not depicted on the EPA figure above.

SOP APPROVAL FORM

TETRA TECH, INC.

EMI OPERATING UNIT

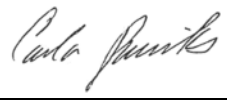
ENVIRONMENTAL STANDARD OPERATING PROCEDURE

RECORDING NOTES IN FIELD LOGBOOKS

SOP NO. 024

REVISION NO. 3

Last Reviewed: July 2020



Quality Assurance Approved

July 2, 2020

Date

1.0 BACKGROUND

Complete and accurate field documentation is critical to a successful project and the field logbook is an important tool to support field documentation needs. The field logbook should include detailed records of all field activities, document interviews with people, and record observations of conditions at a site. Entries should be described in a level of detail to allow personnel to reconstruct, after the fact, activities and events that occurred during their field assignments. Furthermore, entries should be limited to facts. Avoid speculation related to field events and do not record hearsay or unfounded information that may be presented by other parties during field activities. For example, do not record theories regarding the presence or absence of contamination when you are collecting field screening data or speculation regarding the reasons for a property owner's refusal to grant access for sampling.

Field logbooks are considered accountable documents in enforcement proceedings and may be subject to review. Therefore, the entries in the logbook must be accurate and detailed, but should not contain speculative information that could conflict with information presented in subsequent project deliverables and correspondence. Also be aware that the field logbooks for a site may be a primary source of information for depositions and other legal proceedings that may occur months or years after field work is complete and long after our memories have faded. The accuracy, neatness, and completeness of field logbooks are essential for recreating a meaningful account of events.

Field notes may also be recorded digitally, using a variety of software programs. The requirements and use of digital recording programs is not addressed in this standard operating procedure (SOP) because many items are unique to the selected software system. However, many of the principles discussed in this SOP will apply to the digital recording of field notes.

1.1 PURPOSE

The purpose of this SOP is to provide guidance to ensure that field logbook documentation collected during field activities meets all requirements for its later use. Among other things, field logbooks may be used for:

- Identifying, locating, labeling, and tracking samples
- Recording site activities and the whereabouts of field personnel throughout the day
- Documenting any deviations from the project approach, work plans, quality assurance project plans, health and safety plans, sampling plans, and any changes in project personnel
- Recording arrival and departure times for field personnel each morning and evening and weather conditions each day

- Describing photographs taken during the project.

In addition, the data recorded in the field logbook may later assist in the interpretation of analytical results. A complete and accurate logbook also aids in maintaining quality control, because it can verify adherence to project scope and requirements.

1.2 SCOPE

This SOP establishes the general requirements and procedures for documenting site activities in the field logbook.

1.3 DEFINITIONS

None.

1.4 REFERENCES

Compton, R.R. 1985. *Geology in the Field*. John Wiley and Sons. New York, NY.

1.5 REQUIREMENTS AND RESOURCES

The following items are required for field notation:

- Bound (sewn) notebooks
- Ballpoint pens or Sharpies with permanent waterproof ink
- 6-inch ruler (optional)

Field logbooks should be bound (sewn) with water-resistant and acid-proof covers, and each page should have preprinted lines or grids and numbered pages. They should be approximately $7^1/_2$ by $4^1/_2$ inches or $8^1/_2$ by 11 inches in size. Loose-leaf sheets are not acceptable for use as a field logbook, although logs and field forms used to record field measurements and data are acceptable as loose-leaf sheets maintained in a three-ring binder with numbered pages, as a supplement to the logbook. If notes are written on loose paper, they must be transcribed as soon as possible into a bound field logbook by the same person who recorded the notes originally.

Ideally, distribution of logbooks should be controlled by a designated person in each office. This person assigns a document control number to each logbook, and records the assignment of each logbook distributed (name of person, date distributed, and project number). The purpose of this procedure is to ensure the integrity of the logbook before its use in the field, and to document each logbook assigned to a

project. In the event that more than one logbook is assigned to a project, this process will ensure that all logbooks are accounted for at project closeout.

2.0 PROCEDURES

The following subsections provide general guidelines and formatting requirements for field logbooks, and detailed procedures for completing field logbooks.

2.1 GENERAL GUIDELINES

- A separate field logbook must be maintained for each project. If a site consists of multiple subsites (or operable units), designate a separate field logbook for each subsite. Similarly, if multiple activities are occurring simultaneously requiring more than one task leader (for example, well installation, private well sampling, or geophysical survey), each task leader should maintain a separate field logbook to ensure that each activity is documented in sufficient detail.

- At larger sites, a general field log may be kept at the site trailer or designated field office to track site visitors, document daily safety meetings, and record overall site issues or occurrences.

- Data from multiple subsites may be entered into one logbook that contains only one type of information for special tasks, such as periodic well water-level measurements.

- All logbooks must be bound and contain consecutively numbered pages. If the pages are not pre-numbered, the sequential page number should be written at the top of each page.

- No pages can be removed from the logbook for any purpose.

- All information must be entered using permanent, waterproof ink, either a traditional ballpoint pen or a permanent marker. Do not use pens with water-based ink (typically identified as rollerball or gel ink pens) because the ink may wash out if the paper gets wet. Pencils are not permissible for field notes because information can be erased. The entries should be written dark enough so that the logbook can be easily photocopied.

- Be sure that all entries are legible. Use print rather than cursive writing and keep the logbook pages free of dirt and moisture to the extent possible.

- Set apart critical information such as sample numbers by circling or drawing a box around the critical data.

- Do not enter information in the logbook that is not related to the project. The language used in the logbook should be factual and objective. Avoid speculation that could conflict with information presented in subsequent project deliverables and correspondence (see Section 1.0 above).

- Use military time, unless otherwise specified by the client. If a logbook entry is not related to a specific event, set it aside with the identification as a “NOTE.”

- Include site sketches, as appropriate.

- Begin a new page for each day’s notes.

- Include the date, project number, and location (if the project has multiple locations) at the top of each page.

- At the end of a day, draw a single diagonal line through any unused lines on the page, and sign at the bottom of the page. Note and implement any client-specific requirements (for example, some clients require each logbook page to be signed).

- Write notes on every line of the logbook. Do not skip any pages or parts of pages unless a day's activity ends in the middle of a page.

- If a line is left blank for some reason, cross it out (with a single line) and initial to prevent unauthorized entries.

- Cross out (with a single line) and initial any edits to the logbook entries. Note and implement any client-specific requirements (for example, some clients also require that edits be dated). Edits should only be made if the initial entry is illegible or erroneous. Do not make corrections for grammar or style.

2.2 LOGBOOK FORMAT

The layout and organization of each field logbook should be consistent and generally follow the format guidelines presented below. Some clients or contracts may have specific formatting guidelines that differ somewhat from this SOP; review client requirements at the start of the project to help ensure any client-specific guidelines are integrated.

2.2.1 Logbook Cover

Spaces are usually provided on the inside front cover (or the opening page in some logbooks) for the company name, address, contact names, and telephone numbers. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page. Information to be included on the inside front cover or first page includes:

- Logbook document control number (assigned by issuer)
- "Book # of #" (determined by the project manager if there is more than one logbook for the project)
- Contract and task order numbers
- Name of the site and site location (city and state)
- Name of subsite (or operable unit), if applicable
- Type of activity, if the logbook is for a specific activity, such as well installation or indoor air sampling
- Beginning and ending dates of activities entered into the logbook

2.2.2 Inside Cover or First Page

Spaces are usually provided on the inside front cover (or the opening page in some logbooks) for the company name, address, contact names, and telephone numbers. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page. Information to be included on the inside front cover or first page includes:

- Tetra Tech project manager and site manager names and telephone numbers
- Tetra Tech office address
- Client contact and telephone number
- Site safety officer and telephone number
- Emergency contact telephone number (911, if applicable, or nearest hospital)
- Subcontractor contacts and telephone numbers
- Site property owner or property manager contact information

Note—some clients prohibit the inclusion of personally identifiable information such as personal mobile telephone numbers on official project records.

2.3 ENTERING INFORMATION IN THE LOGBOOK

The following lists provide guidance on the types of information to be included in a typical field logbook. This guidance is general and is not intended to be all-inclusive. Certain projects or clients may specify logbook requirements that are beyond the elements presented in this SOP.

2.3.1 General Daily Entries

- Document what time field personnel depart the Tetra Tech office and arrive at the hotel or site. If permitted by the client to charge travel time for site work, document what time personnel leave and arrive at the hotel each day. (This information may be needed at remote sites where hotel accommodations are not near the site.)
- Indicate when all subcontractors arrive and depart the site.
- Note weather conditions at the time of arrival on site and any changes to the weather that might affect completion of project tasks during the day.
- Include the date and project number at the top of each page.
- Document that a site safety meeting was held and include the basic contents of the meeting.
- List the level of personal protection to be used for health and safety.

- Summarize the day's planned activities.
- Summarize which activities each field team member will be doing.

2.3.2 Field Activity Entries

- Refer to field data collection forms for details about field data collection activities (for example time, date, depth of samples, and field measurements). If separate field sampling sheets are not used, see Section 2.3.3 regarding logbook entries for sampling activities.
- Refer to well purge forms, well construction logs, and other activity-specific forms as applicable rather than including this type of information in the field logbook. These other forms allow the information to be more accessible at a later date.
- List any air monitoring instrumentation used, with readings and locations.
- Refer to instrument field logs for equipment calibration information.
- Summarize pertinent conversations with site visitors (agency representatives, property owners, client contacts, and local citizens).
- Summarize any problems or deviations from the quality assurance project plan (QAPP) or field sampling plan.
- Document the activities and whereabouts of each team member. (As indicated in Section 2.1, multiple logbooks may be required to ensure sufficient detail for contemporaneous activities).
- Indicate when utility clearances are completed, including which companies participated.
- Indicate when verbal access to a property is obtained.
- Include names, addresses, and telephone numbers of any pertinent site contacts, property owners, and any other relevant personnel.
- Document when lunch breaks or other work stoppages occur.
- Include approximate scale for all diagrams. If a scale is not available, write "not to scale" on the diagram. Indicate the north direction on all maps and cross-sections, and label features on each diagram.

