Letter Health Consultation

Evaluation of Contaminants in Indoor Air and Groundwater:
East High School

700 South 1600 East PCE Plume

Operable Unit 1 (OU-1): 0045S

Salt Lake City, Salt Lake County, Utah

EPA FACILITY ID: UTD981548985

October 28, 2024

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Office of Community Health Hazard Assessment
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. To prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared By:

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Office of Community Health Hazard Assessment
Atlanta, Georgia 30333

October 11, 2024

Shannon Smith
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550 Foothill Blvd Ste 202
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Dear Shannon Smith:

In 2019, the Department of Veterans Affairs Medical Center (VAMC) requested that the Agency for Toxic Substances and Disease Registry (ATSDR) review the results of indoor air, soil, and surface water samplings from a groundwater plume beneath the East Side Springs section of Salt Lake City, UT. The plume and homes associated with the contaminated groundwater are part of the 700 South 1600 East PCE Plume Superfund Site. When ATSDR's 2023 public health assessment (PHA) was originally written, the indoor air samples from East High School were all below the detection limit [ATSDR 2023]. However, ATSDR recommended an additional round of sampling to assess indoor air during a different time of the year. This document is a follow up to that original PHA. This document assesses data from the additional round of indoor air and groundwater sampling around East High School.

Based on the evaluation of the newer sampling data, ATSDR is unable to determine whether breathing the air inside East High School poses a health hazard to people. This is because the indoor air grab sample and HAPSITE® analysis method does not meet ATSDR's time-integrated standard for sampling vapor intrusion. If ATSDR did assume this data was an adequate assessment of vapor intrusion, then the air students, teachers, and workers are breathing inside the school would not be expected to harm people's health. The grab sample levels of tetrachloroethylene (PCE), trichloroethylene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC) are all below levels of concern. However, ATSDR does not deem the grab sampling and HAPSITE® analysis technique to be of sufficient quality to assess vapor intrusion over time [ATSDR 2016].

ATSDR's evaluation of the groundwater data from 2021 and 2022 indicate the groundwater PCE concentration near East High School exceed ATSDR's soil vapor intrusion-groundwater comparison value (CV) and are increasing over time. Therefore, ATSDR cannot exclude the possibility that vapor intrusion is occurring above a level of concern.

ATSDR recommends VAMC use a time-integrated sampling method to assess indoor air, such as an evacuated canister, during a typical exposure period for a school/workday. In both the summer and the winter, VAMC should also concurrently sample the indoor air, outdoor air, and sub-slab soil gas of East High School. Additionally, VAMC should continue to monitor the groundwater concentration and boundary of the PCE plume. Moving forward, the indoor air of the school should be re-sampled if at any time groundwater or sub-slab soil gas contaminant levels are above levels of concern within 100 feet of the school. ATSDR will continue to follow up on other public health action recommendations published in the original 2023 PHA.

Background

The 700 South 1600 East PCE Plume site covers approximately 300 acres on the east side of Salt Lake City. The site contains a groundwater plume contaminated with volatile organic compounds. From approximately 1976 to 1984, the Department of Veterans Affairs Medical Center (VAMC) operated a dry-cleaning facility on this site [EPA 2012]. At the time, most dry cleaners used PCE as a dry-cleaning solvent [ATSDR 2019]. The dry cleaner disposed of condensate from the dry-cleaning solvent recovery system into a drain connected to the municipal sewer system. Sewer system leaks are believed to be the source of PCE that entered the aquifer [EPA 2012].

Since 2013, this site has been listed as the 700 South 1600 East PCE Plume Superfund Site. For cleanup purposes, site regulators divided the site into two operable units. Accelerated Operable Unit 1 (AOU-1) contains the shallow groundwater PCE plume (less than 50 feet below ground surface), and residential homes built above the contaminated groundwater. The groundwater PCE plume and source was labeled as Operating Unit 2 (OU-2). In 2019, the VA determined, with regulatory approval, that AOU-1 and OU-2 would be combined into a single operable unit, OU-1.

Environmental Data and Health Implications

The Environmental Protection Agency (EPA) identified five chemicals as initial contaminants of concern. In environments with limited oxygen, PCE breaks down into TCE, cis-1,2-DCE, and VC. 1,4-dioxane has also been associated with chlorinated solvent manufacturing, so it because a concern during this data review [EPA 2017].

