Proposed Plan for Interim Record of Decision at the Billings PCE OU1 Superfund Site

July 2025

See the Glossary of Terms at the end of this Proposed Plan for definitions of the terms shown in **bold** text.

Introduction

This Proposed Plan identifies the EPA's Preferred Alternative for addressing contaminated indoor air at the Billings PCE Superfund Site (Site) in Billings, Yellowstone County, Montana. This document is issued by the U.S. Environmental Protection Agency (EPA), the lead agency for site activities.

A Proposed Plan is a document to help with public involvement in a **Superfund** site's remedy selection process. A Proposed Plan also presents the EPA's preliminary recommendation of how to best address contamination at a site; summarizes the alternatives that have been evaluated; and explains the reasons the EPA recommends the **Preferred Alternative** for the remedy. One of the EPA's responsibilities for a Superfund site is to allow for public participation and seek public input on the Preferred Alternative.[1]

The Preferred Alternative and the other alternative that was evaluated are summarized in this Proposed Plan and are described in detail in the **Focused Feasibility Study**.[2] This Proposed Plan also summarizes Site information that can be found in greater detail in documents contained in the **Administrative Record** file which can be found online at the link below. Electronic copies of this Administrative Record can also be accessed in person at the Billings

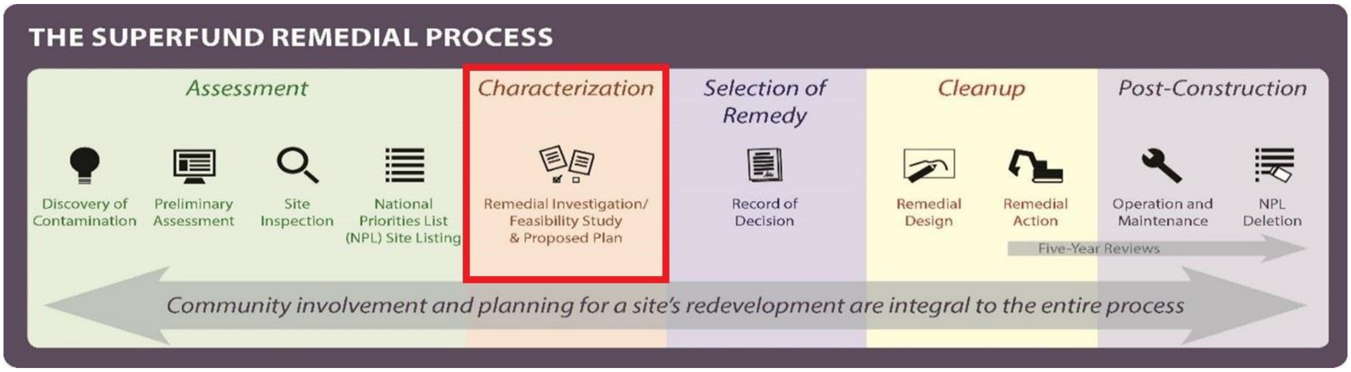
Public Comment Period:	July 28, 2025, to September 26, 2025
Public Meeting - learn more about the preferred alternative and provide verbal comments:	August 27, 2025 5:30 PM Billings Public Library 510 N. Broadway Billings, MT 59101
Where to submit written comments:	BillingsPCEcomments@epa.gov

[1] The Proposed Plan is a document that the lead agency is required to issue to fulfill the requirements of CERCLA §117(a) and section 300.430(f)(2) of the **National Oil and Hazardous Substances Pollution Contingency Plan** (NCP).
[2] The Focused Feasibility Study is available in the Administrative Record on our webpage www.epa.gov/superfund/billings-pce under Site Documents & Data or at this link: https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.docdata&id=0801303#AR

Public Library at 510 N Broadway, Billings, MT, 59101.

This Proposed Plan is an important part of the Superfund Remedial Process (**Figure 1**). During the public comment period, the EPA is asking the public to review this Proposed Plan and provide comments on the Preferred Alternative as well as the other alternative considered. The EPA, in consultation with the Montana Department of Environmental Quality (DEQ), will select a remedy after reviewing and considering all information submitted during the public comment period.

Figure 1 – Overview of the Superfund Remedial Process



It is the EPA's current judgment, as the lead agency, that the Preferred Alternative in this Proposed Plan is necessary to protect public health, welfare, or the environment from actual or threatened releases of hazardous substances into the environment.

Comments received during the public comment period and the EPA's responses will be documented in the Responsiveness Summary section of the **Interim Record of Decision** (IROD)[3] that will be issued later this year. The IROD will also explain which alternative has been selected and the basis for the selection.

Site Background and History

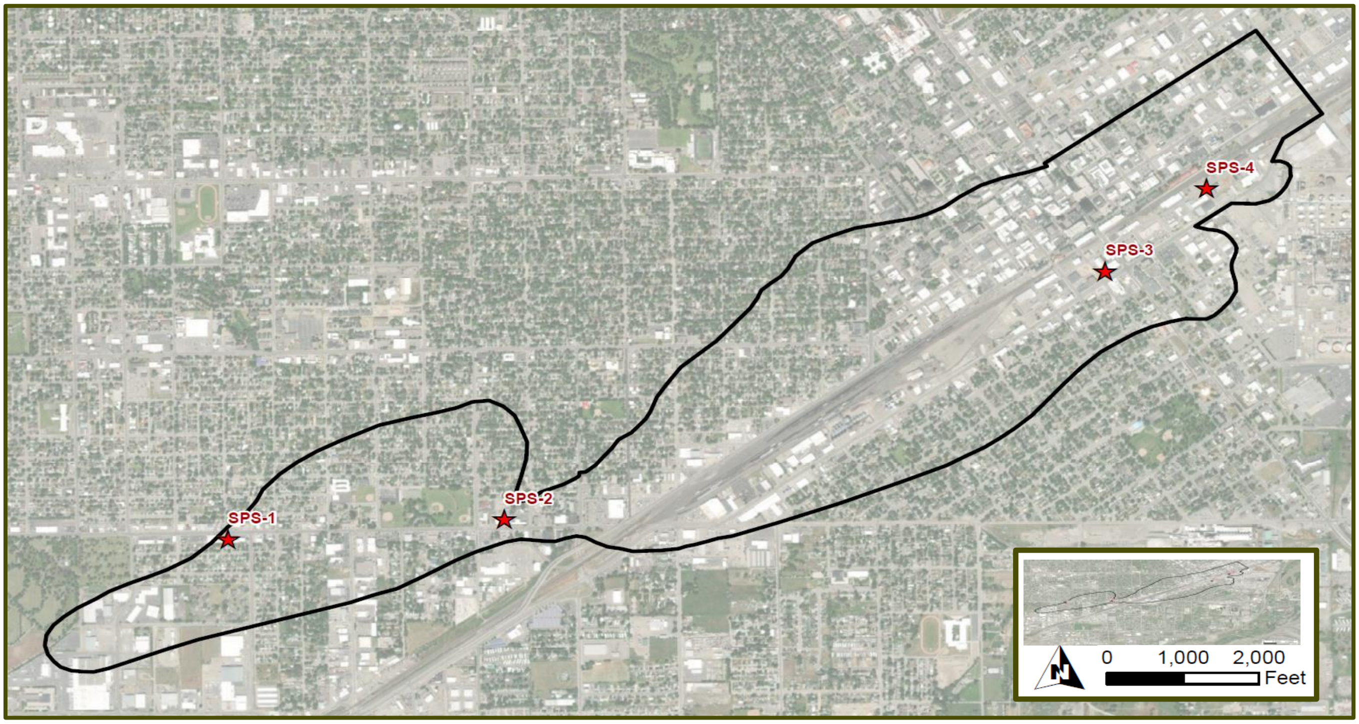
Site Overview

The Billings PCE Superfund Site (CERCLIS ID MTD986073252) includes an approximately 1,100-acre groundwater contamination plume located in Billings, Yellowstone County, Montana **(Figure 2)**. Groundwater and soil have been contaminated at several locations by chemicals used in historical dry-cleaning operations and other industrial sources. The primary **contaminants of concern** associated with dry-cleaning operations include:

[3] The IROD will be "Interim" because the remedy documented in this IROD will be limited in scope and will only address indoor air contamination. Addressing the remaining contamination sources, such as groundwater and soil, will be done in separate Proposed Plans and Records of Decision. Implementing an interim remedy for addressing indoor air speeds up protection of human health while investigations and planning to address the other sources may continue for several years. There will be a Final Record of Decision for the Site that will not be "interim", and the selected remedy will address all relevant contamination and exposure pathways.

- **tetrachloroethene** (also known as **perchloroethylene**) (PCE)
- **trichloroethene** (TCE)
- *cis*-1,2-**dichloroethene** (DCE)

Figure 2 – Site Map [4]