2.3.3 Sampling Activity Entries

The following information should typically be on a sample collection log and referenced in the logbook. If the project does not use sample sheets as a result of project-specific requirements, this information should be included in the logbook.

- Location description
- Names of samplers
- Collection time

- Designation of sample as a grab or composite sample
- Identification of blind duplicates or split samples
- Type of sample (water, sediment, soil gas, or other medium)
- On-site measurement data (such as pH, temperature, and specific conductivity)
- Field observations (odors, colors, weather)
- Preliminary sample description
- Type of preservative used
- Instrument readings, if applicable

2.3.4 Closing Daily Entries

- Describe decontamination procedures (personnel and equipment).
- Describe handling and disposition of any investigation-derived wastes.
- Summarize which planned activities were completed and which ones were not.
- Note the times that personnel depart the site for the day.
- Summarize any activities conducted after departing the site (paperwork, sample packaging, etc.). This may be required to document billable time incurred after field activities were completed for the day.

2.3.5 Photographic Log Entries

- Before using a digital camera, ensure that the system date and time are correct. Verify whether the timestamp is being recorded on the image, if required.
- Indicate in the text that photographs were taken and the location where the photographs can be found (for example, in the project file) and identify the photographer.
- Begin a new photolog page for each new field day.
- Record the time of photograph so that the image can be generally identified when reviewing the digital files.
- Note the direction in which the photograph was taken, along with any relevant details that might not be understood when looking at the photograph.
- In the event that a film camera is used, the sequential number of the image should also be recorded, and the time from the logbook will be the recorded time for the photograph.

2.4 LOGBOOK STORAGE

Custody of logbooks must be maintained at all times. During field activities, field personnel must keep the logbooks in a secure place (locked car, trailer, or field office) when the logbook is not in personal possession. When the field work is over, the logbook should be included in the project file, which should be in a secured file cabinet; in addition, if directed by the project manager, scan logbook pages for electronic file management upon returning to the office. The logbook may be referenced in preparing subsequent reports and scanned logbook pages may be included as an appendix to a report. However, it is advisable to obtain direction directly from the client before including the logbook as a report appendix, because its inclusion may not be appropriate in all cases.

2.5 HEALTH AND SAFETY CONSIDERATIONS

In addition to the procedures outlined in this SOP, all field staff must be aware of and follow the health and safety practices that result from the Activity Hazard Analyses (AHA) for a project. The AHAs include critical safety procedures, required controls, and minimum personal protective equipment necessary to address potential hazards. The hazards specific to project tasks must be identified and controlled to the extent practicable and communicated to all project personnel via the approved, project-specific health and safety plan.

ATTACHMENTS

1. EPA XRF SOP
2. Brookhaven National Laboratory Wipe Sampling SOP
3. EPA Bulk Asbestos SOP

ATTACHMENT 1

EPA XRF SOP

Region 4
U.S. Environmental Protection Agency
Science and Ecosystem Support Division
Athens, Georgia

OPERATING PROCEDURE

Title: **Field X-Ray Fluorescence Measurement**

Effective Date: September 8, 2017	**Number:** SESDPROC-107-R4

Authors

Name: Kevin Simmons
Title: Environmental Scientist
Signature: Date: 9/6/2017

Approvals

Name: John Deatrick
Title: Chief, Field Services Branch
Signature: John Deatrick Date: 9/6/17

Name: Hunter Johnson
Title: Field Quality Manager, Science and Ecosystem Support Division
Signature: Date: 9/6/17

Revision History

The top row of this table shows the most recent changes to this controlled document. For previous revision history information, archived versions of this document are maintained by the SESD Document Control Coordinator on the SESD local area network (LAN).

History	Effective Date
SESDPROC-107-R4, *Field X-Ray Fluorescence Measurement*, replaces SESDPROC-107-R3 **General:** Corrected any typographical, grammatical and/or editorial errors. Throughout the document references were added to reference the Region 4 Superfund X-Ray Fluorescence Field Operations Guide (XRF FOG). **Section 2:** Omitted second bullet. Revised third bullet to up update the frequency that reference standards and blanks are run. **Section 3.2:** Added "or bag" to first sentence of paragraph. **Section 3.2.2:** Added "(Ex-Situ)" into Section title.	September 8, 2017
SESDPROC-107-R3, *Field X-Ray Fluorescence Measurement*, replaces SESDPROC-107-R2	December 18, 2015
SESDPROC-107-R2, *Field X-Ray Fluorescence Measurement*, replaces SESDPROC-107-R1	December 20, 2011
SESDPROC-107-R1, *Field X-Ray Fluorescence Measurement*, replaces SESDPROC-107-R0	November 1, 2007
SESDPROC-107-R0, *Field X-Ray Fluorescence*, Original Issue	February 05, 2007

TABLE OF CONTENTS

1 General Information

1.1 Purpose

This document describes general and specific procedures, methods and considerations to be used and observed when conducting field X-ray fluorescence (XRF) measurements of soil and sediment samples.

1.2 Scope/Application

The procedures contained in this document are to be used by field personnel when measuring metals concentrations in soil, sediment or other solids in the field. On the occasion that SESD field personnel determine that any of the procedures described in this procedure cannot be used to obtain metals analyses of the media being sampled, and that another method or XRF instrument must be used to obtain said measurements, the variant instrument and measurement procedure will be documented in the field logbook, along with a description of the circumstances requiring its use. Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.

1.3 Documentation/Verification

This procedure was prepared by persons deemed technically competent by SESD management, based on their knowledge, skills and abilities and has been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the SESD local area network (LAN). The Document Control Coordinator (DCC) is responsible for ensuring the most recent version of the procedure is placed on the LAN and for maintaining records of review conducted prior to its issuance.

1.4 References

SESD Operating Procedure for Equipment Inventory and Management, SESDPROC-108, Most Recent Version

SESD Operating Procedure for Logbooks, SESDPROC-010, Most Recent Version

SESD Operating Procedure for Sediment Sampling, SESDPROC-200, Most Recent Version

SESD Operating Procedure for Soil Sampling, SESDPROC-300, Most Recent Version

United States Environmental Protection Agency (US EPA). Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment, Method 6200, Revision 0, February 2007.

US EPA. 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. Region 4 Science and Ecosystem Support Division (SESD), Athens, GA.

US EPA. Safety, Health and Environmental Management Program Procedures and Policy Manual. Region 4 SESD, Athens, GA, Most Recent Version.

Region 4 Superfund X-Ray Fluorescence Field Operations Guide (XRF FOG), Most Recent Version

1.5 General Precautions

1.5.1 Safety

Proper safety precautions must be observed when conducting field XRF measurements. Refer to the SESD Safety, Health and Environmental Management Program Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASPs) for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional. When using this procedure, minimize exposure to potential health hazards through the use of protective clothing, eye wear and gloves. The operator should always be aware of the instrument's radioactive source and the direction of its beam of X-rays. The operator should never point the open source at anyone. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate.

1.5.2 Procedural Precautions

All field XRF measurements pertinent to the sampling event are recorded in a bound field record logbook for the event. This record is created and maintained by the analyst providing the field XRF support. After the investigation is complete, the analyst will conduct post-processing of the field measurements and will enter final measurement data in the SESD laboratory information management system and provide the SESD project leader with a copy of the field measurement logbook. All other records and documentation of the investigation should be recorded according to the procedures outlined in the SESD Operating Procedure for Logbooks (SESDPROC-010).

1.5.3 Limitations

There are three main sources of interference in XRF analysis that may impact data quality. They are sample preparation error, spectral interferences and chemical matrix interferences.

- Preparation Error – The accuracy of the analysis is strongly impacted by sample homogenization. The more homogeneous the sample, typically analyzed by the cup method, the more accurate the results. There is no control of this limitation when conducting in situ analysis.

- Spectral Interference – Each element has a signature spectrum of energies and relative intensities. Many elements, however, produce X-rays of similar energy and discerning which element produced a detected X-ray is a factor of the detector's resolution capability and the software's ability to fit all of the data to the relative intensities produced by the various wavelengths.

- Chemical Matrix Interference – This refers to the effect that one element has on another in producing X-rays which reach the detector. Dominant elemental components of a sample, such as silicon in soils, vary in concentration from sample to sample and therefore so does that element's influence on the other elements in the sample.

There are several other limitations that the field investigator must be acutely aware of when conducting field analysis using XRF.

- Soil moisture – Excessive soil moisture biases the results low, i.e., the higher the soil moisture in a particular matrix, the lower the reported concentration relative to the actual concentration. This limitation may be overcome by drying the sample. Without sample drying, XRF measurement results for samples with typical soil moistures within the range of 15% - 25% are routinely reported at values less than laboratory confirmation analysis for the same samples. The actual difference may vary significantly for all samples from a site but the XRF results reported by the instrument are typically on the order of 70% - 80% of the laboratory reported value for samples in this moisture range. This factor should be taken into consideration when making decisions based on XRF results.

