



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8

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TECHNICAL MEMORANDUM

SUBJECT: Request for Region 8 Superfund Emergency Response Program Assistance for the Billings PCE superfund site in Billings, MT.

TO: Roger Hoogerheide, RPM, USEPA R8, Montana
Bridget Williams, RPM, USEPA R8, Montana

FROM: Jason Fritz, Ph.D., Toxicologist, Toxicology Team Lead and Acting Manager, Technical Assistance Branch, EPA Region 8 Laboratory Services and Applied Sciences Division

RE: Exceedances of Removal Management Levels in Residential Structures

Summary:

The Billings PCE (BPCE) vapor intrusion (VI) Study Area (the “Site”) is defined by a 100-foot buffer surrounding the 1.0 microgram per liter ($\mu\text{g/L}$) perchloroethylene (PCE) isopleth, as defined in the 2019 RI Report (Trihydro, 2019). The Site was added to the National Priorities List in the Federal Register in September 2021, and includes a shallow groundwater contaminant plume encompassing 855 acres and extending three miles through numerous mixed-use neighborhoods into downtown Billings. Groundwater contamination is associated with releases of dry-cleaning chemicals, including PCE, trichloroethylene (TCE), *cis*-1,2-dichloroethylene (1,2-DCE), as well as petroleum hydrocarbons and volatile organic compounds (VOCs) such as chloroform from other industrial sources. Based upon historical data, and recent sampling of sub-slab soil vapor (SS), crawlspace (CS) and/or indoor air (IA) from approximately 70 structures conducted in April, 2022, a complete VI pathway has been identified at some structures. Analytical results were compared against VI screening levels (VISLs), including sub-slab soil vapor action levels (SSAL), consistent with EPA and Montana Department of Environmental Quality (DEQ) recommendations for VI investigations (EPA, 2015a,b; MTDEQ, 2021).

While results from numerous structures exceeded regional screening levels (RSLs) and comparable VISLs based upon a hazard quotient (HQ) > 0.1 , and/or a cancer risk (CR) value of $> 1 \times 10^{-6}$ (EPA, 1991a,b), results from the nine residential structures described below were especially concerning, because they exceeded removal management levels (RMLs), or comparable SSALs, for one or more Site contaminants of potential concern (COPC).

As a Toxicologist responsible for providing technical support to the Region 8 Superfund program, I recommend securing removal group support for acting based upon concerns for human exposures above RMLs, and the resulting increased potential for adverse effects on public health (EPA, 1991a).

Analysis:

The baseline human health risk assessment (HHRA) for Billings PCE has not yet been completed (EPA, 1991b); as part of the remedial investigation, sample data was compared against VISLs, SSALs, and RMLs as described above (EPA, 1991a), and selected results are illustrated below in Table 1 for specific residential structures of concern.