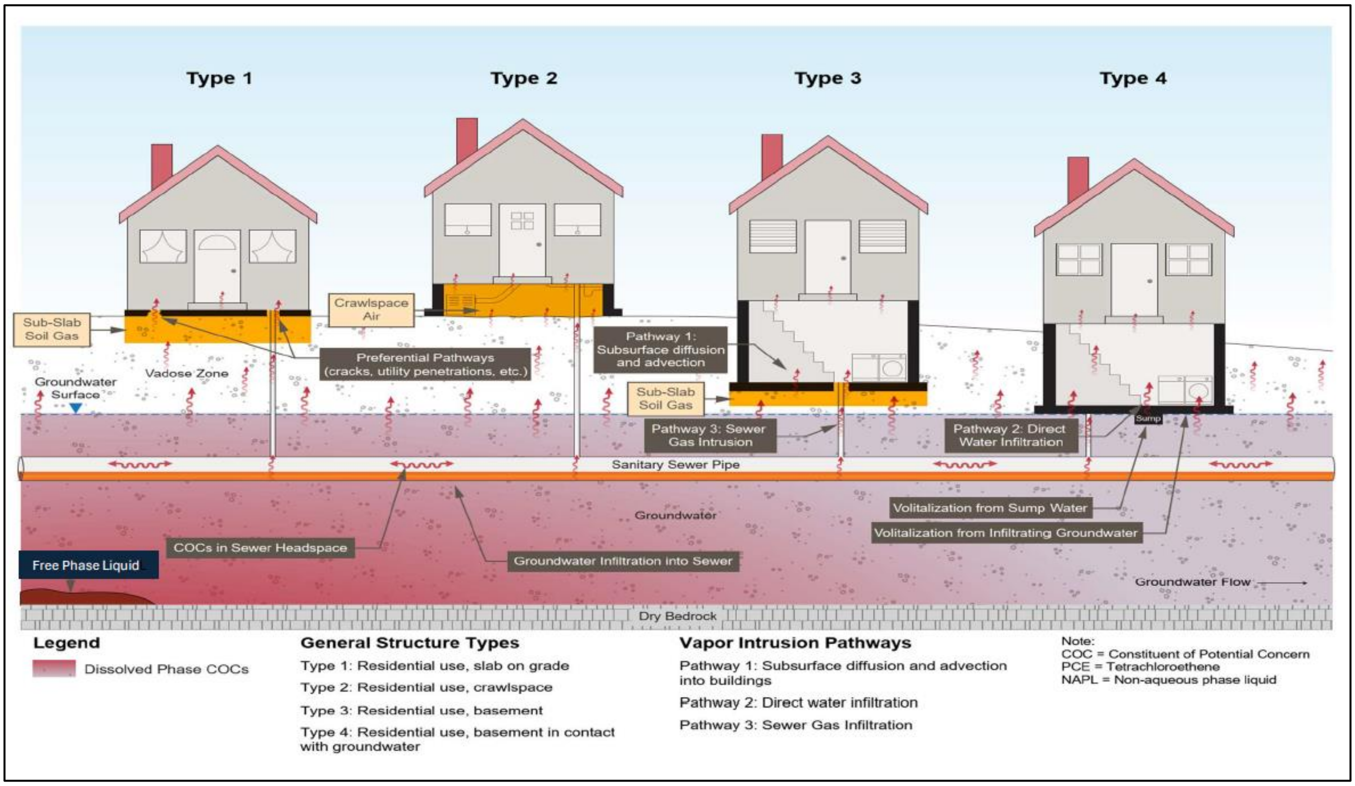


PCE is a solvent for removing stains and grease from fabrics in dry-cleaning operations. PCE is also used to remove grease and other contaminants from metal parts. Once released into the environment, PCE can break down into TCE and *cis*-1,2-DCE. There are four suspected PCE sources (SPSs) at the Site (**Figure 2).** Historically, dry cleaners and other industrial and commercial operations released chlorinated solvents (such as PCE) directly onto the ground, into septic systems, or down sewer drains, which led to the contamination of soil and groundwater. These chlorinated solvents readily form vapors which can then move from the groundwater, into **soil vapor**, and then into the **indoor air** of overlying buildings through cracks in foundations, other openings, or direct contact, and can pose human health risks. This process is called "**vapor intrusion**" **(Figure 3)**. This Proposed Plan is focused on mitigating indoor air contamination that results from vapor intrusion.

---

[4] An interactive Site map can be found on the EPA Billings PCE website or at this link : https://arcg.is/1bzinW

Figure 3 - Generic Vapor Intrusion Model



Additional contaminants of concern have been identified at the Site including chloroform, isopropanol, and naphthalene. These chemicals are not commonly used in dry-cleaning services but are used in, or created by, many other industries and chemical processes. Chloroform can result from using chlorine in drinking water. Naphthalene is found in products like mothballs, pest repellents, asphalt, and gasoline. Isopropanol is commonly used in cleaning agents, hand sanitizers, and cosmetic products. These contaminants were detected sporadically across the Site and were less common in soil vapor samples, so the primary investigation focus has been on PCE and its breakdown products TCE and *cis*-1,2-DCE.

Site Organization

During investigations and cleanup, the EPA may divide a site into a few distinct areas depending on the complexity of the problems associated with the site. These areas, called **Operable Units (OUs)**, may address geographic areas of a site, specific site problems such as environmental media impacted, or areas where a specific action is required. The EPA has divided the Site into three environmental media and geographic operable units:

- OU1 addresses indoor air contamination from vapor intrusion at properties within the Site.
- OU2 addresses the **source area** associated with the contaminated soil at suspected PCE source SPS-2, and contaminated groundwater at and immediately downgradient of SPS-2 **(Figure 2)**.

- OU3 addresses the contamination at the remaining suspected PCE source areas SPS-1, SPS-3 and SPS-4 (**Figure 2**), sitewide groundwater, and the final vapor intrusion remedy.

OU1 is the subject of this Proposed Plan and is discussed in detail in subsequent sections. The Preferred Alternative only mitigates the vapor intrusion pathway. It does not eliminate the source of the vapors (e.g., contaminated groundwater). The final vapor intrusion remedy for OU1 will be addressed in the final ROD along with the OU2 and OU3 remedies, which will cleanup groundwater and the remaining contaminant source areas. The OU1 Preferred Alternative is, therefore, an *interim* action. Investigations at OU2 and OU3 are ongoing. The proposed remedies for OU2 and OU3 will be presented to the public in future Proposed Plans.

Site History

Removal assessments and remedial investigations are two methods to evaluate a Superfund site. In the short term, removal assessments address the most immediate threats to human health and the environment and can be followed by a removal action to address these immediate threats. In the long term, remedial investigations study the type and size of contamination and then the EPA selects cleanup alternatives based on this information. Multiple investigations, assessments and removal actions have been conducted across the Site to date and are described in detail on our site webpage[5]. The investigations and assessments have looked at source areas, groundwater contamination, and vapor intrusion. The removal actions addressed the immediate threats to public health and the environment by removing and treating accessible source-area materials and mitigating indoor-air concentrations of vapor-forming chemicals.

Site Characteristics

Sources of Contamination

A "source area" is the location where a contaminant is released into the environment. Various mechanisms can cause releases. Examples include spills, leaking tanks, leaking pipes and intentional discharge to the land surface or subsurface.

There are four suspected PCE sources (SPSs) at the Site, labeled from west to east as SPS-1, SPS-2, SPS-3, and SPS-4, with the most impactful release occurring at SPS-2 (**Figure 2**). At SPS-2, PCE releases resulted from leaks, spills, or discharges down floor drains associated with dry-cleaning operations between approximately 1967 and 1993. Evidence of releases at SPS-2 include high concentrations of PCE in soil, groundwater**,** soil vapor, and as a **free-phase liquid,** called non-aqueous phase liquid or "NAPL."

Other PCE sources have also resulted in contaminated groundwater and potential vapor intrusion but are much more localized compared to SPS-2. The other suspected PCE sources are:

---

[5] Please visit https://www.epa.gov/superfund/billings-pce for more information.

- SPS-1: A dry-cleaning facility operated at SPS-1 from 1961 through 1981. While PCE contamination has been detected in soil and groundwater, the extent of contamination at this source is less than SPS-2.

- SPS-3: A dry-cleaning facility operated at SPS-3 until at least 1973 resulting in PCE releases to the environment. The EPA determined that PCE levels below the building's foundation at SPS-3 exceeded removal management levels for a commercial structure, so the EPA installed a sub-slab depressurization system in 2023.

- SPS-4: High concentrations of PCE have been detected in groundwater at this location during recent groundwater investigations, indicating a distinct but currently unidentified source. The source of the PCE is being investigated as part of OU3.

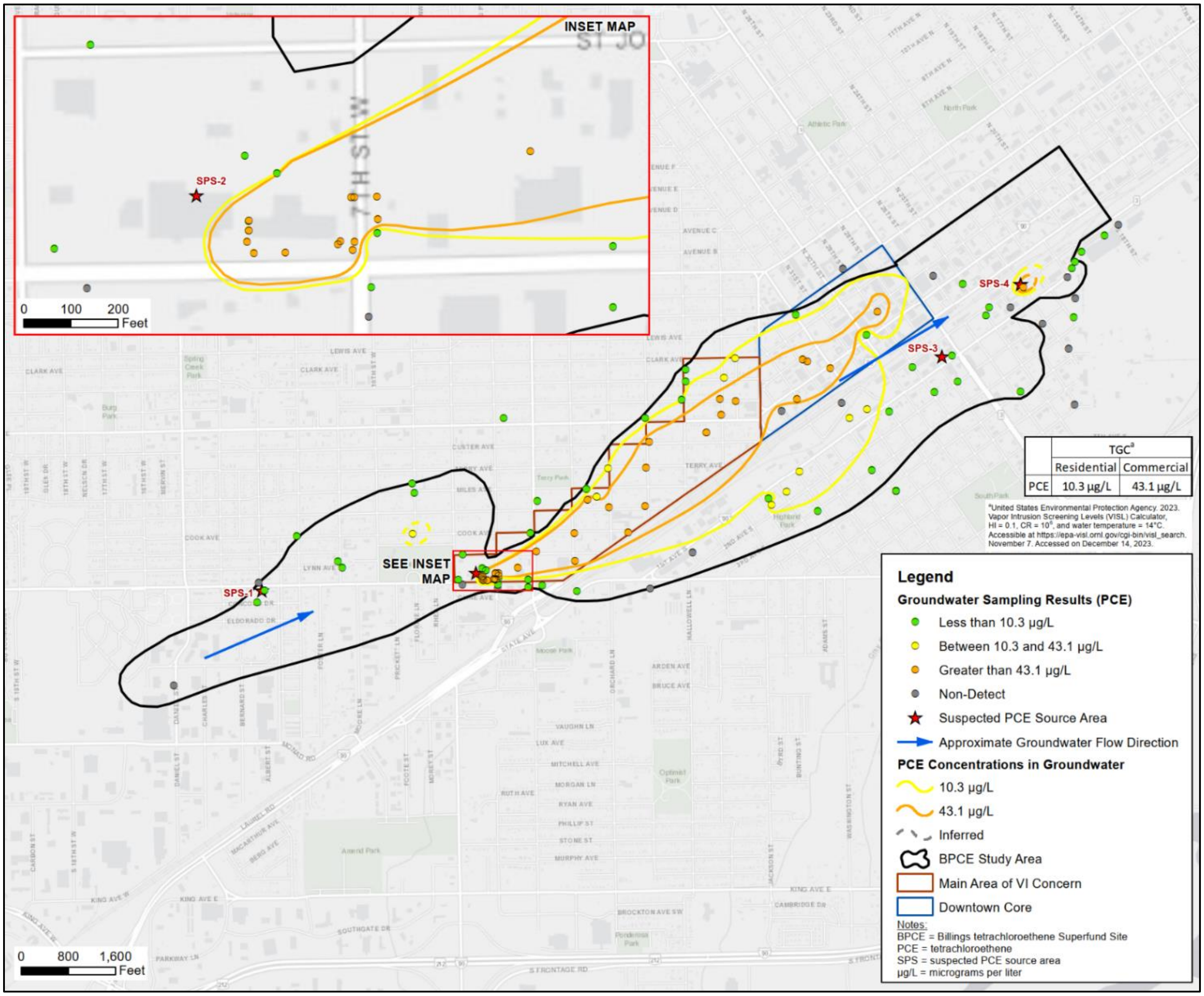
Contaminant Migration and Extent of Contamination

The EPA's sampling data has shown that contaminants at the suspected PCE source areas have migrated from the underlying soils into the shallow groundwater, where they have then dissolved and migrated away from the source areas with the flow and direction of groundwater. Shallow groundwater occurs about 7-13 feet below the land surface and extends to about 30 feet below. The shallow groundwater flows through coarse sand and gravels deposited by the Yellowstone River. Deeper groundwater occurs in the bedrock found below 30 feet, but most or all the groundwater contamination exists in the shallow groundwater and not in bedrock.