- Lack of sensitivity with respect to certain analytes – Due to peak overlaps, some analytes may have problematically high detection limits, i.e., detection limits may be higher than project action levels for certain analytes, limiting its use for rapid field screening for certain elements. One of the most common examples of this phenomenon is the lead/arsenic analyte pair. When lead and arsenic are being analyzed, the peak overlap problem results in detection limits for arsenic that are several times higher than the typical action levels published for this analyte. It commonly is necessary to perform confirmatory analysis in the laboratory to obtain analytical results for arsenic, or other analytes with high detection limits, to obtain data in the range necessary for making regulatory decisions.

2 Operational Checks and Quality Control

All XRF instruments shall be maintained and operated in accordance with the manufacturer's instructions, EPA Method 6200 and the SESD Operating Procedure for Equipment Inventory and Management (SESDPROC-108). Prior to each operational period, the instrument is turned on and is allowed to perform an internal calibration. Following this calibration, a performance check is conducted, using the appropriate National Institute of Standards and Technology (NIST)-traceable standard reference material for the analytes of concern. The value should be within +/- 20% of the stated value of the standard. Following this performance check, an instrument blank sample is analyzed to verify the instrument is not registering false positive results for the analytes of concern. After these checks, the instrument is ready for analysis.

The following operational and quality control requirements also apply to operation of the XRF instrument and must be followed and documented in the field logbook maintained by the analyst:

- During operations, the ambient air temperature will be recorded for each measurement and if the ambient temperature changes by more than 10°F, the instrument will be recalibrated.

- While the instrument is being used, the reference standards and the blank are run at the beginning of each work day, every 4 to 5 hours of analysis time, after the instrument has been off for 1 to 2 hours or if the battery has been changed, and also at the end of the period of operation, prior to turning the instrument off.

- For every twenty samples, or at least once per day, analyze a duplicate using the main sampling technique.

- Once per day, check the instrument’s precision by analyzing one of the site samples at least seven times in replicate.

EPA Method 6200 contains detailed instruction and guidance covering implementation of these procedures and any corrective actions that must be taken based on measured instrument behavior and performance. If at any time during a field investigation, it appears that the environmental conditions could jeopardize the quality of the measurement results, the measurements will be stopped. This will be documented in the field logbook.

In addition, the Region 4 Superfund X-Ray Fluorescence Field Operations Guide (XRF FOG), Most Recent Version, contains additional information, guidance, and QC procedures specific to analyzing soil samples by XRF.

3 Field X-Ray Fluorescence (XRF) Measurement Procedures

3.1 General

XRF is the property of a material to emit X-rays, with a characteristic energy, upon being irradiated by X-rays from a known radioisotope source. The emitted X-rays are detected by the particular XRF instrument as they impact a detector, which converts the energy of the emitted X-ray into electric current. The strength of the current is proportional to the energy of the X-ray. An onboard microprocessor counts how often an energy is detected, assigns the energy to a particular element and reports the calculated concentration for the element.

The XRF instrument available for use by SESD field investigators is the Niton® ~~XLt 700~~ XL3t Series Multi-element XRF Spectrum Analyzer. This instrument uses a miniaturized X-ray tube as its source rather than a radioactive isotope for X-ray generation for analysis.

3.2 Mode of Operation

The instrument is typically used in one of two modes, either for taking in situ measurements or ex situ (measuring sample material that has been placed in a cup or bag for analysis in the instrument tray). The following is a brief description of these modes of operation.

3.2.1 In Situ Measurement

Prior to taking the in situ measurement, the measurement location is cleared of any significant vegetation, such as large clumps of grass, and is scuffed or otherwise leveled to provide a flat surface on which to place the instrument window. A piece of thin Mylar® film is then placed on the measurement location. This protects the instrument window, preventing it from becoming damaged or contaminated by the media being tested. After the window is pressed to the Mylar® film, the window is opened for a nominal (i.e., programmed) sixty seconds.

Because of the shallow penetration of the X-rays in typical soils, the measured concentrations are representative of the concentrations present at the very surface of the material being measured. If conditions representing concentrations over a greater depth are required by the study data quality objectives (i.e., on the order of three to six inches), the cup method, described in Section 3.2.2, must be used.

3.2.2 Collected Sample (Ex-Situ) Measurement

This method is used to measure concentrations of metals in soil and sediment samples collected from a vertical interval, either as a grab or a composite sample. Typically, soil or sediment samples are collected as if the samples were being collected for routine chemical analyses (SESD Operating Procedure for Soil Sampling (SESDPROC-300) and the SESD Operating Procedure for Sediment Sampling (SESDPROC-200). After mixing, the media being sampled may be

placed in either an 8-ounce glass container or a clean, unused zip-closure plastic bag (or equivalent). The XRF analyst then takes an aliquot from the container and places it in a small plastic cup with a Mylar® covering. The cup containing the sample is then loaded into a tray for analysis by the XRF instrument. Alternatively, if project objectives allow, measurements may be obtained by reading directly through the plastic bag. Window opening time considerations are the same as for the in situ measurement procedures described in Section 3.2.1.

The concentrations reported for the samples analyzed by the cup method are representative of the interval sampled, i.e., if the sampler collected the sample from the interval of 0 to 3 inches below ground surface, the reported concentration, assuming thorough homogenization, will be an average of the concentrations over that interval.

The Region 4 Superfund X-Ray Fluorescence Field Operations Guide (XRF FOG), Most Recent Version, contains additional information, guidance, and QC procedures, including spreadsheets available from the Region 4 Scientific Support Section, specific to ex-situ soil analysis by XRF.

4 Study Design

4.1 General

XRF instruments are typically used for two main purposes. First it may be used to rapidly assess site conditions to support a site reconnaissance. Secondly, it may be used to screen large numbers of soil or sediment samples to minimize the number of samples that are sent to a laboratory to provide detailed site characterization data. These uses are summarized in the following sections.

4.2 Reconnaissance

XRF may be used to obtain in situ measurements at a large number of locations in a short period of time to determine if a site warrants further attention with respect to characterization. When used in concert with GPS, and when observing the limitations described in Section 1.5.3, XRF can reveal, where present, contamination patterns at a site which can form the basis for development of a more detailed study to provide definitive data for site characterization. Conversely, the reconnaissance results may form the basis for a "no further action" decision, providing a very cost effective tool for the decision maker.

4.3 Screening Support for Definitive Level Site Characterization

XRF may be used to supplement laboratory analyses to allow for the collection of large numbers of samples to provide a detailed characterization of a site. A high sample density grid or sampling pattern is created to provide adequate detail to meet the data quality objectives of the study or investigation. This sampling pattern may also involve the collection of significant numbers of subsurface soil samples to characterize any contamination present in the subsurface.

All samples, collected according to procedures found in SESD Operating Procedure for Soil Sampling (SESDPROC-300) and SESD Operating Procedure for Sediment Sampling (SESDPROC-200), are delivered to the XRF analyst on site. The analysis of these samples is conducted according to the method described in Section 3.2.2 of this procedure.

Based on the limiting factors described in Section 1.5.3, a confirmatory analytical scheme can be developed which minimizes the numbers of samples that must undergo laboratory analyses, yet provides definitive level data, with a high degree of confidence, to the project leader and other decision makers. Using the moisture limiting factor, there is usually a high degree of confidence that samples that screen at concentrations less than approximately 70% - 80% of the site action level will actually exceed the action level. Of the samples that screen ***at*** the action level, most all will, with a high degree of confidence, exceed the action level. If a reconnaissance is conducted prior to the full-scale site investigation, in addition to the *in situ* analysis, it is advisable to collect and analyze a small subset of the

screened locations to generate site-specific moisture limiting factors. This correlation factor can be used to develop a sampling scheme with more confidence.

Using these relationships, the following scheme may be implemented:

- Ten percent of the samples that screen at concentrations less than approximately 70% - 80% (or other correlation factor developed on actual data) of the site action levels are submitted for confirmation analyses to confirm that concentrations are, in fact, below the site action levels.

- All of the samples that screen at concentrations of 70% - 80% (or other correlation factor developed on actual data) of the action level up to the action level value are submitted for confirmation analyses to confirm that concentrations are, in fact, equal to or greater than the site action levels.

- Ten percent of the samples that screen at concentrations exceeding the action levels are submitted for confirmation analyses to confirm that concentrations are, in fact, greater than the site action levels.

ATTACHMENT 2
BROOKHAVEN NATIONAL LABORATORY WIPE SAMPLING SOP

IH75190
Surface Wipe Sampling for Metals

1.0 Purpose & Scope This document describes a field procedure for taking wipe samples for metals on surfaces. It is based on methodology described in NIOSH 9100 "Lead in Surface Wipe Samples" of the NIOSH Manual of Analytical Methods.

The goal of the procedure is to provide a uniform methodology to collect representative samples. Using this method will ensure repeatability between various sampling personnel and between surface configurations. It is used for characterizing surface levels for the following reasons:

- Decommissioning operational areas
- Evaluating the effectiveness of clean-up of a spill
- Evaluating compliance with housekeeping levels in operational areas
- Characterizing a piece of equipment for release.

2.0 Responsibilities

2.1 **Demonstrated Competency:** This procedure is administered through persons who have demonstrated competency in performing this procedure in accordance with Section 7 are qualified to use this procedure.

2.2 **Chain of Custody procedures:** The qualified sampler is responsible for samples until they have been properly transferred to the IH Group laboratory using the *IH51200 IH Laboratory Equipment & Sample Processing* procedure.

2.3 **Hazard Analysis of the Sampling Task:** It is the responsibility of persons using this method and their supervisors to:

- Use appropriate personal protective equipment; see section 5.3.
- Obtain required training and qualification for hazards in areas.
- Comply with all work planning and work permit system requirements.