The PCE-contaminated plume is concerning because of its potential for vapor intrusion. Vapor intrusion occurs when volatile chemicals evaporate from the groundwater, turn into gas, and enter buildings through cracks in foundations or utility lines.

Air Measurements and Evaluation of East High School

In December 2019, 25 indoor air samples were collected using grab sampling and HAPSITE® analysis techniques. The grab samples show the concentration of a contaminant during a single point in time (minutes) [EPA 2015]. Unfortunately, the grab samples are not representative of exposures over time, nor considered the standard for vapor intrusion assessment. However, ATSDR did evaluate them since they were the only indoor air data available.

VAMC took samples in various locations throughout the school (Table 1). 1,4-dioxane was not sampled during this time, and therefore cannot be assessed. The following evaluation assumes that grab samples are a surrogate of longer-term exposure. However, ATSDR stresses that time-integrated sampling must be performed to make a final health hazard determination.

Table 1: Indoor Air Samples at East High School

Location	PCE ($\mu g/m^3$)	TCE ($\mu g/m^3$)	Cis-1,2-DCE ($\mu g/m^3$)	VC ($\mu g/m^3$)	1,4-Dioxane ($\mu g/m^3$)
Chemical Storage Cabinet	0.5 U	0.5 U	0.5 U	0.5 U	NS
Chemistry Laboratory Classroom	0.5 U	0.5 U	0.5 U	0.5 U	NS
Elevator	0.91	0.5 U	0.5 U	0.5 U	NS
Electronics Laboratory Chemical Storage	0.5 U	0.5 U	0.5 U	0.5 U	NS
Daycare Room	0.5 U	0.5 U	0.5 U	0.5 U	NS
Boiler Room	11	0.5 U	0.5 U	0.5 U	NS
HVAC Area	9.4	0.5 U	0.5 U	0.5 U	NS
Autoshop Chemical Storage Closet	8.6	0.5 U	0.5 U	0.5 U	NS
Autoshop Chemical Waste Area	3.1	0.5 U	0.5 U	0.5 U	NS
Elevator	4.8	0.5 U	0.5 U	0.5 U	NS
Storage	2.4	0.5 U	0.5 U	0.5 U	NS
Paint Storage Closet	0.5 U	0.5 U	0.5 U	0.5 U	NS
Classroom	0.86	0.5 U	0.5 U	0.5 U	NS
Boiler Room	5.4	0.5 U	0.5 U	0.53	NS
Boiler Room	0.89	0.5 U	0.5 U	0.5 U	NS
Sump Room	4	0.5 U	0.5 U	0.5 U	NS
Locker Room	0.5 U	0.5 U	0.5 U	0.5 U	NS
Office	0.5 U	0.5 U	0.5 U	0.5 U	NS
Bathroom	0.41 J	0.5 U	0.5 U	0.5 U	NS
Chemistry Laboratory Classroom	0.5 U	0.5 U	0.5 U	0.5 U	NS
Autoshop Classroom	0.63	0.5 U	0.5 U	0.5 U	NS
Elevator	0.91	0.5 U	0.5 U	0.5 U	NS
Electrical Closet	0.51	0.5 U	0.5 U	0.5 U	NS
Stairwell	0.5 U	0.5 U	0.5 U	0.5 U	NS
Stairwell	0.5 U	0.5 U	0.5 U	0.5 U	NS

U: Analyte was not detected at the associated value, which is the reporting limit
J: Result is estimated
NS: Not sampled

CVs are concentrations of contaminants which human exposure would not likely cause harmful health effects. Each CV is specific to an environmental medium, such as air, soil, or water. Although concentrations below the CV are considered safe, it cannot be assumed that concentrations above the CV would cause harmful health effects. ATSDR uses inhalation CVs to either identify contaminants that are not expected to cause harmful health effects or if contaminants should be further evaluated.

In this evaluation, ATSDR compared the air sampling results to two ATSDR CVs: cancer risk evaluation guide (CREG) and minimal risk level (MRL), also known as environmental media evaluation guide (EMEG).

- ATSDR CREGs are estimated concentrations of carcinogens that would be predicted to cause no more than one excess cancer in a million people exposed in a lifetime.
- ATSDR MRLs/EMEGs are estimated concentrations of contaminants that would be predicted to not cause noncancer health effects during acute (14 days or less), intermediate (between 15 and 364 days), and chronic (365 days or more) exposures.