PCE and TCE form a **contaminant plume** in shallow groundwater that is migrating in the **direction of groundwater flow,** to the east-northeast at this Site. Shallow groundwater contamination extends at least three miles, roughly west to east, through Billings (**Figures 4a** and **4b**). Sampling data has shown that the majority of PCE and TCE exceedances are located downgradient of SPS-2. Groundwater monitoring has been performed twice a year at the Site since Fall 2021. Monitoring results have not shown significant migration of the groundwater plume; however, the full extent of contamination is currently unknown. Additional characterization will continue to evaluate the full extent of contamination on the eastern side of the Site.

The OU1 proposed boundary is 1,100 acres and includes approximately 1,500 commercial and 2,700 residential buildings. The OU1 proposed boundary was originally defined in the 2019 Remedial Investigation Report based on groundwater concentrations and has been updated as Site characterization continues. The shape and size of the Site boundary may continue to be updated as more sampling is conducted, and the sampling data becomes available. This will better define areas where vapor intrusion is occurring or has the potential to occur. The OU1 proposed boundary is located entirely within the Billings city limits.

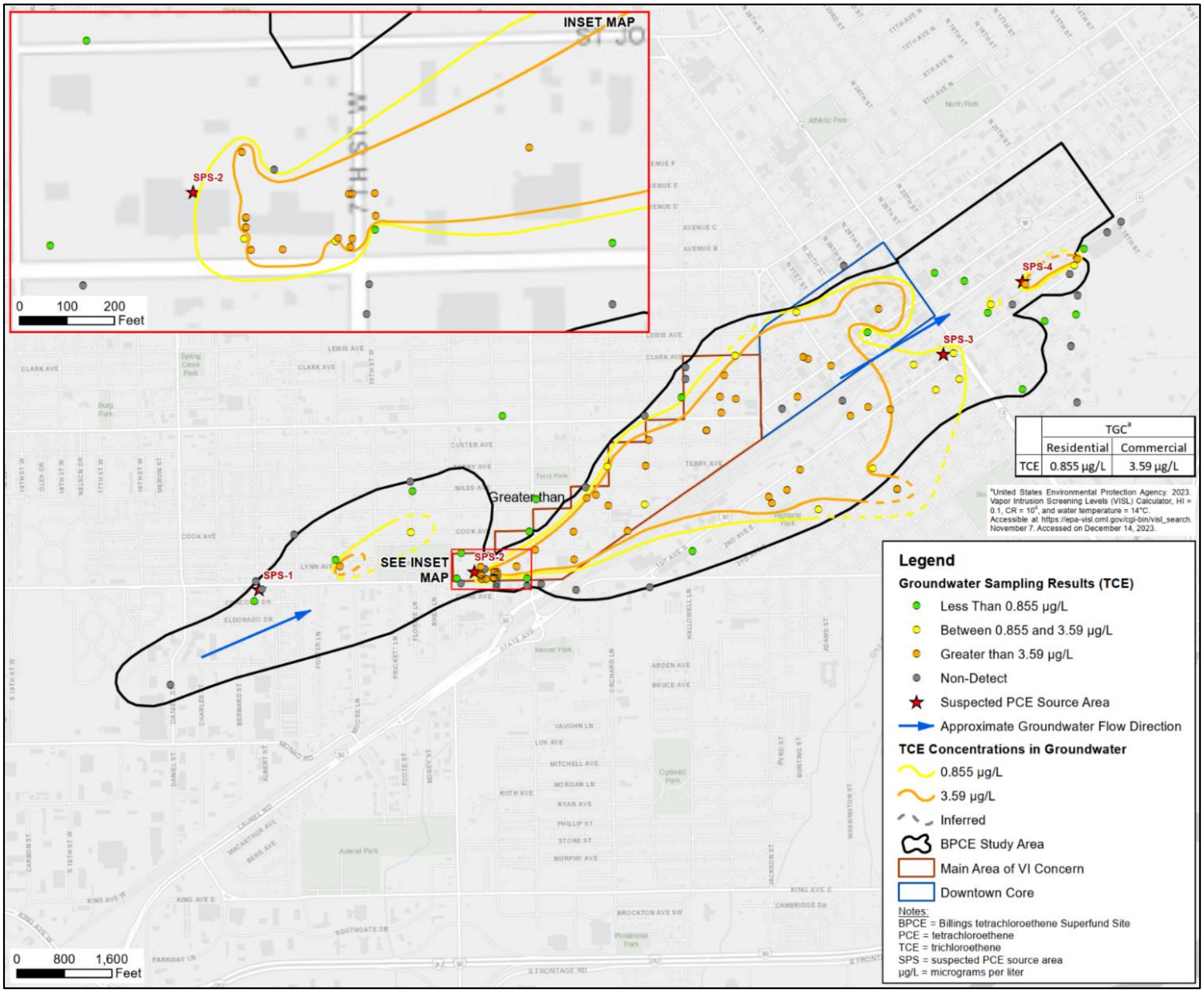
Figure 4a – PCE Groundwater Results Map[6]



---

[6] This map shows PCE concentrations in groundwater compared to **Target Groundwater Concentrations.** Target Groundwater Concentrations are screening levels that are used to evaluate if site conditions have the potential to pose a health concern through the vapor intrusion pathway. The Target Groundwater Concentrations for PCE are 10.3 micrograms per liter (µg/L) for residential buildings and 43.1 µg/L for commercial buildings.

Figure 4b – TCE Groundwater Results Map[7]



[7] This map shows TCE concentrations in groundwater compared to Target Groundwater Concentrations for TCE which are 0.855 µg/L for residential buildings and 3.59 µg/L for commercial buildings.

Vapor Intrusion Overview

Vapor intrusion occurs when vapor-forming chemicals beneath the ground turn into vapor; accumulate under a structure; and migrate into indoor spaces. There are three ways that vapors can enter a building through vapor intrusion (**Figure 3)**:

1. Vapors migrate through soil into the concrete cracks and other openings of the building foundation, and then into buildings located on top of the contamination. This is the most common cause of vapor intrusion.
2. Vapors enter through infiltration of contaminated groundwater into a building through direct contact, for example, through flooding or sumps.
3. Vapors enter sewer pipes and then migrate into structures that are connected to these pipes.

Factors that affect vapor intrusion include, but are not limited to:

- Source strength: The concentrations of vapor-forming chemicals in groundwater and the soils.
- Distance from the source to the building: The distance between the building foundation and the surface of the groundwater can vary from season to season due to groundwater fluctuations.
- Soil characteristics: For example, sand allows more vapors to pass through than silt and clay.
- Meteorological conditions: In places like Billings that have cold winters, vapor intrusion is usually greater during the cold temperatures due to closed windows and doors and heated air rising and escaping from upper levels, drawing air from lower levels – known as the **stack effect**.
- Use of heating, ventilation, and air conditioning (HVAC) units: Some HVAC equipment (usually in commercial buildings) adds fresh air into the building air, which can dilute vapors in the indoor air. Use of HVAC equipment may also increase vapor intrusion because running the system during the winter can decrease air pressure inside the building and pull vapors from under the building.
- Building conditions: A building with many cracks in the concrete slab or walls may allow more vapors to enter than a building with a more intact concrete slab.

Vapor intrusion is a potential human exposure pathway - a way people may encounter hazardous vapors while performing day-to-day indoor activities. According to the 2015 EPA guidance for assessing and mitigating the vapor intrusion pathway[8], a vapor intrusion pathway is considered complete when:

1. An underground source of vapor-forming chemicals exists near or underneath buildings;
2. A pathway exists for vapor-forming chemicals to reach indoor occupants;
3. One or more of the vapor-forming chemicals found underground are also detected in indoor air; and
4. People are present in the building or will be present in the future when the vapor-forming chemicals are or may be present.

If one or more of these conditions is currently absent and is reasonably expected to be absent in the future, the vapor intrusion pathway is considered incomplete and will not likely result in human exposure due to vapor intrusion.

Some chemicals that cause vapor intrusion are also present in household and industrial chemical products. If these products are kept inside the building, they can also cause indoor-air contamination. These same chemicals can also be in outdoor air for reasons unrelated to the Site. Vapor intrusion investigations look at multiple lines of evidence to determine whether indoor air contamination is caused by underground sources, as opposed to indoor or outdoor **background sources.**

Vapor Intrusion at OU1

Between 2022 and 2024, the EPA collected more than 1,000 samples from about 200 buildings in OU1, including samples of **sub-slab soil gas**, **crawlspace air**, and indoor air. The EPA also sampled outdoor air, groundwater, and soil gas in yards, streets, alleys and the sewer lines near the four suspected source areas. The EPA analyzed the results from these samples and reached the following conclusions:

- Soil and groundwater samples contained elevated levels of **site-related** chemicals near and underneath buildings
- Vapors are migrating as a gas from groundwater into the soil where it can accumulate beneath buildings.
- The concentrations of vapor-forming chemicals in the soil gas beneath some buildings are high enough to cause unacceptable concentrations of site-related chemicals in indoor air.