3.0 Definitions

Surface Wipe- a technique for the determination of metal on surfaces conducted by wiping the loose dust from the surface with a cloth/paper media and analysis of the metal on the media by laboratory or XRF measurement.

Definitions associated with surface wipe criteria are cited in Attachment 9.3

4.0 Prerequisites

Area Access:

4.1 Training for hazards may be needed for entry into areas with hazards, such as radiological areas..

4.2 Contact the appropriate Facility Support Representative or Technician to obtain approval to enter radiological areas.
4.3 Review and sign the Work Permit or Radiological Work Permit if needed.
4.4 Use appropriate PPE for area.

5.0 Precautions

5.1 **Hazard assessment:** Taking surface wipe samples may cause some exposure to health risks. Sampling may be performed in areas with metal, chemical or radiological contamination. These hazards must be assessed on a case-by-case basis by a competent individual knowledgeable of the hazards of the area.

5.2 **Job Risk Assessment:** Consult the *Job Risk Assessment* SHSD-JRA-05 for the risk analysis of this operation based on the hazards and controls of this SOP.

5.3 **Personal Protective Equipment:** Use appropriate personal protective equipment when implementing this procedure.

- **Hand:** Use gloves in areas of known or suspected metal, chemical or radiological contamination. Exam-style, splash gloves are acceptable. Acceptable polymers are: Nitrile, PVC, and Natural Rubber. The gloves must have sufficient impermeability to the surface contaminant and solvent used on the collection media to allow safe handling. See Table 1.
- **Body:** Use a disposable suit if contact of the body with contaminated surfaces is anticipated. Acceptable chemical protective equipment materials include: Tyvek®, KleenGuard®, and cotton. Contact the ECR for disposable of garments. If personal clothing items become contaminated, they must be surrender for BNL cleaning or disposal.
- **Foot:** Use disposable shoe coverings, boots or booties if contact of the feet with contaminated surfaces is anticipated. Acceptable material include: Tyvek®, KleenGuard®, and rubber. If personal shoes become contaminated, they must be surrendered for BNL cleaning or disposal.
- **Respiratory:** Under normal use, respiratory protection is not required. Use a respirator in an area with the potential to exceed the OSHA, ACGIH, or DOE standards. The person collecting using respiratory protection must comply with the BNL Respiratory Protection Program.
- **Eye:** Use safety glasses with side shields in laboratories, construction, and general industry areas.

5.4 **Radioactive Concerns:** It is possible that some surfaces to be tested may have radioactive contamination. In these cases, personal protective equipment and administrative controls must be implemented for the radiological contaminant hazard.

In addition, the collected sample must be analyzed for the radiological hazard before it can be submitted to the IH Group for analysis. The radiological contamination must be below the permissible release limits to the general public.

5.5 **Work Planning:** All requirements of work permits and work planning system reviews must be met in performing this procedure.
5.6 **Personal Hygiene:** Remove PPE and wash hands after sampling and before eating or drinking.

5.7 **Environmental Impact and Waste Disposal:** This technique does not have adverse impact on the environment. Based on WMD testing of similar PPE material, the templates and gloves can be disposed as normal trash. See Attachment 9.4.

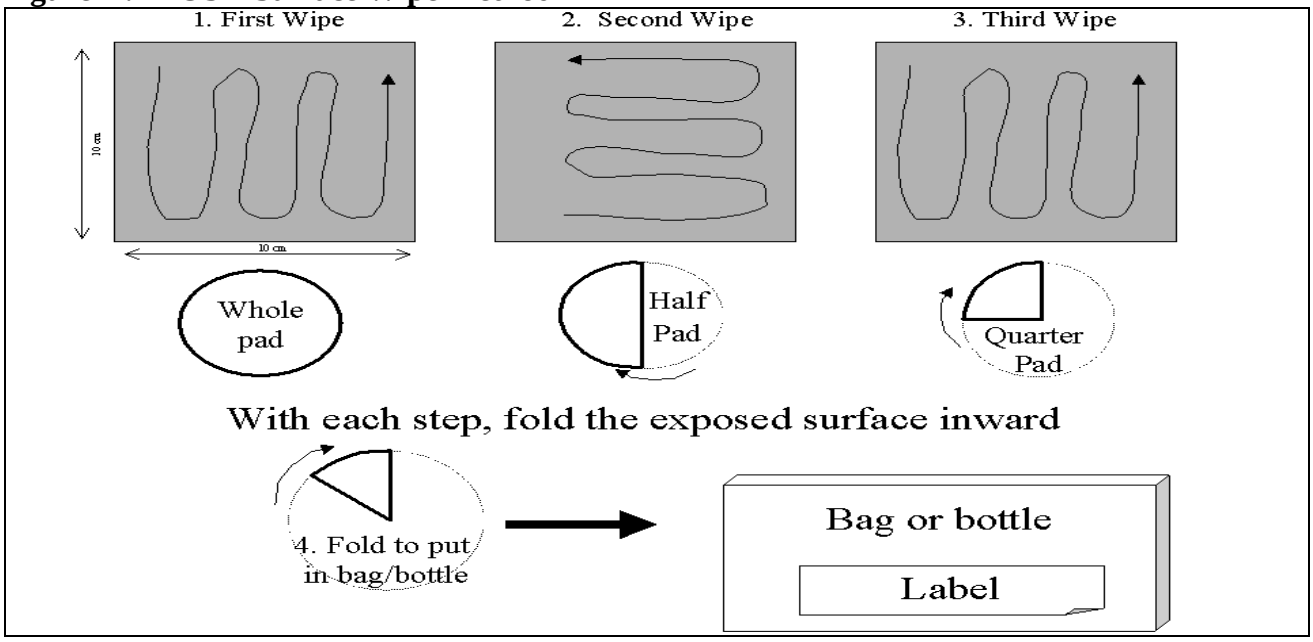
6.0 Procedure

6.1 **Equipment**

Sample container (either):	Bag, plastic, sealable with "zip" type seal.
	Vial, glass or plastic. (Glass is needed for hexane solvents based samples).
Sample media (any of these):	Gauze: 2" x 2" or 4" x 4" cotton gauze
	Paper: Ashless quantitative filter paper (typical diameter is 1.5 to 4 inches)
	Pre-moistened wipe: manufacturer foil wrapped, solvent soaked disposable cloths (such as GhostWipes™ or LeadWipe™ • The type of wipe is dependent on the lab to be used. Check with the lab for appropriate media for the metals to be analyzed. • For multiple metals, check with the lab to ensure they can all be done on a single wipe
Gloves	Appropriate for contaminant and solvent (see Table 1) and site hazards.
Solvent	Distilled water, Isopropanol, ethanol, methanol, n-hexane, or pre-moistened. See Table 1 for recommended solvent for each contaminant.
Template	Plastic sheet or cardboard: See Table 1 for size needed • $100cm^2$: 10 cm x 10 cm square –or- circle of 11.24 cm diameter. • $1ft^2$: 1foot x 1 foot, or other shape totaling 144 in^2.

6.2. **Wipe Technique:** BNL SHSD IH Group has selected the NIOSH method of collecting wipe samples. For uniformity, this method should be used for all sampling surface to be sampled (Visually depicted in Figure A)

Figure A: NIOSH Surface Wipe Method



6.2.1 Use a moistened sample media or pre-moistened wipe (e.g. GhostWipe™). Apply only enough solvent to moisten approximately 80% of the area of the media. Avoid excess

solvent on the filter or pad as it may cause drips and running on the surface thus diluting the sample.

Table 1

Contaminant	Media[1]	Solvent[2]	PPE Glove[2] Disposable Style	Sample Size
Lead	Gauze or Filter	1 -2 ml Distilled Water	Natural Latex Rubber, Nitrile, PVC, or Polyethylene	1 square foot, 100 cm^2 requires advanced approval by IH professional verifying that sensitivity is adequate
	Pre-moistened Wipe (should be cut in half) [3]	n/a		
Beryllium	Gauze or Filter	1 - 2 ml Distilled Water Isopropanol, Methanol, Ethanol	Natural Latex Rubber, Nitrile, PVC, or Polyethylene	1 square foot minimum needed always
	Pre-moistened Wipe (should be cut in half) [4]	n/a		
Arsenic, Cadmium	Gauze or Filter	1-2 ml of Distilled Water	Natural Latex Rubber, Nitrile, PVC, or Polyethylene	100 cm^2 typically acceptable
	Pre-moistened Wipe (should be cut in half) [4]	n/a		
Hexavalent Chromium	**Preferred Medias**: See Attachment 9.2	None: For chrome plating operations, see stabilizing solution in Attachment 9.2.	Powderless: Natural Latex Rubber, Nitrile, PVC, or Polyethylene	100 cm^2 typically acceptable

Notes for Table 1:

(1) Some pre-moistened media may not be compatible is certain laboratory analytical equipment. Check with the laboratory analyzing the samples prior to sampling to ensure the brand of media is compatible.

(2) Solvent: The solvent is not critical for lead, beryllium, and most heavy metals such as cadmium, nickel, and chromium. In doing wipes for these compounds, it is allowable to choose the solvent that will have the least impact (residues) on the owner of the equipment being sampled (i.e. some equipment is sensitive to water residues and an alcohol or other solvent may be preferred by the equipment owner.)

(3) Selection criteria: Breakthrough time greater than 1 hour of continuous contact. Source of data *is DOE Guidelines for the Selection of Chemical Protective Clothing, 1991.*

(4) The use of full size pre-moistened may cause the sample not to meet the minimum level of detection. To increase sensitivity, cut wipe in half to reduce the size of the wipe.