ATSDR compared the maximum concentration of each indoor air contaminant with its respective CV (Table 2). ATSDR does not have an inhalation CV for cis-1,2-DCE, but there is a CV for its

isomer, trans-1,2-DCE. An isomer is a compound with the same chemical formula but different arrangement of atoms leading to different properties. Trans-1,2-DCE is more likely to cause harmful human health effects than cis-1,2-DCE [ATSDR 2023]. The maximum detected concentration of cis-1,2-DCE (0.5 µg/m³) was notably less than the CV of trans-1,2-DCE (12,000 µg/m³). Therefore, ATSDR would not expect adverse health effects from breathing this concentration of cis-1,2-DCE.

ATSDR retained three indoor air contaminants (PCE, TCE, and VC) for further evaluation because the maximum concentrations were above the CREGs (see Table 2). TCE is based on U-qualified data, meaning concentrations were not detected above the method detection limit. Assuming contaminants are present at the detection limit provides a maximum estimate of the potential health risks.

Table 2: Screening of Maximum Indoor Air Values Against ATSDR CVs

	Maximum concentration (µg/m³)	CREG (µg/m³)	MRL / EMEG (µg/m³)	Exceeds ATSDR CREG?	Exceeds ATSDR MRL?	Further Risk Evaluation?
PCE	11	3.8	41	**Yes**	No	**Yes**
TCE	0.5 U	0.21	2.1	**Yes**	No	**Yes**
Cis-1,2-DCE	0.5 U	N/A	N/A	N/A	N/A	No
Trans-1,2-DCE	N/A	N/A	12,000 (Acute)	N/A	No	No
VC	0.53	0.11	51 (Intermediate)	**Yes**	No	**Yes**

U: Analyte was not detected at the associated value, which is the reporting limit

ATSDR estimates the risk scenario to students, teachers, and workers exposed during school hours using the following equations (Appendix A):

- Exposure point concentration (EPC)
    - Adjusted EPC considers school-specific exposure conditions where people are not expected to spend all their time. The EPC is adjusted for duration, frequency, and magnitude of exposure (Appendix B).
- Cancer risk:
    - Cancer risk is used to evaluate the potential for an increase in cancer cases from exposure to a contaminant.
    - TCE is a carcinogen with a mutagenic mode of action. Children are more likely to develop cancer when exposed to carcinogens with a mutagenic mode of action. For this reason, ATSDR adjusts cancer risk using an age-dependent adjustment factor (ADAF) of three for high schoolers under age 16.
    - Reasonable maximum exposure (RME) refers to people who are at the high end of the distribution for exposure to a contaminant (approximately the 95th percentile).
    - Central tendency exposure (CTE) refers to people who have average or typical exposure to a contaminant.

- Cancer risk greater than 1E-06, or one excess cancer in a million people, indicates the need for further in-depth toxicological evaluation of the potential for cancer-related health effects.

- Noncancer risk:
  - Hazard quotient (HQ) is calculated to evaluate the potential for noncancer health hazards to occur from exposure to a contaminant.
  - HQ greater than one indicates the need for further in-depth toxicological evaluation of the potential for noncancer health effects.

Cancer and noncancer risk associated with indoor air samples collected from East High School are shown in Table 3 for PCE, Table 4 for TCE, and Table 5 for VC. The cancer risk for each contaminant is less than 1E-06. Therefore, ATSDR does not expect cancer related health effects nor an increase in cancer risk. The HQ for each contaminant is less than one. Therefore, ATSDR also does not expect noncancer health effects.

Table 3. School: Site-specific estimates for chronic exposure to PCE in air at 11 µg/m^3*

Exposure Group	CTE Adjusted EPC (µg/m^3)	CTE Noncancer Hazard Quotient	CTE Cancer Risk	RME Adjusted EPC (µg/m^3)	RME Noncancer Hazard Quotient	RME Cancer Risk
High School 9th – 12th grades	1.6	0.040	2.2E-8	2.7	0.067	3.7E-8
Full-time educator	2.1	0.051	3.5E-8	2.7	0.067	1.8E-7
Part-time educator	1.2	0.030	1.3E-8	-	-	-
Full-time worker	2.7	0.065	4.4E-8	2.7	0.065	1.8E-7
Part-time worker	1.6	0.039	1.7E-8	-	-	-

Source: [VAMC]
Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m^3 = micrograms per meter cubed; CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher);
* The calculations in this table were generated using ATSDR's PHAST v2.4.1.0. The noncancer hazard quotients were calculated using the chronic (greater than 1 year) minimal risk level of 41 µg/m^3 and the cancer risks were calculated using the inhalation unit risk of 2.6E-07 (µg/m^3)$^{-1}$.