[8] EPA's TECHNICAL GUIDE FOR ASSESSING AND MITIGATING THE VAPOR INTRUSION PATHWAY FROM SUBSURFACE VAPOR SOURCES TO INDOOR AIR, SWER Publication 9200.2-154, June 2015, available at: https://www.epa.gov/vaporintrusion/technical-guide-assessing-and-mitigating-vapor-intrusion-pathway-subsurface-vapor

- People are present in the building or will be present in the future when site-related chemicals are or may be present.

These findings support the conclusion that the vapor intrusion pathway is complete. **Figures 5a** and **5b** show the indoor-air and soil-gas results, respectively, compared to the **Preliminary Remediation Goals** (PRGs). PRGs are risk-based concentration goals that are calculated for each of the contaminants of concern to help with making cleanup decisions**. Figure 5a** shows indoor air results for both PCE and TCE combined, while **Figure 5b** shows soil gas results beneath the buildings. Sample locations that have a PRG exceedance for either PCE, TCE, or both are highlighted on the figures. These figures show that unacceptable levels of vapor intrusion are occurring, or could occur, in parts of OU1. Hundreds of buildings which have not been sampled yet, are located near the buildings that have been sampled on **Figures 5a** and **5b**. The EPA has utilized sampling data from nearby buildings that have been sampled for initial analysis. The Preferred Alternative includes additional sampling opportunities to identify buildings that exceed cleanup goals.

Figure 5a – PCE and TCE Indoor Air Results

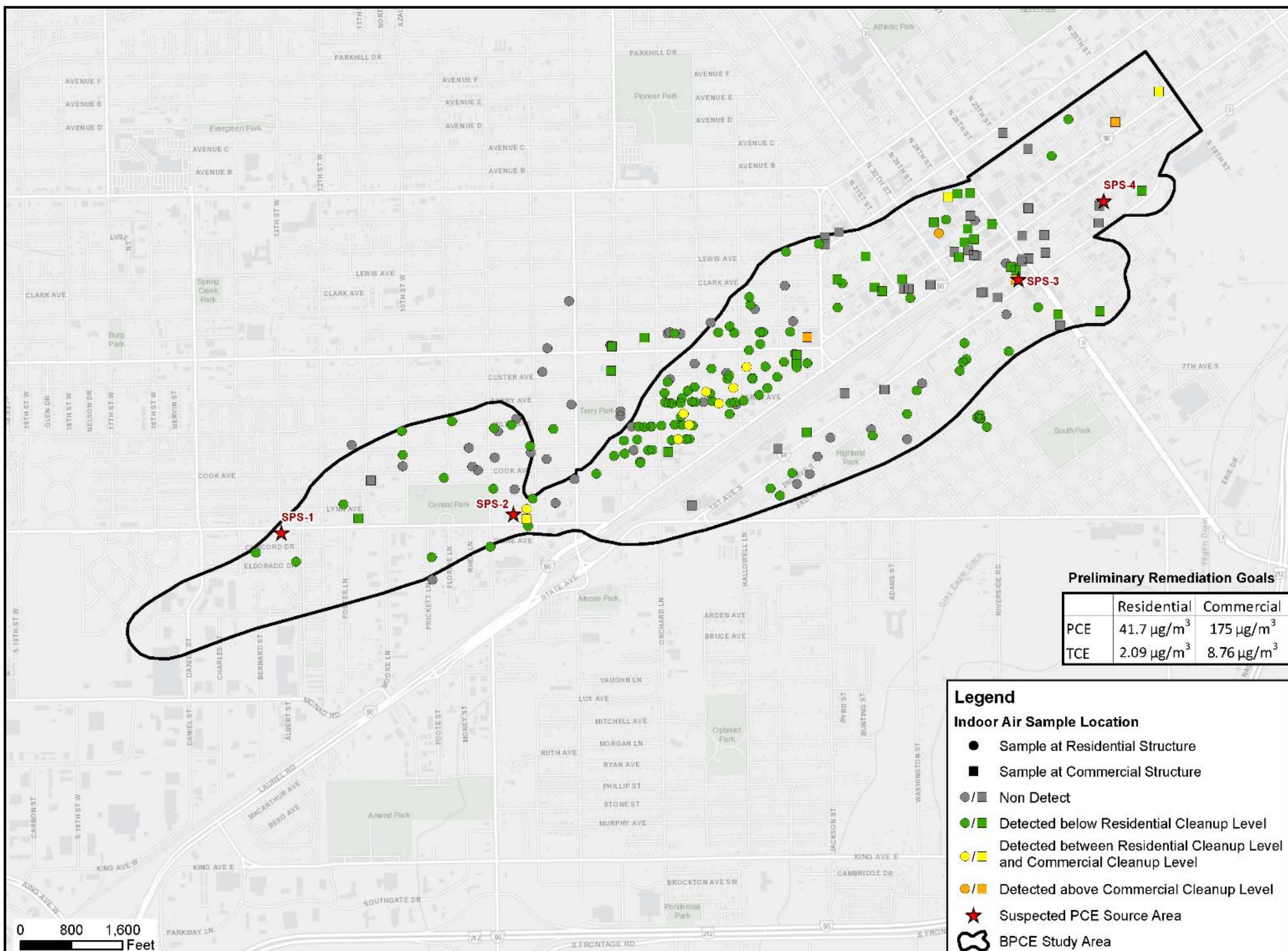
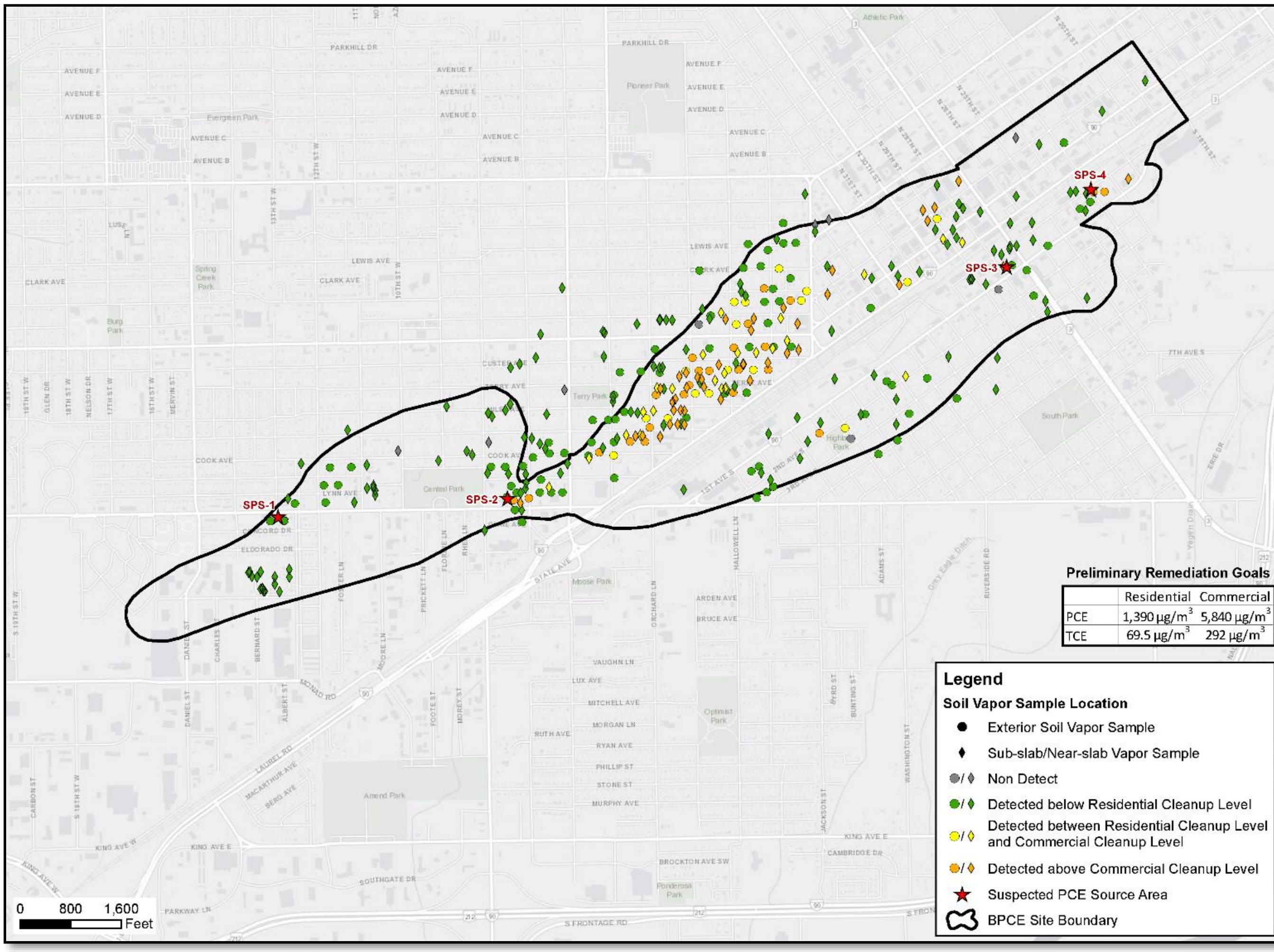