6.2.2 Place the template over the area to be sampled or measure out 1 ft^2 or 100-cm2 surface area, as per Table 1. If the object has a total surface area of less than 1 ft^2 or 100 cm^2, sample the whole surface area, if possible, and record the surface area. If the surface does not allow the use of a template, carefully determine the dimensions that will equal 1 ft^2 or 100 cm^2.

6.2.3 Wipe the surface with firm pressure, using "S" strokes, covering the entire surface (edge to edge). If the surface is very rough (such as concrete), a dabbing action may be substituted for the full contact pressure rubbing of the media across the surface. When dabbing, make sure to completely cover the same area as in the S-stroke wipe. Indicate dabbing done on sample form.

Fold the exposed side of the pad or filter inward (i.e. fold in half).

6.2.4 Using the once-folded media, wipe the same area S-strokes (see Figure A), starting at right angles to the first wipe. Fold the exposed side of the pad or filter inward.

6.2.5 Using the twice-folded media, wipe with S-strokes (see Figure A) starting at the original point and wipe in the same direction. Fold the exposed side of the pad or filter in.

6.2.6 Place the media in a plastic bag or vial. Seal the zip lock or vial. Record the sample identification on the bag or vial.

6.2.7 Thoroughly clean reusable templates or discard paper templates in preparation of the next sample. Based on WMD testing of similar material, templates can be disposed as normal trash.

6.2.8 Remove gloves by pulling them off inside-out and discard appropriately before handling the next filter or pad.

6.2.9 Record the sample identification, surface area sampled, and description of the sample and surface on the sample form (Attachment 9.5) in the electronic SHSD forms page **Surface Wipe (Metals)- Field Sampling Records & Chain of Custody.**

6.2.10 Include 1 blank filter or pad (moisten and placed in bags or vials) with each set of samples (provide 1 blank per 6 samples).

6.3 Surface Wipe Technique for Hexavalent Chromium: see Attachment 9.2.

6.4 Determine HOW MANY samples to take. It is not possible to provide definitive guidance on the number of samples to be taken in every case. Table 2 provides general guidance on which to base professional judgment determining the number of samples. Factors that should be considered in selecting the number of samples include: the size of the area to be tested, the predicted uniformity of contamination over the surface area, and the eventual fate of the surface area (disposal, remediation, background measurement, etc.)

If more than six (6) samples are to be taken, it is suggested that at least one (1) duplicate sample be taken in close proximity to one other to verify the precision (repeatability) of the sampling.

Table 2: Statistical sampling plan

Surface Configuration	Minimum Number of Samples	Qualifier
Entire Surface is less than 100 cm2 (example: a small article)	1	If possible, sample the whole item, one sample is usually sufficient.
Surface Area of object or area is greater than 100 cm2 but only a few square feet (example: table top on which a process is done)	1	If only one sample is taken, select the area with highest potential contamination
Surface Area of object or area is greater than a few square feet (example: floor or wall of a room)	1 - 3	Ideally three samples are taken, but fewer samples may be taken depending on the purpose for sampling

Table 2: Statistical sampling plan

Surface Configuration	Minimum Number of Samples	Qualifier
Multiple surfaces in a large area with the same exposure potential to source (example, many rooms in a building with a common source such as the HVAC system)	1 – 3 for each surface, 6 or more for the whole area	Assumes all the surfaces have similar exposure potential, else treat each area separately.

6.5 Determine WHAT KIND of samples (LOCATION). Consider these locations when characterizing levels of surface metals:

- surfaces that are frequently accessed,
- surfaces that hazardous metal object rest on,
- surfaces that are infrequently cleaned or disturbed (such as top of cabinets or high shelves)
- sources of the contamination (such as process equipment, lab apparatus, site of known spills),
- areas where contamination is not expected (these serve as a control), and
- areas where contamination would not be permissible (such as lunch rooms).

6.6 **Results interpretation:** Normalize the units of **s**ampling results from the laboratory to the base units of the Surface Level Criteria Requirements & Recommendations listed in Attachment 9.3.

Conversion of data between various laboratory reporting units of measures: Data can be converted from the various regulatory reporting and laboratory reporting units of measure based on the following values: 1 sq.ft. = 929 cm^2 1 mg = 1000 ug

Convert form:	Multiply by
ug/100 cm^2 to ug/sq. ft	**9.29**
ug/sq. ft to ug/100 cm^2	**0.1076**

6.7 **Posting equipment or areas:** Consult with Attachment 9.1 for recommended wording to be used for labelling equipment or areas when a warning is needed for toxic metal hazards.

6.8 **Reporting results**: Convey the assessment of results to the requestor of the sampling, in a written analysis documenting: sampling and analysis methods, contamination levels measured, compliance with regulatory and recommended levels, and recommended corrective actions (if necessary).

7.0 Implementation and Training

Qualification Criteria: Use of this SOP is limited to persons who have demonstrated the competency to satisfactorily use the procedure, as evidenced by experience and training. All persons must have demonstrated competency in the qualification criteria set in the Job Performance Measure (Attachment 9.6.) or e-Exam IH75190. Qualification on this JPM is required on a 3 year basis.

8.0 References

8.1 ACGIH: Threshold Limit Values 2005
8.2 DOE: 10CFR 850 Chronic Beryllium Disease Prevention Program
8.3 EPA: Toxic Substance Control Act (TSCA) 40CFR745.227

8.4 Ness, S.A.; *Surface and Dermal Monitoring for Toxic Exposures*, Van Nostrand Reinhold, 1994.
8.5 NIOSH: Manual of Analytical Method, Method 9100: *Lead in Surface Wipe Samples*.
8.6 OSHA: 29CFR1910.1000 Table Z1, Z2; and 1910.1027.
8.7 OSHA: Technical Manual Section II, Chapter 2.

9.0 Attachments

9.1 Sample of Signs for Areas and Equipment
9.2 Wipe Sampling Technique for Hexavalent Chromium
9.3 Surface Wipe Criteria Requirements & Recommendations
9.4 Environmental Evaluation of Surface Wipe Sampling
9.5 Sample of Surface Contamination Sampling Form
9.6 SHSD Job Performance Measure (JPM) Completion Certificate

10.0 Procedure Documentation

ISM Review - Hazard Categorization:	☐ High;	☒ Moderate;	☐ Low/Skill of the craft
Validation:	☐ Formal Walkthrough	☒ Desk Top Review	☒ SME Review

Re	Revision Log
0	New document. Prepared By R. Selvey, CIH 02/25/2000; Technical Reviewed By: N. Bernholc, CIH 02/27/00; RCD Facility Support Approved By: 04/22/01 N. Foster Procedure Committee Review; QA Review : E. Tucker; SHSD Approved By: R. Selvey 03/02/2000
1	Revised for minor correction noted in training classes. Reviewed By: R. Selvey 10/6/00
2	Added new format, SBMS header and reviewed sections on Hazard assessment, PPE. Added Waste Disposal and Environmental Impact text. Reviewed By: R. Selvey 02/05/01
3	Minor format change. Converted SOP number from IH-FP-3.2 to new system IH75190. Reviewed By: R. Selvey 03/09/01
4	Revised to include RCD Facility Support Procedure Committee Review comments. Reviewed By: R. Selvey 04/22/01
5	Updated Table 1 adding Arsenic and Cadmium Media. Update Table 3 with Arsenic and Cadmium Release Criteria and update EPA Lead Criteria. Reviewed By: R. Selvey 04/10/02
6	Updated Table 1 to correct error in lead criteria. Insert Section 7 and transfer information from section 4. Renumbered attachments. Reviewed By: R. Selvey 4/17/02
7	Added Best Management Practice release criteria for Arsenic and Cadmium to Table 3. Reviewed By R. Selvey 08/16/02:
8	Added Best Management Practice release criteria for Nickel to Table 3. Reviewed By: R. Selvey 10/17/02
9	Full review of SOP. Significant text changes. Deleted OSHA Method for procedure & PCB criteria. Updated Attachments 9.1 and 9.2. Added Attachment 9.3. Reviewed By: R. Selvey 05/21/04
10	Added reference and link to JRA-05 in 5.1. Added text to 6.2.2 to clarify using Table 1 to determine 100cm2 versus 1 sq ft. Changed "S-stroke" wording in 6.2.3.through 6.2.5 to avoid confusion with the S-stroke used the Health Physics terminology. The two patterns are different. Changed the qualification criteria in Section 7 to reflect the unified qualification policy. Updated the Sample form (Attachment 9.1) to reflect the *Compliance Suite* order of sample numbering. Reviewed By: R. Selvey 02/21/06
11	Reworded the "S-stroke" wording in 6.2.3.through 6.2.5 to avoid confusion with the S-stroke used the Health Physics terminology. Passage on "dabbing" was modified to indicate that the dabbing action replacing pulling the media, but does not replace the S-pattern. Minor typo corrections in Section 5 and 6. Reviewed By: R. Selvey 02/21/06
12	Section 6.3 was added with a reference to new Attachment 9.4; Table 1: was updated to include hexavalent chromium. Attachment 9.4 was added to include Liberty Mutual Wipe Sample Method. Liberty Mutual method was added. Section 8 References and Attachment 9.4 was added and included in Section 9.0 Attachments. Reviewed By: J. Peters 11/28/06; Reviewed By: R. Selvey 12/05/06
13	Added Section 4.1, 4.2 and 5.6. Revised 5.2. Added document control to attachment 9.3 and 9.4. Reviewed By: R. Selvey 05/23/07
14	Table 3: Updated to include Cobalt and description of calculation. Changed IH training link in Step 7.1. Reviewed By: M.Chuc 09/22/08 Reviewed By: *R. Selvey 10/13/08*
15	Added Attachment 9.5. Reviewed By: *R. Selvey 02/09/09*
16	Edited section 4.0 and 5.2 for brevity. Added definition for Release and Housekeeping Criteria. Changed Cr6 release level based on OSHA recommendation. Added ANSI Caution to Attachment 9.1 sign. Revised directions in Attachment 9.2. Reviewed By: *R. Selvey 03/21/11*
17	Full review of steps 1 to 7. Expanded and revised Release and Housekeeping Criteria definitions in Section 3 and in Table3. Reviewed By: *R. Selvey 04/27/11*
18	Corrected error in units in section 3: mg/100cm^2 to ug/100 cm^2. Reviewed By: *R. Selvey 05/10/11*
19	Edited Section s 2 and 7 to remove reference to rescinded HP65100. Changed format of Section 9. Reviewer: R. Selvey 03/04/14
20	Total review and revision. Replaced Table 3 with Appendix 9.3 and added OSHA Technical Manual ratio. Removed criteria for Al, Ba, Co, Cu, Hf, In, Mn, Mo, Pt, Rh, Se, Ag, Ta, Te, Tl, Sn, W, Y, Yt, and Zr. Added link to e-Exam and e-form. Added short-life disclaimer to Cr6 in Attachment 9.2. Revised by: R. Selvey 06/13/8/16