Table 4. School: Site-specific estimates for chronic exposure to TCE in air at 0.5 µg/m³*

Exposure Group	CTE Adjusted EPC (µg/m³)	CTE Noncancer Hazard Quotient	CTE Cancer Risk	RME Adjusted EPC (µg/m³)	RME Noncancer Hazard Quotient	RME Cancer Risk
High School 9th – 12th grades	0.075	0.036	2.0E-8	0.12	0.059	3.3E-8
Full-time educator	0.095	0.045	2.5E-8	0.12	0.059	1.3E-7
Part-time educator	0.057	0.027	9.3E-9	-	-	-
Full-time worker	0.12	0.058	3.2E-8	0.12	0.058	1.3E-7
Part-time worker	0.073	0.035	1.2E-8	-	-	-

Source: [VAMC]
Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m^3 = micrograms per meter cubed; CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher);
* The calculations in this table were generated using ATSDR's PHAST v2.4.1.0. The noncancer hazard quotients were calculated using the chronic (greater than 1 year) minimal risk level of 2.1 µg/m^3 and the cancer risks were calculated using the inhalation unit risks of 2.1E-06 [NHL], 1.0E-06 [liver], 1.0E-06 [kidney] (µg/m^3)$^{-1}$ and age-dependent adjustment factors.

Table 5. School: Site-specific estimates for chronic and intermediate exposure to VC in air at 0.53 µg/m³*

Exposure Group	CTE Adjusted EPC (µg/m³)	CTE Noncancer Hazard Quotient	CTE Cancer Risk	RME Adjusted EPC (µg/m³)	RME Noncancer Hazard Quotient	RME Cancer Risk
High School 9th – 12th grades	0.079	0.0021	3.6E-8	0.13	0.0029	6.0E-8
Full-time educator	0.10	0.0026	2.8E-8	0.13	0.0029	1.5E-7
Part-time educator	0.060	0.0016	1.1E-8	-	-	-
Full-time worker	0.13	0.0026	3.6E-8	0.13	0.0026	1.5E-7
Part-time worker	0.077	0.0016	1.3E-8	-	-	-

Source: [VAMC]
Abbreviations: adjusted EPC = the exposure point concentration (EPC) times the appropriate exposure factors; µg/m^3 = micrograms per meter cubed; CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher);
* The calculations in this table were generated using ATSDR's PHAST v2.4.1.0. The noncancer hazard quotients were calculated using the intermediate (two weeks to less than 1 year) minimal risk level of 51 µg/m^3.

Groundwater Data and Evaluation of East High School

In 2021, a hydrogeology report estimates the PCE concentrations of the groundwater plume and approximates the plume's boundaries (see Appendix C). This shows East High School (sampling location 0045S) is located directly within the PCE plume 50 µg/L boundary. Monitoring well 13 (MW-13) is located on the property of East High School (see Appendix D). During June 2021, June 2022, and November 2022, VAMC took groundwater samples at various feet below ground surface (ft bgs). The concentrations of PCE detected in those samples exceeds ATSDR's soil vapor intrusion-groundwater CV of 5.3 µg/L (see Table 6).

ATSDR's soil vapor intrusion-groundwater CVs are derived using indoor air CVs that have no known or anticipated adverse human health effects. These CVs are protective estimates for use in screening the groundwater-to-indoor air pathway, allowing for a margin of safety to the human population. Table 6 suggests PCE concentrations are increasing over time and are a concern because of potential vapor intrusion into East High School.

Table 6: Groundwater Samples from MW-13

Location	Total Well Depth (ft bgs)	PCE Concentration (µg/L) in June 2021	PCE Concentration (µg/L) in June 2022	PCE Concentration (µg/L) in November 2022
MW-13S	22	NS	34	42
MW-13D	90	NS	50	56
MW-13L	160	50	56	64 J

NS: Not sampled
J: Result is estimated

Limitations

As part of this assessment, ATSDR made several assumptions that could lead to the over- or underestimating risk. Some limitations of this assessment include

1. The grab samples and HAPSITE® analysis technique is not sufficient to assess the potential for human health hazard caused by vapor intrusion [EPA 2014]. The standard sampling technique ATSDR supports includes a time-integrated method which measures air vapor concentration over a longer period of time.
2. Long-term sampling is needed to assess temporal trends of vapor intrusion concentrations due to seasonal factors, such as temperature, weather, and barometric pressure. Indoor air samples were not obtained during the summer season, as recommended in the original PHA.
3. The vapor intrusion potential for buildings may change with building age or alterations to building properties such as the ventilation, slab, or utility entry points.
4. Sub-slab gas and outdoor air samples were not obtained. These additional samples can help characterize relative contribution of vapor intrusion and identify background sources.