Figure 5b – PCE and TCE Soil Gas Results

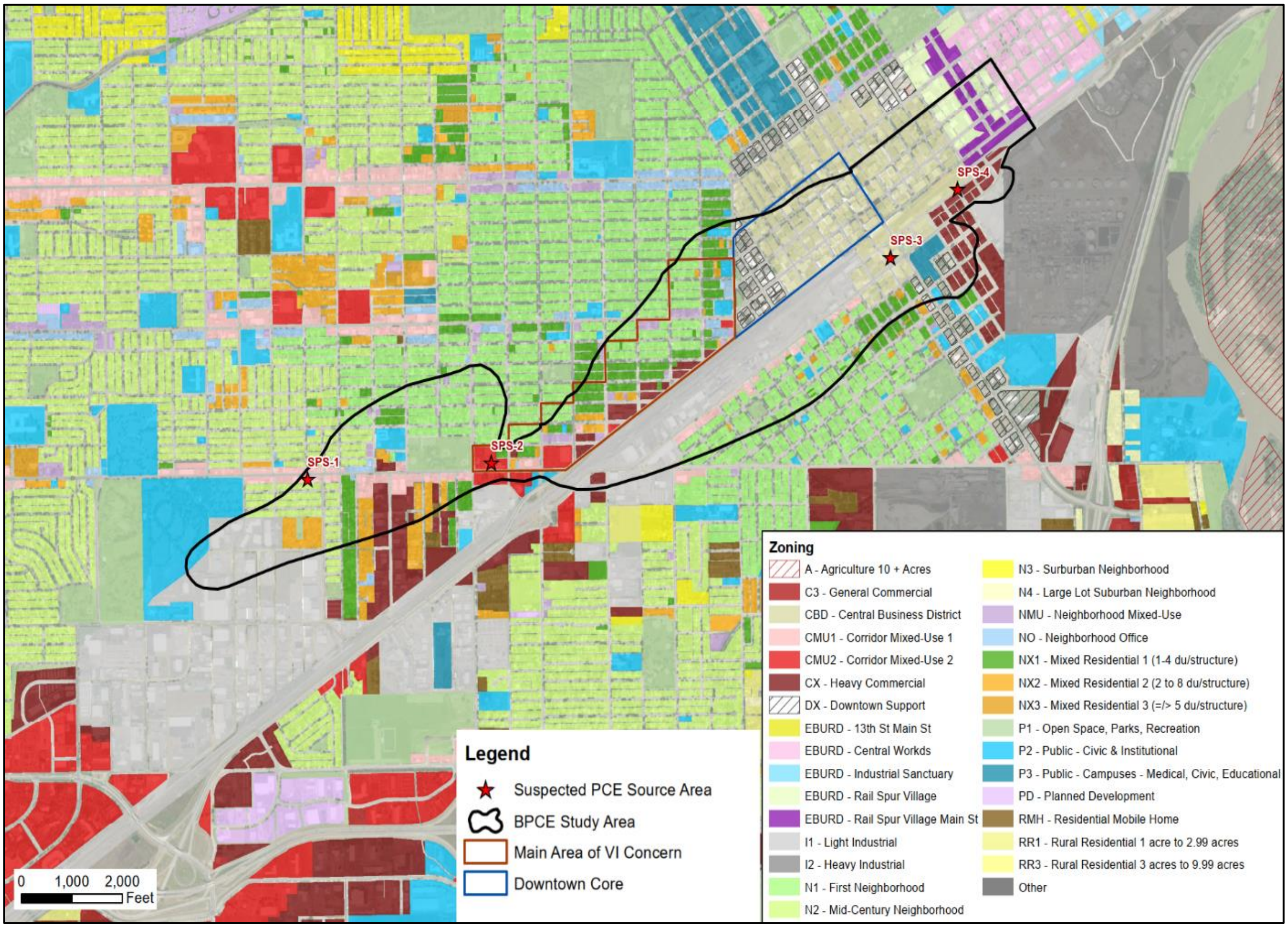


Land Use

OU1 encompasses a broad variety of urban land uses.[9] Land uses include commercial businesses, residences, schools, streets, industrial or manufacturing businesses, a railroad corridor, and municipal rights of way. Properties next to the Central Avenue and Montana Avenue corridors, along the railroad corridor, are generally zoned Community Commercial or Controlled Industrial (**Figure 6**). Properties located further from these corridors are typically zoned for Residential and Residential Multi-Family use. The northeastern edge of the plume extends into the Central Business District, as well as the South 27th Street Corridor Zoning District along 27th Street South. Multiple parks and public spaces are also located adjacent to or within the plume boundary.

[9] See City of Billings Zoning Map: https://billings.maps.arcgis.com/apps/webappviewer/index.html?id=a85b2d6e205b4569af1539a68b563c95

Figure 6 - Zoning Map



Scope and Role

This Proposed Plan presents the Preferred Alternative for addressing contaminated indoor air in OU1. The OU1 selected remedy, which will be identified in the IROD, will reduce people's exposure to contaminants of concern in indoor air after the interim remedy is implemented. The Preferred Alternative does not eliminate contaminated groundwater, which is the cause of the vapor intrusion. Cleanup of groundwater and the contaminant source areas will be addressed as part of the OU2 and OU3 remedies. The OU1 Preferred Alternative is, therefore, an interim action. The final vapor intrusion remedy for OU1 will be addressed in the final ROD along with the OU2 and OU3 remedies.

Summary of Site Risks

The human health and ecological risks posed by the Site determine whether a remedial action is needed. The EPA completed a Baseline Human Health Risk Assessment for OU1 to determine the current and future effects of contaminants on human health. This gives an estimate of the likelihood of developing adverse health effects if no further actions were taken to address the vapor intrusion pathway at the

Site. The OU1 risk assessment focused on evaluating human health risks associated with inhaling contaminants in indoor air by residents and commercial/industrial workers who reside or work in Site structures. Future risk assessments for OU2 and OU3 will evaluate risk associated with other **exposure pathways** such as drinking contaminated groundwater[10], exposure to soils irrigated with shallow groundwater, utility workers' exposure to contaminated soil and groundwater, and consideration for risks to ecological receptors.

The EPA utilizes a four-step process to estimate human health risk at a Superfund site:

1. Analyze Contamination
2. Assess Potential Health Hazards
3. Estimate Exposure
4. Characterize Site Risk

In Step 1, the EPA analyzes the concentrations of contaminants found at a site using two types of data to determine exposure from vapor intrusion:

1. Site-specific indoor air or crawlspace air results: Vapor intrusion exposures occur through breathing contaminated indoor air, so indoor air results are the most direct way to evaluate exposures and risks.
2. Site-specific sub-slab soil gas results: People are not exposed to sub-slab soil gas directly. To use sub-slab soil gas data in a risk assessment, risk assessors estimate the reduction in vapor concentrations or dilution (**attenuation**) that occurs when vapors below the slab enter a building and mix with indoor air.

In Step 2, the EPA evaluates the potential human health hazards of the chemicals by looking at information from human or animal toxicity studies. The EPA evaluates both cancer and non-cancer health effects to assess this potential **toxicity**.

In Step 3, the EPA considers the different ways that people might be exposed to the potentially hazardous contaminants identified in Steps 1 and 2; the concentrations that people might be exposed to; and the potential frequency and duration of exposure. Using this information, the EPA calculates a **reasonable maximum exposure** scenario, which portrays the highest level of exposure that could reasonably be expected to occur.

In Step 4, the EPA brings together the information from Step 2 and Step 3 to evaluate if there is the potential for unacceptable risk at the Site that warrants further action to protect human health.

The EPA estimates risk for cancer and non-cancer health effects as described below.

---

[10] The City of Billings does not use shallow groundwater in its drinking water supply. No one is currently known to be using contaminated shallow groundwater for drinking water.

Cancer Risks

The likelihood of a person developing cancer from exposure to cancer-causing chemicals at a Superfund site is generally expressed as an excess lifetime cancer risk. For example, an excess lifetime cancer risk of "one in ten thousand" means that for every ten thousand people that could be exposed over time, an **extra case** of cancer may result from exposure to Site contaminants. An extra cancer case means that one more person could get cancer during their lifetime than would normally be expected from all other causes. Lifetime cancer risks were evaluated assuming time-weighted exposures beginning as a child and extending into adulthood.

For carcinogens, the EPA considers excess lifetime cancer risks between one-in-one-million (1 in 1,000,000) and one-in-ten-thousand (1 in 10,000) to be within the acceptable risk range.[11] For OU1, the EPA has selected one-in-one-hundred-thousand (1 in 100,000) as the threshold risk value for evaluating unacceptable risk at the Site, and for calculating **cleanup levels**. This is the same risk value that the State of Montana uses for vapor intrusion cleanups across the state.

Non-Cancer Risks

For non-cancer risks, the EPA compares the following two factors:

1. The concentration of a chemical that is unlikely to cause an adverse, non-cancer, human-health effect. For inhalation exposure pathways like vapor intrusion, this is called the **reference concentration**.
2. The amount of the same chemical that a person could be exposed to at a site. Typically, this is averaged over a long period of exposure. For inhalation exposure pathways like vapor intrusion, this is called the **exposure point concentration**.

The EPA calculates a "hazard quotient" for each potential contaminant by dividing the exposure point concentration by the reference concentration.

1. If the exposure point concentration is greater than the reference concentration, the hazard quotient will be greater than one. This means that adverse non-cancer health effects are possible.
2. If the exposure point concentration is less than the reference concentration, the hazard quotient will be less than one. This means that adverse non-cancer health effects are not likely.

The EPA also calculates a hazard index, which is the sum of hazard quotients for chemicals that affect the same part of the human body. The EPA sets a **target hazard index** of one when evaluating and implementing remedies for environmental contamination at a site. This means that for a hazard index greater than one, adverse non-cancer health effects are possible.

[11] This acceptable risk range is a national policy specified in the regulations that govern the Superfund program. See 40 Code of Federal Regulations, Section 300.430(e)(2)(i)(A)(*2*) at: https://www.govinfo.gov/content/pkg/CFR-2015-title40-vol28/xml/CFR-2015-title40-vol28-part300.xml#seqnum300.430

Risk Assessment Findings

The main findings from the human health risk assessment are:

- The vapor intrusion pathway is complete at certain structures, and people are or may be exposed to site-related chemicals by inhaling them in indoor air.
- There is unacceptable risk identified at the Site in indoor air and sub-slab soil vapor based on estimated risks for both cancer and non-cancer human health effects.
- There are twelve primary risk drivers identified[12].

Of the identified primary risk drivers, six chemicals are being considered as contaminants of concern, requiring remedial response for the Site OU1[13]. The six chemicals include Chloroform, Cis-1,2-Dichloroethene, Isopropanol, Naphthalene, PCE, and TCE. Risk assessments do not evaluate additional factors considered by risk managers to identify which contaminants will be addressed by the remedy, such as background concentrations or source attribution. For example, chemicals may be present in indoor air for reasons unrelated to vapor intrusion. Actions such as storing dry-cleaned clothes in a home, using brake cleaning products in an attached garage, cleaning firearms, placing mothballs near clothing, or using other household chemicals can release the same chemicals directly into the indoor air.

The six chemicals being considered as contaminants of concern to be addressed by the cleanup are selected because:

- They have been detected in sub-slab soil gas and/or indoor air at concentrations that indicate concentrations in indoor air are likely due to vapor intrusion. These factors support the conclusion that the concentrations in indoor air are related to Site contamination and not indoor or outdoor background sources.
- They are sufficiently widespread and show elevated risks in indoor air and sub-slab soil vapor.