21	Revised Attachment 9.3 to correct Cr+6. Added column for ug/sq ft. Corrected error in Table 1 Attachment 3. Revised by; R. Selvey 09/13/16.
22	Revised Attachment 9.3 to remove no-regulated Nickel and CrIII and adjusted values for Arsenic and CrVI to match OSHA Housekeeping philosophy. Added proposed changes for all release criteria to allow comments on impact. Revised by; R. Selvey 05/01/17.
23	Team reviewed revision to Attachment 9.3. Values aligned with OSHA, EPA/HUD and DOE policies. Approved by: R. Selvey 06/23/17

Attachment 9.1

Samples of Signs for Areas and Equipment

CAUTION

Cadmium Surface Contamination

Some surfaces in this area have Cadmium levels above BNL Guidelines

- **Do NOT perform operations that causes the dust to become airborne (such as using an air hose to clean surfaces or dry sweeping)**
- **Contact SHSD IH Group x-7475 prior to Building Renovations or Demolition**
- **Wash hands prior to eating, drinking, chewing gum, or smoking**
- **Do not eat or drink in this area.**

CLEAN

The material on this pallet is <u>below</u> (i.e. cleaner than) the SHSD Best Management Practice Surface Release Guidelines for Lead and Cadmium

It is appropriate to be released and used anywhere at BNL without any specific precautions.

Exceeds Guidelines for Lead or Cadmium

The material on this pallet is <u>above</u> (i.e. not cleaner than) the SHSD Best Management Practice Surface Release Guidelines for Lead and/or Cadmium

Specific precautions are needed in areas where this material is used or stored.

- **No operations that cause airborne dust (such as air hoses, blowers, or dry sweeping)**
- **Wash hands prior to eating, drinking, chewing gums, or smoking.**
- **Do not eat or drink in this area.**
- **Notify occupants of the area of the presence of Lead/Cadmium on these surfaces.**

Attachment 9.2

WIPE SAMPLING TECHNIQUE FOR HEXAVALENT CHROMIUM

Note: Hexavalent Chromium has a short life on surfaces. Sampling and analyzed needs to be completed within a few days of generation. For sampling of long term dust accumulations, use Cr3 sampling.

Materials supplied by the lab:

Sampling media:

- For chrome plating: PVC or binderless quartz filter. All other operations:
  - 5 um, 37-mm PVC filter for smooth surfaces
  - 0.45 mm thick 37-or 47-mm binderless quartz fiber filter for rough surfaces (preferred media for both smooth and rough surfaces)
- Immediately after sampling, place the filter sample in a vial containing 10% Na_2CO_3 with 2% $NaHCO_3$ to stabilize the Cr^{+6}.
- Do not use Ghost wipe®, Whatman, mixed cellulose ester (MCE) or glass fiber filter as they convert Cr^{+6} to Cr^{+3}.

Template (10 cm x 10 cm)
Teflon coated or plastic tweezers
Empty glass vials
Glass vials containing 5 ml aqueous solution of 10% Na_2CO_3 with 2% $NaHCO_3$ for chrome plating samples
Powderless gloves

Sampling Technique:

1. Prepare a sufficient number of vials, each labeled with a unique number.
2. Sketch a diagram of the room or area to be sampled.
3. Wear a new pair of clean gloves for each sample. **DO NOT** use powdered gloves.
4. Record the sample vial number and location where the sample is taken.
5. Remove the filter from the carrying container with a clean PTFE-coated tweezers or plastic tweezers. **DO NOT** use metal tweezers to handle the filters, as they could deposit Cr^{+6} onto the filters.
   Note: Surfaces should not be wetted with water as the water will allow any metal interference to interact with Cr^{+6} thereby affecting the results.
6. Use firm pressure when wiping the surface. Start at the one corner moving to the opposite side then upward one wipe width and wipe back to the starting side. Repeat to cover the whole surface area. Fold inward and repeat wiping the entire surface again. Fold in and repeat a third time.
7. After wiping, fold the filter with the contaminant side inward. Place the filter immediately in the sample vial and cap. *Filter samples taken in chrome plating operation must be placed in a vial containing 10% Na_2CO_3 with 2% $NaHCO_3$ to stabilize the Cr^{+6}.*
8. Submit at least one blank wipe filter, treated in the same fashion, but without wiping.
9. Sample results will be reported as ug/100cm^2. OSHA's target concentration is 0.050ug/100 cm^2.
10. Ship samples immediately. If unable to ship immediately, keep cold then ship next day air to the lab.

Attachment 9.3

Required and Recommended Surface Wipe Criteria

06/26/17

Compound	Criteria ug/100cm^2	Criteria ug/ft^2		Criteria type R = Requirement; G= Guidance, Recommended, Non-regulatory	OSHA PEL ug/m^3
Arsenic (As) 29CFR1910.1018	100	929	G	OSHA Regulated Areas [AFAP] & Operational Areas: Floors & accessible surfaces	10 ug/m^3
	6.7	62	G	Non-Operational Areas: Floors & accessible surfaces	
Beryllium (Be) 10CFR850	3.0	28	R	DOE Regulated Areas & Be Operational Areas: Floors & accessible surfaces [Housekeeping]	2 ug/m^3
	0.2	1.9	G	Non-Operational Areas & Public Areas: Floors & accessible surfaces	
	3.0	28	R	Equipment Release to Be Operational Areas	
	0.2	1.9	R	Equipment Release to Non-beryllium Area of a DOE facility & Public	
Cadmium (Cd) 29CFR1910.1027	50	465	G	OSHA Regulated Areas [AFAP] & Operational Areas: Floors & accessible surfaces	5 ug/m^3 [.1027] 200 ug/m^3 [Z.2]
	3.3	31	G	Non-Operational Areas: Floors & accessible surfaces	
Chromium, hexavalent (Cr) VI 29CFR1910.1026	50	465	G	OSHA Regulated Areas [AFAP] & Operational Areas: Floors & accessible surfaces	5 ug/m^3
	3.3	31	G	Non-Operational Areas: Floors & accessible surfaces	
Lead (Pb) 29CFR1910.1025	500	4645	G	Accelerator Operational Areas & OSHA Regulated Areas [AFAP]: Floors & accessible surfaces	50 ug/m^3
	50	465	G	Laboratory Operational Areas: Floors & accessible surfaces	
	22	200	G	Non-Operational Areas: Floors & accessible surfaces	
	22	200	G	OSHA 1926.62 Construction Sites: change areas, storage facilities, & lunchrooms [Housekeeping]	
	4.3	40	G	Eating & food prep surfaces	
	43	400	G	Public/Lodging/Childcare- Window troughs	
	27	250	G	Public/Lodging/Childcare- Window sills	
	4.3	40	G	Public/Lodging/Childcare- Floors, Eating & food prep surfaces	
Acrylonitrile 29CFR1910.1045	43	400	G	OSHA Regulated Areas [AFAP] & Operational Areas: Floors & accessible surfaces	[2 ppm] 4.3 ug/m^3
Dibromodicloro-propane 29CFR1910.1044	1.0	9.3	G	OSHA Regulated Areas [AFAP] & Operational Areas: Floors & accessible surfaces	[1 ppb] 0.01 ug/m^3
Methylenedianiline 29CFR1910.1050	0.8	7.5	G	OSHA Regulated Areas [AFAP] & Operational Areas: Floors & accessible surfaces	[10 ppb] 0.08 ug/m^3

Definition (for purposes of the table above):

AFAP: As Free As Practicable; Housekeeping- All surfaces shall be maintained as free as practicable of accumulations of [OSHA Regulated Substances]: Arsenic: 1910.1018(k); Cadmium: 1910.1027(k); Chromium: 1910.1026(j); Lead: 1910.1025(h); Acrylonitrile: 1910.1045(k) DBCP: 1910.1044(k); MDA: 1910.1050(l). The enumerated guidance criteria level is based on: OSHA Technical Manual; Section II: Chapter 2 Surface Contaminants, Skin Exposure, Biological Monitoring and Other Analyses; III. Wipe Sampling, Field Portable X-Ray Fluorescence Sampling, Dermal Sampling and Biological Monitoring; A. Surface Wipe Sampling.