Table 1 Selected Analytes from Specific Residential Structures

Tier	Property	Sample Location	Sample Date	PCE ⁴	TCE ⁴	1,2-DCE ⁴	Chloroform ⁴
		EPA Residential IA VI RML ¹		125	2.09	125	12.2
		EPA Residential IA VISL ²		4.17	0.209	4.17	0.122
		EPA Residential SSAL ³		139	6.95	139	4.07
1		IA-DININGROOM_04	4/20/2022	18.0	1.52	< 0.234 U	
		IA-LIVINGRM_05	4/20/2022	16	0.96	< 0.018 U	0.80
		CS-BASEMENT_01	4/20/2022	35.7	2.95	< 0.234 U	
		CS-BASEMENT_01D	4/20/2022	36.1	3.06	< 0.234 U	
		CS-CRAWLSPACE_03	4/20/2022	19	1.1	0.058 J	0.60
1		IA-BASEMENT_02	4/21/2022	31.9	6.55	0.226 J	
		IA-MASTERBED_03	4/21/2022	24.6	4.66	< 0.226 U	
		CS-CRAWLSPACE_01	4/21/2022	21.1	3.89	< 0.226 U	
		SS-BASEMENT_05	4/21/2022	9900 J	1100 J	17 J	42 J
1		IA-BASEMENT_02	4/22/2022	30.4	3.33	< 0.226 U	
		IA-KITCHEN_03	4/22/2022	17.9	2.13	< 0.226 U	
		CS-BASEMENT_01	4/22/2022	33.9	4.41	< 0.226 U	
1		IA-BASEMENT_01	4/25/2022	130 D	7.52	0.238 J	
		IA-LIVINGROOM_02	4/25/2022	104 D	5.83	< 0.232 U	
		SS-BASEMENT_03	4/25/2022	7600 J	340 J	14 J	16 J
2		IA-BASEMENT_07	4/20/2022	9.68	1.32	< 0.234 U	
		IA-BASEMENT_08	4/20/2022	6.5	0.67		0.24
		IA-LIVINGROOM_09	4/20/2022	3.02	0.419 J	< 0.234 U	
		SS-BASEMENT_11	4/19/2022	36000	3100	200	160
2		IA-BASEBDRM_06	4/27/2022	2.07	0.957	< 0.235 U	
		IA-BEDRM_07	4/27/2022	0.907	< 0.378 U	< 0.235 U	
		SS-BASEMENT_08	4/27/2022	23000 J	5500 J	490 J	87 J
2		IA-BASEMENT_01	4/27/2022	8.82	1.11	< 0.192 U	
		IA-HALLWAY_02	4/27/2022	8.98	1.00	< 0.192 U	
		SS-BASEMEN_04	4/27/2022	8100 J	660 J	14 J	25 J
3		IA-BASEMENT_01	4/20/2022	2.61	< 0.376 U	< 0.234 U	

Tier	Property	Sample Location	Sample Date	PCE ⁴	TCE ⁴	1,2-DCE ⁴	Chloroform ⁴
		IA-BASEMENT_01D	4/20/2022	2.18	< 0.376 U	< 0.234 U	
		IA-LIVRM_03	4/20/2022	1.84	< 0.376 U	< 0.234 U	
		SS-BASEMENT_05	4/20/2022	1600 J	120 J	0.55 J	2.4 J
		SS-BASEMENT_05D	4/20/2022	1400 J	94 J	0.95 J	2.6 J
3		IA-BEDROOM_01	4/26/2022	2.26 J	< 0.375 U	< 0.233 U	
		IA-BEDROOM_01D	4/26/2022	3.52 J	0.528 J	< 0.233 U	
		IA-BEDROOM_03	4/26/2022	0.88	0.060 J	< 0.014 U	0.68
		IA-BEDROOM_03D	4/26/2022	0.96	0.058 J	< 0.014 U	0.67
		IA-LIVINGROOM_05	4/26/2022	1.65	< 0.375 U	< 0.233 U	
		IA-LIVINGROOM_06	4/26/2022	0.41	0.035 J	< 0.014 U	0.71
		IA-LIVINGROOM_06D	4/26/2022	0.43	0.041 J	< 0.013 U	0.78
		SS-BASEMENT_08	4/25/2022	3400 J	170 J	1.8 J	1.6 J

¹ Risk management level (RML), based upon CR > 1 x 10⁻⁴ and/or HQ = 3.0 for all contaminants except for TCE, where HQ = 1.0; red highlighting indicates exceedance.

² Vapor intrusion screening level (VISL) for indoor air (IA) and crawlspace (CS) samples, based upon CR > 1 x 10⁻⁶ and/or HQ = 0.1; yellow highlighting indicates exceedance.

³ Sub-slab soil vapor action level (SSAL); yellow highlighting indicates exceedance based upon CR > 1 x 10⁻⁶ and/or HQ = 0.1; red highlighting indicates exceedance based upon based upon CR > 1 x 10⁻⁴ and/or HQ = 3.0 for all contaminants except for TCE, where HQ = 1.0, comparable to an RML for sub-slab soil vapor.

⁴ Results presented for PCE, TCE, 1,2-DCE and chloroform are presented in µg/m³. "J" and "D" codes included from laboratory reported results, as indicated.