Remedial Action Objectives and Preliminary Remediation Goals

In accordance with Superfund and the **National Oil and Hazardous Substance Contingency Plan (NCP)**, the EPA conducted an OU1 Focused Feasibility Study to evaluate remedies to reduce people's exposures to site-related chemicals in indoor air. One of the EPA's first steps in the Focused Feasibility Study process was establishing **Remedial Action Objectives**. These are site-specific goals for protecting human health and the environment. They are developed for the specific media(s) and

[12] For a thorough explanation on all twelve identified primary risk drivers, please reference the Human Health Risk Assessment and the OU1 Feasibility Study in the Administrative Record listed on our Site webpage.
[13] EPA's PRG Memorandum provides additional detail regarding EPA's decision to carry forward these six COCs. See the OU1 PRG Memo in the Administrative Record listed on our Site webpage.

contaminants of concern for the Site. Remedial Action Objectives provide the basis for selecting appropriate response actions, remedial technologies, and developing alternatives.

The following Remedial Action Objectives have been established to address vapor intrusion risks:

- Prevent current and future exposure to indoor air contaminant of concern concentrations that are or could become present above cleanup levels due to vapor intrusion associated with the Site.
- Mitigate migration of contaminants of concern from subsurface media into indoor air that are above levels protective of current and future occupants.

When achieved, these Remedial Action Objectives will address Site risks by preventing exposure to contaminants of concern in indoor air at concentrations posing unacceptable risk to human health.

To support achievement of the Remedial Action Objectives, the EPA calculated indoor air and sub-slab soil vapor Preliminary Remediation Goals (PRGs) (**Table 1**). The Proposed Plan PRGs are chemical-specific concentrations calculated for each medium (indoor air and soil vapor) and each land use combination (residential and commercial) to protect human health. The EPA calculated PRG concentrations using **target risk levels** consistent with the EPA guidance[14] (see Summary of Site Risks) and **exposure assumptions,** such as duration and frequency to determine reasonable maximum exposures. When the concentrations of contaminants of concern are below the PRGs, human health risks are unlikely to exceed unacceptable risk thresholds.

Table 1: Preliminary Remediation Goals

Chemical	Abbreviation	Residential Indoor Air (μg/m^3)	Residential Soil Vapor (μg/m^3)	Commercial Indoor Air (μg/m^3)	Commercial Soil Vapor (μg/m^3)
Tetrachloroethene	PCE	42	1,390	175	5,840
Trichloroethene	TCE	1.0	35	4.4	146
cis-1,2-Dichloroethene	cis-DCE	21	695	88	2,920
Isopropanol	None	209	6,950	876	29,200
Naphthalene	None	0.4	14	1.8	60
Chloroform	None	0.6	20	2.7	89

[14] PRGs were calculated using a total excess lifetime cancer risk of 1 in 100,000, and a total noncancer hazard index of 1. For chemicals that can cause both cancer and non-cancer effects, the PRG was based on the effect resulting in the lowest (most conservative) indoor air or soil vapor concentration.

The PRGs shown in **Table 1** have units of micrograms (one-millionth of a gram) per cubic meter of air ($\mu g/m^3$). The residential PRGs are lower than the commercial PRGs because, on average, people spend more time in residential buildings than in commercial buildings. Therefore, a lower concentration is required in a residential building to achieve the same level of protectiveness.

Summary of Remedial Alternatives

The EPA evaluated two remedial alternatives to meet the Remedial Action Objectives and reduce people's exposure to site-related contamination in indoor air. Below are the two remedial alternatives evaluated, the second of which is the EPA's Preferred Alternative:

- Alternative 1: No Action
- Alternative 2: Appropriate Vapor Intrusion Mitigation

A summary of these remedial alternatives is provided below.

Alternative 1 – No Action

In every feasibility study, a no action alternative is developed as a baseline for comparative analysis purposes[15]. Including a no action alternative is a regulatory requirement that provides clear communication to stakeholders of the effects of inaction and establishes a baseline for comparing costs and benefits of other alternatives. Under Alternative 1, no further action would be taken to address vapor intrusion at the Site. Based on vapor intrusion investigations that have been performed to date, it is expected that this alternative would allow occupants in affected buildings to be potentially exposed to Site-related contamination in indoor air at concentrations that represent unacceptable levels of risk to human health. Since the no action alternative does not satisfy most or all the remedial-alternative evaluation criteria (**Table 5**), it was not selected as the preferred alternative.

Alternative 2 – Appropriate Vapor Intrusion Mitigation

Alternative 2 includes monitoring, **institutional controls**, and various engineering controls to meet the OU1 Remedial Action Objectives. The remedial actions associated with Alternative 2 are described in detail in **Table 2** and include the following actions:

- **Monitoring** – Monitoring includes sampling of environmental media to identify structures where remedial action is required and to evaluate if such action is effective.

[15] The no action alternative is required by the National Oil Pollution and Hazardous Substance Contingency Plan (40 Code of Federal Regulations [CFR] § 300.430)

- **Engineering Controls** – Engineering controls include using various remedial technologies and process options to mitigate vapor intrusion. **Table 2** lists the available technologies and process options that may be used as appropriate based on structure conditions.

- **Institutional Controls** – Institutional controls are non-engineered instruments, such as administrative and legal rules, that help to minimize the potential for exposure to contamination and/or protect the integrity of a remedial action. For Alternative 2, institutional controls include governmental controls (e.g., a city ordinance), consent for access forms, deed notifications, and informational devices (**Table 3**).

Sub-slab depressurization is the most practical, effective and common vapor intrusion engineering control, therefore, the OU1 Preferred Alternative will give preference to sub-slab depressurization. **Figure 7** illustrates how sub-slab depressurization prevents migration of subsurface vapors into a building. These systems function like radon mitigation systems. In most cases, a fan will pull air from suction points installed beneath a building and route the vapors through a stack on the roof that will likely include a filter. This will create a vacuum beneath the slab which reduces the amount of vapor-forming chemicals that have the potential to enter a building.

Alternative 2 also includes a variety of other remedial technologies and process options that may be needed in rare instances (**Table 2**). For example, dewatering of basements may be needed if contaminated groundwater is in direct contact with a basement slab or foundation, perhaps through flooding, or a crawlspace may need to be encapsulated with a vapor barrier to allow for extraction of gases from beneath the barrier.

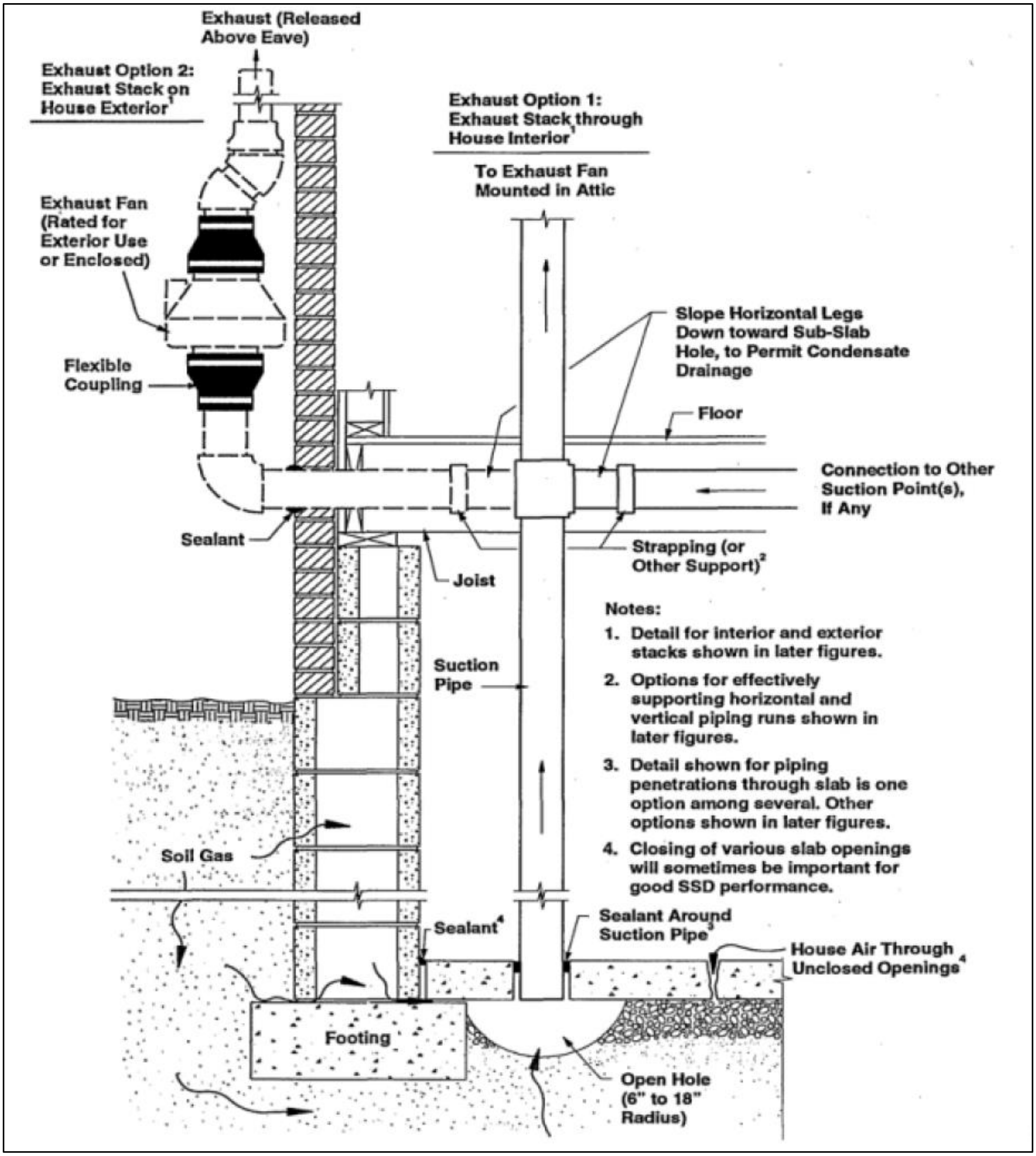
Table 2: Process Options Associated with Alternative 2