Accessible surfaces: Surfaces that can reasonably be expected to be contacted during typical operations. This would include table tops, desks tops, and other surfaces where contact with hands, arms and body are likely. [BNL]

Eating & Food Prep Surfaces = Surfaces on which food preparation, eating & drinking are done. This includes lunchroom counters/tables; kitchen counter tops, stove tops; water cooler surfaces; and tables/desks in offices/conference rooms where food and beverage consumption is permitted. [BNL]

Equipment Release to Operational Area [Beryllium] = Maximum removable contamination on equipment that is being released to a facility using the beryllium. Equipment must be labeled and sealed in impermeable bag or container. [DOE 10CFR850.31]

Equipment Release to Operational Area [OSHA Regulated Substance] = Maximum removable contamination on equipment that is being released to a facility using the regulated substance. [BNL]

Equipment Release to Non-Operational Area or Public [Beryllium] = Maximum removable contamination on equipment that is being released to the general public or to a non-beryllium area of a DOE facility. Equipment release is conditioned on the recipient's commitment to implement controls that will prevent foreseeable beryllium exposure, considering the nature of the equipment or item and its future use and the nature of the beryllium contamination. [DOE 10CFR850.31]

Equipment Release to Non-Operational Area or Public [OSHA Regulated Substance] = Maximum removable contamination on equipment that is being released to the general public or to a Non-Operational Area. [BNL]

Housekeeping = Maximum level allowed on accessible surfaces in Operational Areas during Non-Operational periods. Surfaces contaminated with dusts and waste must not exceed a removable contamination level criterion during Non-Operational periods. This sampling would not include the interior of installed closed systems such as enclosures, glove boxes, chambers, or ventilation systems. [DOE 10CFR850.30]

Non-Beryllium Area = Area where beryllium is not used in a DOE facility. [DOE 10CFR 850.31]

Non-Operational Area [Beryllium] = Area where beryllium is not used and where workers are not trained in hazards and controls. Personal hygiene control practices are not in place (hand washing is not expected on exiting the area) and eating & drinking are permitted. [BNL]

Non-Operational Area [OSHA Regulated Substance] = Area where an OSHA Regulated Substance is not used and where workers are not trained in hazards and controls. Personal hygiene control practices are not in place (hand washing is not expected on exiting the area) and eating & drinking are permitted. [BNL]

Operational Area [Beryllium] = Area where workers are routinely in the presence of beryllium as part of their work activity. [DOE 10CFR850.3]

Operational Area [OSHA Regulated Substance] = Area where workers are routinely in the presence of an *OSHA Regulated Substance* as part of their work activity. Workers who handle the substance have been trained in hazards and controls. Substances are routinely used, handled or stored and personal hygiene control practices are in place (e.g. eating, drinking are prohibited in the area; hand washing is expected on exiting the area). Examples: lead shielding blocks, shops, and accelerator areas using organic and inorganic metallic compounds. [BNL]

OSHA Regulated Substance = A substance regulated in 29CFR1910.1003-1054 in the expanded health standards:

- Metals:
  - Arsenic 29CFR1910.1018;
  - Cadmium 29CFR1910.1027;
  - Chromium, hexavalent 29CFR1910.1026;
  - Lead 29CFR1910.1025
- Chemicals:
  - Acrylonitrile 29CFR1910.1045;
  - Benzene 29CFR1910.1028;
  - Dibromodicloro- propane 29CFR1910.1044;
  - Formaldehyde 29CFR1910.1048;
  - Methylenedianiline 29CFR1910.1050;
  - Methylene Chloride 29CFR1910.1052;
- OSHA 13 carcinogens = 4-Nitrobiphenyl, Chemical Abstracts Service Register Number (CAS No.) 92933; alpha-Naphthylamine, CAS No. 134327; methyl chloromethyl ether, CAS No. 107302; 3,3'-Dichlorobenzidine (and its salts) CAS No. 91941; bis-Chloromethyl ether, CAS No. 542881; beta-Naphthylamine, CAS No. 91598; Benzidine, CAS No. 92875; 4-Aminodiphenyl, CAS No. 92671; Ethyleneimine, CAS No. 151564; beta-Propiolactone, CAS No. 57578; 2-Acetylaminofluorene, CAS No. 53963; 4-Dimethylaminoazo-benzene, CAS No. 60117; and N-Nitrosodimethylamine, CAS No. 62759. [OSHA]

Public = Persons who are not: DOE employees, BSA employees, contractors, sub-contractors, and persons with Student, Intern, User or Guest appointments. The public includes visitors and family members living in residence at Upton. They are not trained by BNL in hazards and controls of toxic substances. [BNL]

Public/ Lodging/Childcare Areas = Area open to the public for periods longer than short visits or tours or areas intended for frequent access by visitors and/or family members. Eating and drinking is allowed in public areas. Occupants are not trained in the hazards of the metal or control measures. Hand washing is not expected on exit of the area. Public areas include: Science Museum (935), Coin Laundry (363), Berkner Hall (388), Swimming Pool (462), Gymnasium (461), Brookhaven Center (30), Research Support Building (400), BNL Upton on-site housing: Cavendish (153), Compton (170), Curie (258), Fleming (180), Guest House (257), Danish House (388), Apartments, Efficiencies; and areas with high occupancy by children: Child Development Center (370), Recreation Hall (317), School House (373) [BNL]

Regulated Area [Beryllium] = Area demarcated by the responsible employer in which the airborne concentration of beryllium exceeds, or can reasonably be expected to exceed, the action level. [DOE 10CFR850.3]

Regulated Area [OSHA Regulated Substance] = Area where an OSHA Regulated Substance is used in a manner that airborne exposure levels exceed the Permissible Exposure Limit. Area is formally demarcated and access to the area is controlled to those meeting the entry requirements in the OSHA regulation. Personal hygiene control practices are in place; eating and drinking are prohibited; hand washing is expected on exiting the area. OSHA standards require these areas to be “As Free As Practicable”. The OSHA Technical Manual (G1) provides a recommended method to enumerate AFAP [BNL]

IH 75190 Attachment 9.4

Environmental Evaluation of Surface Wipe Sampling for Chemicals/Metals

Operation Description: Field samples for potential metals or chemicals are collected on pre-moistened pads. This process concentrates toxic substances on the media. The wipes are either sent off-site for analysis or in some instances are analyzed at BNL by the IH Group using direct reading meters.

Frequency of Operation: 10 to 20 times per year.

Environmental impact:

- The wipes sampled at BNL are consumed in the analysis at the end of test by the off-site lab. Conformance with proper wipe disposal by the off-site vendor laboratory is validated to BNL IH Group's satisfaction in the AHIA Accreditation process.
- PPE used during sampling and the paper templates are disposed of at the direction of the EPD ECR. The current policy is for disposal as non-hazardous waste. This is justified because the concentration is too low to be of concern (a few micrograms per wipe surface).

Waste Disposal:

- PPE and paper templates are disposed of as non-hazardous waste, unless otherwise directed by EPD.

Brookhaven National Laboratory
Safety & Health Service Division
Industrial Hygiene Group

Surface Contamination Sampling Form

BNL-IH75190 Attachment 9.5 Sample- Do not use

Analyte:

	LEAD
	BERYLLIUM
	CADMIUM
	Other:

DEPT:
BUILDING:

LOCATION NAME, ROOM NUMBER & DESCRIPTION:

Sample Media:

	Ghost Wipe™
	Cotton Gauze Size:
	Filter Paper Type & Size:
	Other:

Solvent:

	Pre-Moistened
	Distilled Water
	Hexane
	Isopropanol
	Other:

Surface Area Measurement:

	Template
	Measured Area
	Estimated Area
	Other:

REASON FOR SAMPLING:

___Area Characterization
___Pre-Remediation
___Post Remediation

Other:

Sample Identification

Sample Number				Sample Location	Surface Type Metal / Plastic / Glass /Painted Wood / Wood / Painted Concrete / Concrete	Surface Area
Bldg#	MMDDYY	Analyte Symbol	Sample #			
						_____1 ft^2 _____100 cm^2 other: _____
						_____1 ft^2 _____100 cm^2 other: _____
						_____1 ft^2 _____100 cm^2 other: _____
						_____1 ft^2 _____100 cm^2 other: _____

Sample of online form
Use e-Forms from SHSD web page current version

___Additional Samples next page

Total Number of Samples:_____

SAMPLE DATE:	**RELINQUISHED TO SHSD IH LAB BY: (SIGNATURE):** / **DATE /TIME:** /
SAMPLES TAKEN BY: (Print Name and Signature) /	**RECEIVED BY SHSD IH LAB EMPLOYEE (SIGNATURE):** / **DATE /TIME:** /

BROOKHAVEN NATIONAL LABORATORY

IH75190 Attachment 9.6

HP-IHP-75190

Environmental, Safety, Health & Quality Directorate
SHSD Industrial Hygiene

Surface Wipe Sampling for Metals
Job Performance Measure (JPM) Completion Certificate

Candidate's Name	Life Number:	Qualification Number: **HP-IHP- 75190**

Knowledge of the Principles of Surface Wipe Sampling **Demonstrated by Written Exam**

Criteria	Qualifying Standard
Hazard Analysis	Understands the need to perform a hazard analysis of the sampling area and potential exposure to the sampler.
Personal Protective Equipment	Understands the need to be aware of the potential surface contamination and airborne levels of contaminants and knows how to determine the need for PPE.
Sampling Protocol	Understands the exposure monitoring logic necessary to appropriately select sampling locations to accurately measure worker, public and environmental exposure potential.
Analysis of data	Understands the need to perform analysis on the sampling data to assess potential exposure to the sampler, worker, public and environment, and to recommend corrective actions as necessary.