5. ATSDR's re-assessment of East High School is based on the limited indoor air grab sampling investigation of 25 discrete locations for each contaminant. The original PHA sampled 102 discrete locations.
6. J-qualified indoor air and groundwater data for PCE indicate some sampled concentrations were estimated values, which could over- or underestimate risk.
7. U-qualified data indicate the sampled concentrations were not detected above the method detection limit. Subsequent risk analysis that assumes contaminants were present at the detection limit could overestimate exposure risk.

Cancer and noncancer health effects could have been substantially greater before air and groundwater sampling were conducted, but historical risk cannot be evaluated with available data.

Conclusions

ATSDR reaches the following conclusions:

Conclusion 1: Based on the evaluation of the East High School sampling data, ATSDR is unable to determine whether breathing the air inside East High School poses a health hazard to people. This is because the indoor air grab sample and HAPSITE® analysis method does not meet ATSDR's time-integrated standard for sampling vapor intrusion. If ATSDR did assume that this data were an adequate assessment of vapor intrusion, then the air students, teachers, and workers are breathing inside the school would not be expected to harm people's health. The grab sample levels of tetrachloroethylene (PCE), trichloroethylene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC) are all below levels of concern. However, ATSDR does not deem the grab sampling and HAPSITE® analysis technique to be sufficient to assess vapor intrusion over time.

Basis for conclusion: HAPSITE® air samples, also known as grab samples with real-time analysis, show a concentration of a contaminant during a single point in time. They are useful to confirm the presence or absence of indoor air contaminants and identify specific vapor-forming chemicals emitted from indoor commercial product sources or emitted from suspected openings for gas entry into buildings [EPA 2015]. However, grab samples cannot be relied upon to demonstrate that vapor intrusion is occurring in a specific building over time. They also cannot be used to determine the potential human health hazard from breathing in contaminated air.

Next steps: To make a complete public health conclusion about potential vapor intrusion air exposure hazard, ATSDR requires a time-integrated indoor air sampling method. The sampling method duration should occur during a typical exposure period for a school/workday because concentrations can vary significantly over time. ATSDR also prefers both cold and hot weather sampling data. During these seasons, more chemical can accumulate inside buildings when doors and windows remain mostly shut to maintain heating and air conditioning.

Conclusion 2: The groundwater data from 2021 and 2022 indicate the groundwater PCE concentration near East High School is above ATSDR's soil vapor intrusion-groundwater CV. Therefore, ATSDR cannot exclude the possibility that vapor intrusion is occurring above a level of concern.

Basis of conclusion: Vapor intrusion can be affected by proximity of contaminated groundwater to buildings [ATSDR 2016]. When contaminated groundwater shows levels of concern closer to a building, the likelihood of exposure to vapor intrusion increases. During 2021 and 2022, the PCE concentrations continually increased over time above the soil vapor intrusion-groundwater CV and the plume was found to be within 100 feet of East High School.

Next steps: Due to elevated PCE levels detected in the groundwater plume, appropriate time-integrated indoor air sampling should be conducted to confirm the presence of vapor intrusion and the potential for a human health hazard. ATSDR requires a standard time-integrated sampling method for indoor air during a typical exposure period and during cold and hot weather.

Recommendations

ATSDR is unable to assess human health risk based on the indoor air grab samples obtained. ATSDR recommends the following actions:

- VAMC use a time-integrated indoor air sampling method, such as evacuated canisters, to measure vapor intrusion during a typical exposure period for a school/workday.
- VAMC sample indoor air, outdoor air, and sub-slab soil gas concurrently in both the summer and the winter. To assess if vapor intrusion is active during sampling, VAMC should consider using indicators, tracers, and surrogates [ATSDR 2022].[1]
- VAMC analyze and report all contaminants of potential concern, e.g., PCE, TCE, cis-1,2-DCE, VC, and 1,4-dioxane.
- VAMC continue to monitor the groundwater concentration and boundary of the PCE plume in relation to East High School. The indoor air of the school should be re-sampled if at any time the groundwater or sub-slab soil gas contaminant levels are found above levels of concern within 100 feet of the school.
- ATSDR will continue to follow up on other public health actions recommended in the original 2023 PHA.