Process Option	Description	Alternative 1: No Action	Alternative 2: Appropriate Vapor Intrusion Mitigation
Institutional Controls	See **Table 3**	Not a process option	Included as a process option
Monitoring - Air Sampling and Analysis and Visual Inspections	Sampling indoor air, crawlspace air, and sub-slab soil gas in structures to assess the need for vapor intrusion mitigation. Sampling indoor air, crawl space, sub-slab soil gas, or vapor intrusion mitigation system effluent in structures where vapor intrusion is being mitigated. Outdoor air will also be sampled during indoor air investigations. Visual inspections and testing of the vapor intrusion mitigation systems will be periodically conducted.	Not a process option	Included as a process option
Sealing the Vapor Entry Points	Involves filling cracks in the floor slab and gaps around pipes and utility lines in basement walls or pouring concrete over unfinished dirt floors.	Not a process option	Included as a process option

Process Option	Description	Alternative 1: No Action	Alternative 2: Appropriate Vapor Intrusion Mitigation
Sub-Slab Depressurization	A mitigation system that creates negative pressure below a building's concrete slab to prevent gas from entering. This is achieved by using a fan to draw air from beneath the slab and vent it outdoors, effectively preventing gases from migrating into the building. Sub-slab depressurization systems are typically installed by cutting holes in the slab, installing PVC pipes, and connecting them to a fan.	Not a process option	Included as a process option
Sub-Membrane Depressurization	A method of actively drawing air from under a vapor barrier in a crawlspace. It works by encapsulating the crawlspace with a plastic liner, creating a space for a fan to pull air from below the liner and venting it outside. This process creates a negative pressure, drawing contaminants out from under the barrier.	Not a process option	Possibly a process option
Block Wall Depressurization	A mitigation method used in homes with concrete block foundations. It works by creating a vacuum within the hollow spaces of the block wall to draw out gases and vent them to the outside preventing them from entering the home through these voids.	Not a process option	Possibly a process option
Drain Tile Depressurization	A mitigation method that utilizes an existing drain tile system to create a vacuum that draws gas from the soil and vents it outside, preventing it from entering a home or building. This method involves creating a negative pressure within the drain tile network, essentially acting as an underground ventilation system.	Not a process option	Possibly a process option
Sewer Gas Depressurization	A mitigation method used in locations where contaminant vapors are entering through the sewer pipes. It works by reducing the pressure of sewer gases within a plumbing system or subsurface area, typically using a fan installed at the outlet of the main sewer vent, to prevent vapors from entering a building.	Not a process option	Possibly a process option

Process Option	Description	Alternative 1: No Action	Alternative 2: Appropriate Vapor Intrusion Mitigation
Exterior Subsurface Soil Depressurization / Soil Vapor Extraction	A method used to mitigate vapor intrusion by creating a negative pressure beneath a building's foundation, thereby drawing gases away from the structure and venting it outdoors.	Not a process option	Possibly a process option
Sump or Drain Tile Dewatering System	Uses perforated pipes, typically made of plastic, to collect and remove excess water from soil, often used to prevent basement flooding. These systems route water to a collection point like a sump pit, where a sump pumps it away.	Not a process option	Possibly a process option
Granular Activated Carbon (GAC) Indoor Air Treatment	A treatment process that uses loose granules of activated carbon to remove contaminants by adsorption from indoor air. GAC is highly porous, providing a large surface area for trapping chemicals, organic compounds, and other pollutants.	Not a process option	Possibly a process option
Granular Activated Carbon (GAC) Effluent Air Treatment	Uses GAC filtration to remove contaminants from the effluent of other treatment technologies before venting to outdoor air.	Not a process option	Included as a process option
Actively Increase Structure Ventilation	Adds fresh air into a building to dilute contaminants in indoor air. Can be used with or without heat or energy recovery ventilation.	Not a process option	Possibly a process option
Indoor Air Pressurization	Refers to increasing the air pressure inside a building or room relative to the air pressure outside. Maintaining a slightly positive pressure helps prevent contaminants from entering the building.	Not a process option	Possibly a process option
Active or Passive Sub-Slab Ventilation	Primarily applicable to new structures, perforated piping is set in the foundation to direct vapors from under the building to vent above the roofline of the structure to outdoor air. It can use passive ventilation, or a fan may be added for active ventilation.	Not a process option	Possibly a process option
Vapor Barriers	Consist of a thin layer of impermeable material, typically polyethylene sheeting, included in building construction to prevent vapors from entering a building.	Not a process option	Possibly a process option

Figure 7: Generic Sub-slab Depressurization System Figure[16]

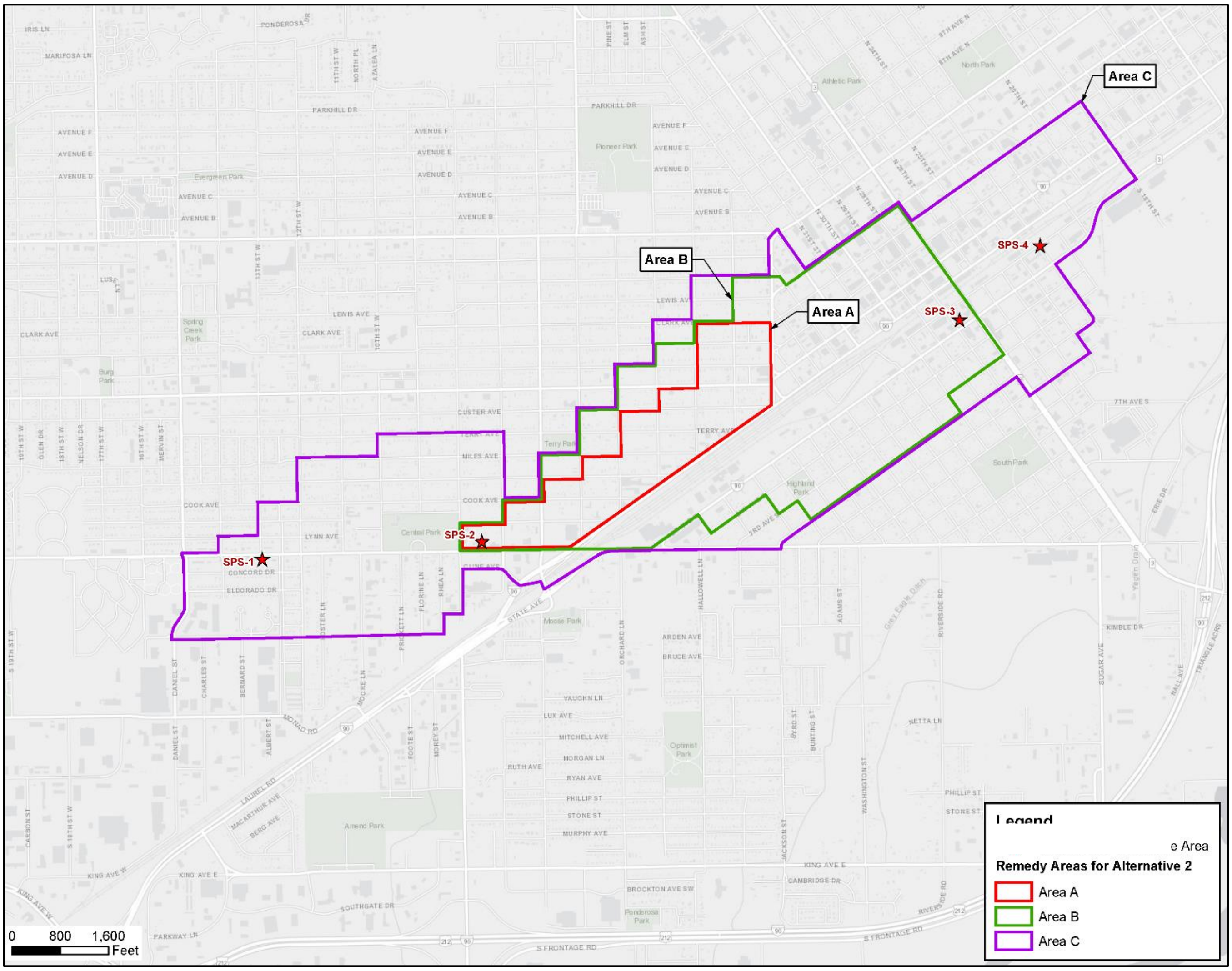


[16] Figure from the EPA. 2015. OSWER Technical guide for assessing and mitigating the vapor intrusion pathway from subsurface vapor sources to indoor air. OSWER Publication 9200.2-154. Office of Solid Waste and Emergency Response. Figure 8-1.

Remedy Areas

Under Alternative 2, the Site is divided into three remedy areas, A, B, and C, to facilitate remedy implementation.

Figure 8: Remedy Areas for Alternative 2[17]



These areas are defined based on concentrations of PCE and TCE in groundwater, soil vapor, and indoor air. For Alternative 2, it is proposed that the remedial action will be implemented in the three remedy areas as follows:

Area A:

- Encompasses 155 acres and includes approximately 706 residential and 39 commercial structures.

---

[17] To view your property on the map, please visit https://arcg.is/1bzinW

- Considered the main area of vapor intrusion concern because most exceedances in indoor air and soil vapor samples occur in Area A.
- Alternative 2 proposes that all residential structures in Area A will be eligible for vapor intrusion mitigation systems without the need for **pre-mitigation sampling**.
- All commercial structures will be eligible for pre-mitigation sampling. Indoor air and sub-slab soil vapor sampling results will be compared to cleanup levels (PRGs) to determine if a vapor intrusion mitigation system is needed. This is because cleanup levels (PRGs) for commercial structures are higher than residential cleanup levels.
- **Direct outreach** will be performed to notify tenants and owners of the availability of pre-mitigation sampling and vapor intrusion mitigation systems.

Area B:

- Encompasses 395 acres and includes 723 residential and 741 commercial structures.
- There are some exceedances in indoor air samples and soil vapor samples, but to a lesser extent than in Area A.
- Alternative 2 proposes that all structures in Area B will be eligible for pre-mitigation sampling to determine the need for vapor intrusion mitigation systems. Indoor air and sub-slab soil vapor sampling results will be compared to cleanup levels (PRGs) to determine if vapor intrusion mitigation systems are necessary.
- The EPA will emphasize outreach with these property owners and tenants to secure access for pre-mitigation sampling.