Practical Skill Evaluation: Demonstration of Surface Wipe Methodology

Criteria	Qualifying Performance Standard	Unsat.	Recov.	Satisf.
Sampling Equipment	Knows where equipment needed for the procedure is located and how to properly sign it out.			
Moistening Media	a. Filter/gauze: Moistens media with the appropriate solvent. Applies solvent to moisten approximately 80% of the area of the media. Does not over moisten. b. For pre-moistened media, shows reduction in size of wipe.			
Size of Area & Use of Template	Understands the importance of quantifying the area sampled. Demonstrates placing template on surface or measuring the surface area.			
Folding Media at each wipe step	Demonstrates the inward folding of media after each wipe and placement of media into container so that surfaces loaded in the wiping are not exposed.			
NIOSH Method wipe pattern	Demonstrates the technique of three passes of wiping in "S" pattern, changing the direction on second pass, original direction on third pass.			
Choose correct solvent	Knows how to select correct solvent from Table 1.			
Select the correct number of samples	Knows how to choose the appropriate numbers of samples based on Table 2.			
Record forms	Shows how to correctly and completely fill all forms associated with this SOP.			

I accept the responsibility for performing this task as demonstrated within this JPM and the corresponding SOP.

Candidate Signature:	Date:

I certify the candidate has satisfactorily performed each of the above listed steps and is capable of performing the task unsupervised.

Evaluator Signature:	Date:

ATTACHMENT 3
EPA BULK ASBESTOS SAMPLING SOP

COPY

Region 4
U.S. Environmental Protection Agency
Science and Ecosystem Support Division
Athens, Georgia

GUIDANCE DOCUMENT

Title: **Bulk Sampling for Asbestos**

Effective Date: June 4, 2013	**Number:** SESDGUID-104-R1

Author

Name: Doug Jager
Title: Environmental Scientist
Signature: Date: 6/3/2013

Approvals

Name: Danny France
Title: Chief, Enforcement and Investigations Branch
Signature: Date: 6/3/13

Name: Bobby Lewis
Title: Field Quality Manager, Science and Ecosystem Support Division
Signature: Date: 6/3/13

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Revision History

The top row of this table shows the most recent changes to this controlled document. For previous revision history information, archived versions of this document are maintained by the SESD Document Control Coordinator on the SESD local area network (LAN).

History	Effective Date
SESDGUID-104-R1, *Bulk Sampling for Asbestos,* Replaces SESDGUID-104-R0 **General:** Corrected any typographical, grammatical and/or editorial errors. **Title Page:** Changed author from Greg Noah to Doug Jager. Changed Enforcement and Investigation Branch Chief from Archie Lee to Danny France. Changed Field Quality Manager from Laura Ackerman to Bobby Lewis. **Revision History:** Changes were made to reflect the current practice of only including the most recent changes in the revision history. **Section 1.2:** Added the following statement - Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.	**June 4, 2013**
SESDGUID-104-R0, *Bulk Sampling for Asbestos,* Original Issue	**August 7, 2009**

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TABLE OF CONTENTS

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1 General Information

1.1 Purpose

This document describes how SESD conducts bulk sampling for asbestos and asbestiform fibers during investigations. The purpose of these investigations is to determine quantity and type of asbestos that may be present onsite to assist decision makers in recommending a course of remediation, enforcement action, or management control.

1.2 Scope/Application

The procedures contained in this document cover the bulk sampling methodology of collecting bulk asbestos samples from bulk materials by SESD personnel and how asbestos investigations are conducted. This procedure contains direction developed solely to provide internal guidance to SESD employees. Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.

1.3 Documentation/Verification

This procedure was prepared by persons deemed technically competent by SESD management, based on their knowledge, skills and abilities and has been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the SESD local area network (LAN). The Document Control Coordinator is responsible for ensuring the most recent version of the procedure is placed on the SESD LAN and for maintaining records of review conducted prior to its issuance.

1.4 Definitions

1.4.1 Bulk Sample

A small portion (usually thumbnail size) of a suspect asbestos-containing building material collected for laboratory analysis to determine asbestos content.

1.5 References

SESD Operating Procedure for Control of Records, SESDPROC-002, Most Recent Version

SESD Operating Procedure for Equipment Inventory and Management, SESDPROC-108, Most Recent Version

SESD Operating Procedure for Logbooks, SESDPROC-010, Most Recent Version

SESD Operating Procedure for Report Preparation and Distribution, SESDPROC-003, Most Recent Version.

SESD Operating Procedure for Sample and Evidence Management, SESDPROC-005, Most Recent Version

US EPA. Safety, Health and Environmental Management Program Procedures and Policy Manual. Region 4 SESD, Athens, GA, Most Recent Version

USEPA, 40 Code of Federal Regulations, Part 763.86, Asbestos - Sampling

1.6 General Precautions

1.6.1 Safety

Asbestos exposure is primarily an inhalation hazard. Respiratory protection should be worn that will meet the protection factor designated in the SESD Safety, Health and Environmental Management Program Manual if there is risk of friable asbestos containing material becoming airborne. Also, if friable asbestos is expected to be disturbed, protective clothing may be necessary to avoid contaminating the worker and the site.

Refer to the SESD Safety, Health and Environmental Management Program Manual and any pertinent site-specific Health and Safety Plans (HASPs) for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional. When using this procedure, minimize exposure to potential health hazards through the use of protective clothing, eye wear and gloves. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate.

1.6.2 Procedural Precautions

The sampler should be aware that cross contamination and disruption of asbestos containing material is a potential when conducting bulk asbestos sampling.

The sampler should take the following precautions to avoid cross contamination and disruption of material while sampling.

- The sampling tool must be cleaned with amended water after every sample is collected, or a different clean tool must be used.
- The sampler must avoid touching the material being sampled with his/her hands.

- The area being sampled must be sufficiently wet before collecting the sample.
- The space left after sampling must be enclosed or encapsulated to reduce the chance of airborne exposure.
- The object or material sampled should be minimally disturbed during the sampling process.

2 Quality Control

Since bulk asbestos sampling is conducted using an object to essentially cut out or off a small amount of material for analysis, quality control is limited to controls instituted in the field to reduce the risk of cross contamination. The precautions for reducing the chance of cross contamination are listed above in Section 1.6.2, Procedural Precautions. The main objectives are cleanliness of the sampling tool and adequate wetting of the material to reduce the risk of airborne exposure of asbestos fibers to the sampler or other unused sampling tools or equipment. Quality control steps for the analysis of sample are noted in the contract laboratory's Standard Operating Procedures and Quality Assurance Plans.

3 Methodology

3.1 Summary of Procedure

SESD uses the method described in 40 CFR Part 763.86, Sampling (for asbestos) for collecting bulk asbestos samples. This method describes sampling for surfacing material, thermal system insulation, and miscellaneous material. 40 CFR Part 763.92(a) (1) and (2), and 40 CFR Part 763, Subpart. E, Appendix C also contain ancillary topics related to project management and planning that are suggested for bulk asbestos sampling.

The sampler or sampling team identifies areas with suspect materials to be sampled for asbestos. Materials that might be suspect for asbestos may include, but are not limited to, thermal system insulation, joint compound, roofing material, gaskets, floor coverings, decorative coatings, and wire insulation. The sampler will use a sampling tool appropriate for each kind of material and collect samples in airtight containers for subsequent laboratory analysis. The sampler should always use a clean tool to collect the sample, and special attention must be paid to avoid creation of airborne asbestos. This method is intended to provide material to a laboratory where the fibers can be quantified and qualitatively identified as a specific type of asbestos or non-asbestiform fiber. Sample location (GPS), study site, sample description, time, date and project identification number should be recorded in the logbook, and pictures may be taken of the samples.

3.2 Apparatus, Materials, and Chemicals

- Sampling tool (knife, corer, spatula, etc)
- Spray bottle of tap water amended with a few drops of dishwashing liquid
- Disposable low lint wipes for cleaning tools
- 8 ounce glass jars
- Respirator
- Latex gloves
- Disposable Tyvek® clothing
- Silicone caulk or appropriate sealant
- Global Positioning System (GPS) receiver
- Camera
- Project logbook

3.3 Personnel Training for Bulk Sampling

Personnel will be trained to collect bulk asbestos samples using the requirements set forth in 40 CFR Part 763.92(a) (1) and (2) and 40 CFR Part. 763, Subpart. E, App. C. The training incorporates many sections of 40 CFR Part 763, but should focus on the sampling method listed in 40 CFR Part 763.86. The training includes inspection planning, bulk sampling, personal protection, and reporting. Personnel must demonstrate proficiency by identifying areas where asbestos may be found and properly collecting a bulk sample using proper methodology.

3.4 Maintenance and Calibration

All instruments will be maintained and operated in accordance with the manufacturer's instructions and the SESD Operating Procedure for Equipment Inventory and Management (SESDPROC-108). All instruments placed in service will be calibrated to ensure that they are operational before they are taken to the field. If the instrument is not functioning properly, it will be red tagged and taken out of service. An instrument that has been red tagged will be repaired by personnel qualified to do instrument repair or by authorized company representatives, then calibrated and returned to service.

3.5 Records

Information generated or obtained by SESD personnel will be organized and accounted for in accordance with the SESD Operating Procedure for Control of Records (SESDPROC-002). Field notes, recorded in a bound field logbook, will be generated, as well as chain-of-custody documentation in accordance with SESD Operating Procedure for Logbooks (SESDPROC-010) and SESD Procedure for Sample and Evidence Management (SESDPROC-005).

3.6 Data Review and Documentation

Data will be reviewed to ensure that the data is complete and meets the enforcement/technical requirements of the particular investigation objectives. The data will be reviewed by the project leader, team members, other technical experts and SESD quality control staff, as appropriate. This review will be conducted in accordance with SESD Operating Procedure for Report Preparation and Distribution (SESDPROC-003).