[1] https://iavi.rti.org/assets/docs/Temp_Measurement_Fact_Sheet_int.pdf, https://iavi.rti.org/assets/docs/Pressure_Measurement_Fact_Sheet_Int.pdf, https://iavi.rti.org/assets/docs/Radon_methods_fact_sheet_int.pdf

Sincerely,

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[VA] Department of Veterans Affairs. 2022. Appendix H – Final Human Health Risk Assessment. 700 South 1600 East PCE Plume Site. Contract No: W912DQ-18-D-3008.

Appendix A: Air Inhalation Exposure, Noncancer Risk, and Cancer Risk Equations

Site-specific Parameters Table
PHAST Report, v2.4.1.0, June 10, 2024

Equations

Air Inhalation Exposure Equation

Adjusted EPC = EPC x $EF_{noncancer}$ **Equation 1**

EPC = exposure point concentration, $EF_{noncancer}$ = exposure factor (unitless)

Hazard Quotient

HQ = Adjusted EPC ÷ HG **Equation 2**

HQ = hazard quotient, EPC = exposure point concentration (µg/m^3 or ppb), HG = health guideline (e.g., inhalation MRL, RfC)

Cancer Risk Equations

CR = Adjusted EPC x IUR x (ED ÷ LY) **Equation 3**

ADAF-adjusted CR = (Adjusted EPC x IUR) x (ED ÷ LY) x ADAF **Equation 4**

Total CR = Sum of the CR for all exposure groups **Equation 5**

CR = cancer risk (unitless), EPC = exposure point concentration (µg/m^3 or ppb), IUR = inhalation unit risk ((µg/m^3 or ppb)$^{-1}$), ED = exposure duration (years), LY = lifetime years (78 years), ADAF = age-dependent adjustment factor (unitless), EF (cancer) = exposure factor (cancer) calculated as follows: EF (noncancer; unitless) x exposure group specific exposure duration (years) ÷ lifetime of 78 years