The nine structures were categorized into priority tiers as follows:

- **Tier 1 (four structures):** RML exceedances of indoor and/or crawlspace air for one or more contaminants, along with exceedances of SSALs comparable to RMLs where SS samples were available.
- **Tier 2 (three structures):** RSL exceedances of indoor and/or crawlspace air for one or more contaminants, along with exceedances of SSALs comparable to RMLs.
- **Tier 3 (two structures):** Exceedances of SSALs comparable to RMLs for one contaminant, with lesser SSAL exceedances for one or more other contaminants.

Results:

A release of hazardous substances, pollutants, or contaminants is present due to documented VI at the Site. Multiple completed exposure pathways may exist for VI, as PCE and decomposition products TCE and 1,2-DCE, as well as other VOCs including chloroform, have been documented in the groundwater, in the sub-slab soil vapor, crawlspace and/or indoor air (TriHydro, 2019).

PCE and TCE are hazardous substances within the meaning of Section 101(14) of CERCLA because they are listed at 40 C.F.R. § 302.4. Historical groundwater, sub-slab and indoor air sampling, in addition to current results, indicate that PCE vapors are migrating into residential structures at levels that may be harmful to human health. Breathing high levels of 1,2 DCE and/or chloroform can cause nausea, drowsiness, and tiredness; breathing very high levels can be fatal. While long-term human health effects of exposure to low concentrations of 1,2 DCE are not known, effects similar to PCE and TCE are suspected.

Structures in Tier 1 are clearly being impacted by VI above RMLs for breathable air and should be the highest priority for short-term action. Impacts to breathable air in Tier 2 structures, while less than that in Tier 1, are substantial, and are present along with SS concentrations exceeding SSALs by up to 790-fold, a staggering amount, which presents very high probability of significant increases in IA over the near term. Structures in Tier 3 had limited impacts to breathable air from the April 2022 sampling event, but SSAL exceedances comparable to RMLs were detected for TCE, a contaminant of particular concern for intermediate duration exposures for women who are or may become pregnant. Therefore the possibility for unacceptable near-term impacts to indoor air resulting from any disturbance of slab integrity, change in environmental conditions, fluctuations in water table, etc, appears high.

Conclusions:

The conditions for these structures at the Site present a threat to the public health or welfare, and the environment, and may meet the criteria for a removal action as provided for in the NCP at 40 C.F.R. § 300.415(b)(2). These criteria include, but are not limited to, the following: actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.

Analytical results described above indicate that hazardous substances (PCE, TCE, cis-1,2-DCE, and chloroform), as defined by CERCLA § 101(14) are present and represent an actual or potential exposure threat to nearby human populations. Concentrations of the hazardous substance exceeds relevant screening levels, as described above (EPA 1991a,b).

Endangerment Recommendation:

Given the conditions at the Site, the nature of the known and suspected hazardous substances at the Site, and the potential for exposure, actual or threatened releases of hazardous substances from this Site may present an imminent and substantial endangerment to public health, welfare, or the environment, if not addressed for the specific structures described above.

I recommend that some manner of appropriate response action is implemented to control PCE and breakdown product vapors and/or emissions originating from Site source(s), or to otherwise reduce human residential exposures.

References:

U.S. Environmental Protection Agency (EPA). 2015a. Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air. Washington, DC. OSWER Publication 9200.2-154

U.S. Environmental Protection Agency (EPA). 2015b. Technical Guide For Addressing Petroleum Vapor Intrusion At Leaking Underground Storage Tank Sites. Washington, DC. OUST Publication. EPA 510-R-15-001

U.S. Environmental Protection Agency (EPA). 1991a. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. Washington, DC. OSWER Directive 9355.0-30

U.S. Environmental Protection Agency (EPA). 1991b. Risk Assessment Guidance for Superfund (RAGS), Volume 1, Part B. Washington, DC. EPA Publication 9285.7-01B

Montana Department of Environmental Quality. 2021. Montana Vapor Intrusion Guide. DEQ-WMRD-Vapor-1

Trihydro. 2019. Remedial Investigation Report, Billings PCE Groundwater Facility, Billings, Montana. May 15.