Appendix B: Site-specific Exposure Parameters

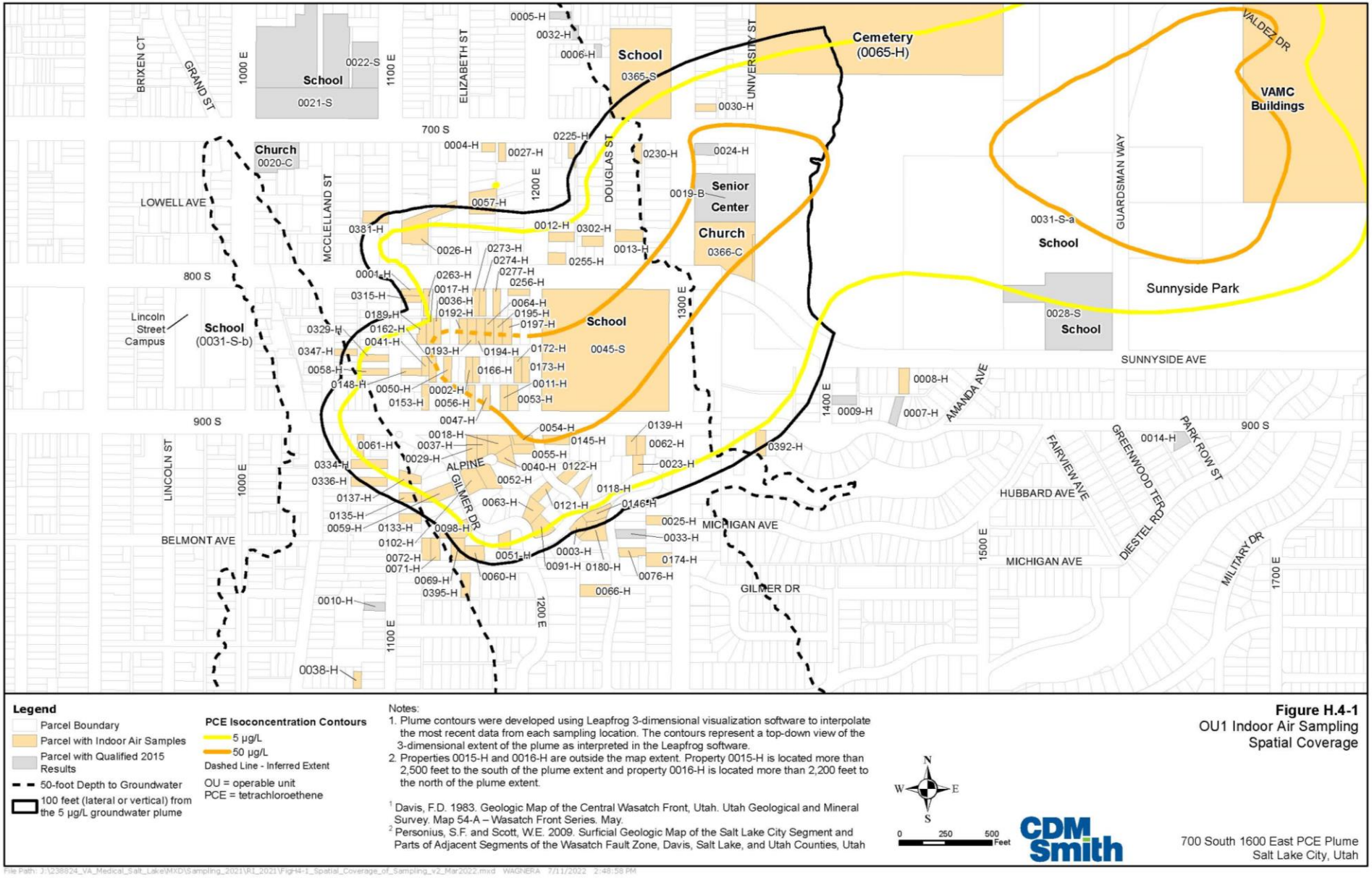
Site-specific Exposure Parameters

Default Exposure Groups

Exposure Group	Daily (hours/day) CTE	Daily (hours/day) RME	Weekly (days/week) CTE	Weekly (days/week) RME	Annually (weeks/year) CTE	Annually (weeks/year) RME	Age-Specific Exposure Duration (years) CTE	Age-Specific Exposure Duration (years) RME	Notes
High School 9th – 12th grades	6.7	9.3	5	5	39	47	4	4	-
Full-time educator	8.5	9.3	5	5	39	47	5	20	-
Part-time educator	5.1	NA	5	NA	39	NA	3.1	NA	-
Full-time worker	8.5	8.5	5	5	50	50	5	20	-
Part-time worker	5.1	NA	5	NA	50	NA	3.1	NA	-

Abbreviations: CTE = central tendency exposure (typical); RME = reasonable maximum exposure (higher)

Appendix C: Estimated PCE Groundwater Plume Boundaries in Relation to Sampling Location in 2021



Legend

- Parcel Boundary
- Parcel with Indoor Air Samples
- Parcel with Qualified 2015 Results
- 50-foot Depth to Groundwater
- 100 feet (lateral or vertical) from the 5 µg/L groundwater plume

PCE Isoconcentration Contours

- 5 µg/L
- 50 µg/L
- Dashed Line - Inferred Extent

OU = operable unit
PCE = tetrachloroethene

Notes:

1. Plume contours were developed using Leapfrog 3-dimensional visualization software to interpolate the most recent data from each sampling location. The contours represent a top-down view of the 3-dimensional extent of the plume as interpreted in the Leapfrog software.
2. Properties 0015-H and 0016-H are outside the map extent. Property 0015-H is located more than 2,500 feet to the south of the plume extent and property 0016-H is located more than 2,200 feet to the north of the plume extent.

[1] Davis, F.D. 1983. Geologic Map of the Central Wasatch Front, Utah. Utah Geological and Mineral Survey. Map 54-A – Wasatch Front Series. May.
[2] Personius, S.F. and Scott, W.E. 2009. Surficial Geologic Map of the Salt Lake City Segment and Parts of Adjacent Segments of the Wasatch Fault Zone, Davis, Salt Lake, and Utah Counties, Utah

N W E S

0 250 500 Feet

CDM Smith

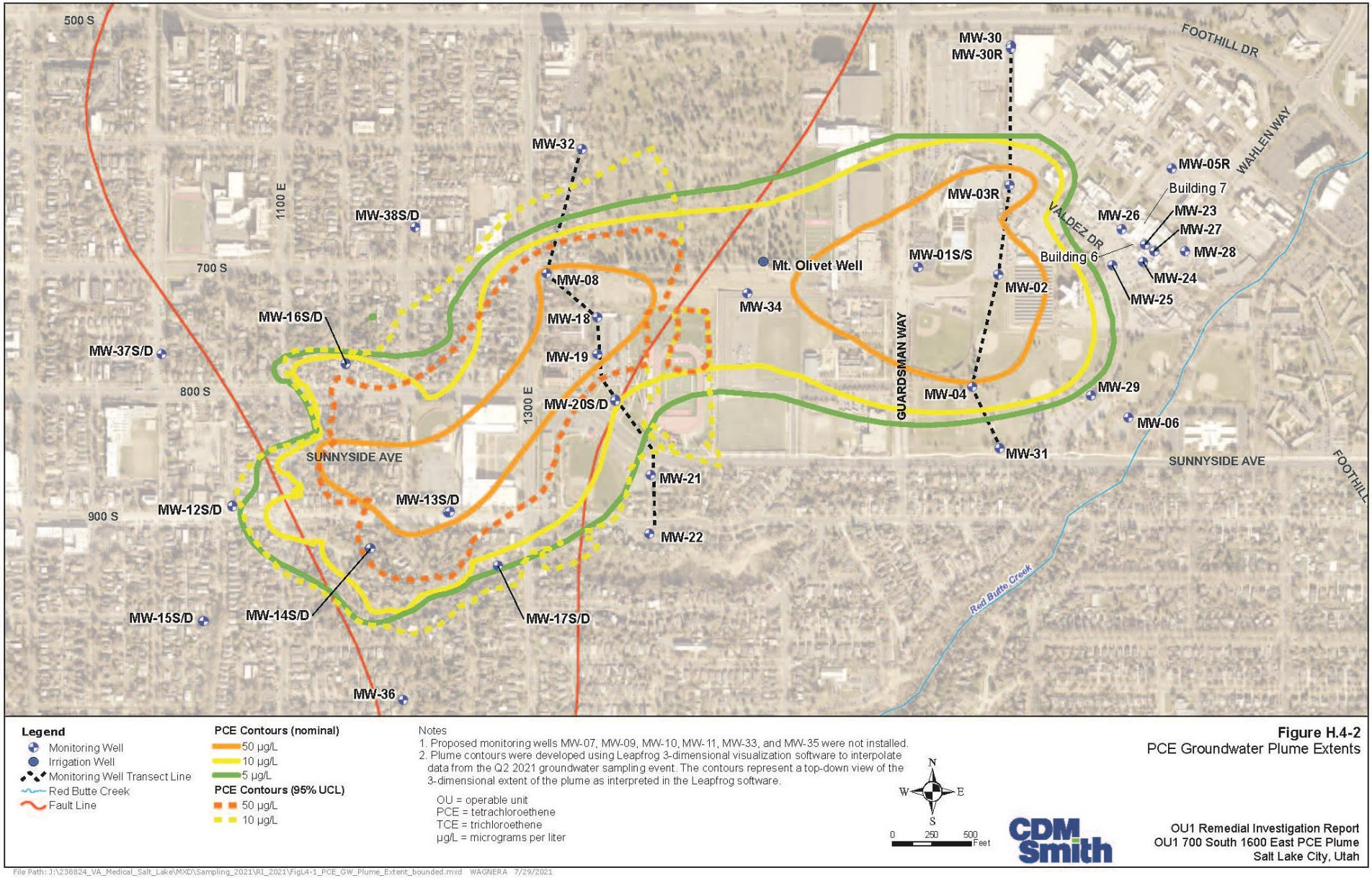
Figure H.4-1
OU1 Indoor Air Sampling
Spatial Coverage

700 South 1600 East PCE Plume
Salt Lake City, Utah

File Path: J:\253824_VA_Medical_Salt_Lake\MXD\Sampling_2021\R1_2021\Fig H4-1_Spatial_Coverage_of_Sampling_v2_Mar2022.mxd WAGNERA 7/11/2022 2:48:58 PM

Source: [VA 2022]

Appendix D: Estimated PCE Groundwater Plume Boundaries Based on Groundwater Data from Monitoring Wells in 2021



Source: [VA 2022]