Area C:

- Encompasses 550 acres and includes 1,247 residential and 736 commercial structures.
- There were only sporadic exceedances in indoor air samples and soil vapor samples.
- Alternative 2 proposes that all structures in Area C will be eligible for pre-mitigation sampling. Indoor air and sub-slab soil vapor sampling results will be compared to cleanup goals (PRGs) to determine if vapor intrusion mitigation systems are necessary.
- Residents and tenants will be informed of pre-mitigation sampling opportunities via informational devices such as fact sheets, public meetings and outreach efforts.

Alternative 2 also includes periodic maintenance and monitoring of the vapor intrusion mitigation systems to evaluate system effectiveness and ensure continued functionality. Because vapor intrusion mitigation technologies only reduce risk while the system is operating, access to the systems for routine inspection and maintenance will be required for all installed systems. This includes vapor intrusion mitigation systems that will be installed as part of the OU1 remedy, the vapor intrusion mitigation systems that were installed by the EPA's removal program, and the handful of mitigation systems that have been installed by property owners to address radon concerns. All structures that will have a vapor intrusion mitigation system installed as part of the

OU1 remedial action will have baseline sampling performed prior to installation as well as system performance monitoring after installation to evaluate system effectiveness. Periodic long-term monitoring and maintenance will also be performed to ensure continued functionality until the final Site remedy is complete.

The EPA also understands community concerns about running hundreds of vapor intrusion mitigations systems concurrently and the potential impacts on outdoor air. Therefore, as a part of Alternative 2, the EPA proposes to install granular activated carbon filters on vapor intrusion mitigation system effluent for all systems installed in residential structures in Area A. For residential structures outside of Area A and all commercial structures, sampling and air dispersion modeling will be used to determine if effluent filtration is needed. Replacing and maintaining the filters will be included as part of the operation and maintenance of the remedy.

Institutional Controls

As noted above, Alternative 2 includes the use of institutional controls to ensure the remedy remains protective of human health (**Table 3**). The following institutional controls are proposed:

Table 3 – Institutional Controls

Institutional Controls	Remedy Area A[1]	Remedy Area B[1]	Remedy Area C[1]
City of Billings ordinance requiring vapor intrusion mitigation measures for new construction.	Yes	No	No
City of Billings ordinance requiring owners to notify tenants regarding availability of sampling, sampling results, and mitigation system installations.	Yes	No	No
City of Billings ordinance or policy prompting notification to the EPA of land use changes (e.g. commercial to residential) or building permit applications that may affect vapor intrusion mitigation systems.	Yes	No	No
Consent for Access Forms granting the EPA, DEQ, and/or its authorized representatives' access to a property to inspect, monitor, and maintain a vapor intrusion mitigation system.	Yes, if the structure has a vapor intrusion mitigation system	Yes, if the structure has a vapor intrusion mitigation system	Yes, if the structure has a vapor intrusion mitigation system
Consent for Access Forms requesting that property owners refrain from activities that would interfere with the vapor intrusion mitigation system's performance.	Yes, if the structure has a vapor intrusion mitigation system	Yes, if the structure has a vapor intrusion mitigation system	Yes, if the structure has a vapor intrusion mitigation system
Deed Notification - If access is denied by the property owner for the installation of vapor intrusion mitigation systems or for post-mitigation monitoring, the EPA intends to apply a **deed notification** informing affected parties of the decision and continued availability of vapor intrusion mitigation system availability.	Yes, for all residential structures and commercial structures where sampling has determined mitigation is needed and property owner has denied access	Yes, for structures where sampling has determined mitigation is needed and property owner has denied access	Yes, for structures where sampling has determined mitigation is needed and property owner has denied access
Direct outreach - Reaching out to owners and tenants directly, typically through personalized emails, phone calls, face to face or other methods, regarding availability of vapor intrusion mitigation systems without additional sampling.	Yes, for residential structures only	No	No
Outreach - Letter and fact sheet regarding availability of sampling and vapor intrusion mitigation systems, if warranted based on sampling.	Yes, for commercial structures only[2]	Yes	Yes
Outreach - Fact sheet reporting on the status of the OU1 interim remedy.	Yes	Yes	Yes

Notes

- [1] See **Figure 8**.

- [2] Because mitigation systems will be available to residential structures, sampling to determine the occurrence and magnitude of vapor intrusion is not needed. Sampling to establish baseline conditions and operating and maintaining mitigation systems will be completed as necessary.

Evaluation of Alternatives

The **NCP** identifies nine evaluation criteria for evaluating remedial alternatives. The purpose of this evaluation is to promote consistent identification of the relative advantages and disadvantages of each alternative, thereby guiding selection of remedies that offer the most effective and efficient means of achieving site cleanup goals. The nine criteria are described in **Table 4** below, followed by a discussion of how each alternative meets or does not meet each criterion.

Table 4: Alternative Evaluation Criteria

Threshold Criteria: Alternatives must meet these criteria to be eligible for selection.
1. Overall Protection of Human Health and the Environment: Will the alternative provide adequate protection of human health and the environment against unacceptable risk?
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs): Will the alternative comply with all ARARs of federal and state environmental statutes or justify a waiver?
Primary Balancing Criteria: These criteria are used to weigh major trade-offs among alternatives.
3. Long-Term Effectiveness and Permanence: Will the alternative be able to provide reliable, long-term protection with minimal residual risk?
4. Reduction of Toxicity, Mobility, or Volume through Treatment: Will the alternative use treatment technologies that reduce the hazardous substances' toxicity, mobility, or volume?
5. Short-Term Effectiveness: How quickly can the alternative protect against unacceptable risk and will it come with adverse impacts to workers, the community, or the environment?
6. Implementability: Can the alternative be easily implemented, considering technical and administrative issues and availability of services and materials?
7. Cost: What are the estimated capital and annual operation and maintenance costs? If costs are accrued over time, what would the present value of the total cost be, accounting for inflation? Costs are expected to be accurate within a range of +50% to -30%.
Modifying Criteria: These criteria allow for state and community participation in alternative selection
8. State Agency Acceptance: Does the DEQ concur with the alternative?
9. Community Acceptance: Does the public agree with the alternative?

A summary of alternative compliance with each criterion is presented in **Table 5** below. A more detailed discussion follows.

Table 5: Alternative Compliance with Criteria

Evaluation Criteria	Alternative 1: No Action	Alternative 2: Appropriate Vapor Intrusion Mitigation
Threshold Criteria:		
1. Overall Protection of Human Health and the Environment	Not protective	Protective
2. Compliance with ARARs	Not assessed, alternative does not meet threshold criteria	Compliant
Primary Balancing Criteria:		
3. Long-Term Effectiveness and Permanence	Not assessed, alternative does not meet threshold criteria	Poor until the OU2 and OU3 remedies are planned, implemented, and eventually, completed
4. Reduction of Toxicity, Mobility, or Volume through Treatment	Not assessed, alternative does not meet threshold criteria	Poor because Alternative 2 is designed to mitigate occupant exposure in indoor air primarily by preventing vapor intrusion. It is not intended to treat contaminants at the Site.
5. Short-Term Effectiveness	Not assessed, alternative does not meet threshold criteria	Excellent because short-term risks to the community, the workers installing the vapor intrusion mitigation systems, or the general environment is minimal. Any potential threats to the workers from encountering Site-related contaminants during vapor intrusion system installation would be evaluated and mitigated by preparation and implementation of a health and safety plan.
6. Implementability	Not assessed, alternative does not meet threshold criteria	Readily implementable, but varies by structure
7. Cost	Not assessed, alternative does not meet threshold criteria	Estimated to be $33,608,000 over 35 years
Modifying Criteria:		
8. State Agency Acceptance	Not assessed, alternative does not meet threshold criteria	Criteria to be evaluated following the public comment period and incorporated into the IROD
9. Community Acceptance	Not assessed, alternative does not meet threshold criteria	Criteria to be evaluated following the public comment period and incorporated into the IROD

1. *Overall Protection of Human Health and the Environment*

Alternative 1 (No Action) would provide no improvement over current conditions and no risk reduction and therefore would not be protective of human health or the environment. Alternative 1 does not meet the threshold criterion of overall protection of human health and the environment and is therefore not eligible for selection and will not be discussed further in this Proposed Plan.

Alternative 2 (Appropriate Vapor Intrusion Mitigation) would protect structure occupants from exposure to site-related vapors in indoor air by mitigating vapor intrusion. However, Alternative 2 will not address the source of contaminated soil vapor (contaminated groundwater, soil and free-phase liquid – addressed under OU2 and OU3). Therefore, Alternative 2 is intended to protect human health only on an interim basis until remedial action is completed on the source areas and groundwater and a vapor intrusion mitigation system is no longer necessary. Alternative 2 is considered protective of human health from risks via the vapor intrusion pathway.

2. *Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)*

Applicable or Relevant and Appropriate Requirements (ARARs) are the specific environmental standards under Federal or State environmental law that apply to the cleanup of the Site. The mitigation components of Alternative 2 would trigger ARARs[18] including:

- Waste characterization and, if applicable, solid and hazardous waste management requirements for any materials generated as part of vapor intrusion mitigation installation.
- Discharge limits and pre-treatment requirements if mitigation requires discharge of groundwater collected in sumps to surface waters (likely through City of Billings sanitary or stormwater sewers).

The resources and expertise needed to comply with these ARARs are available and there are no technical or administrative impediments to compliance. Thus, Alternative 2 will comply with ARARs which are included as Appendix C to the Focused Feasibility Study.

3. *Long-term Effectiveness and Permanence*

The vapor intrusion mitigation, monitoring and institutional controls of Alternative 2 will not achieve long-term effectiveness and permanence. This is because this remedial alternative does not reduce or eliminate the sources of vapor-forming chemicals in the source areas or in groundwater. If Alternative 2 were the only one ever implemented at the Site, residual risks would remain as soon as the vapor intrusion mitigation systems were turned off.

Cleaning up contaminated groundwater and source areas will be done as part of the OU2 and OU3 remedies, which will be designed to achieve long-term effectiveness and permanence at the Site.

[18] CERCLA section 121(d)(2) specifies that remedial actions shall attain any standard, requirement, criteria, or limitation under federal environmental law or any more stringent promulgated standard, requirement, criteria or limitation under state environmental or facility siting law that is legally applicable to the hazardous substance (or pollutant or contaminant) concerned or is relevant and appropriate under the circumstances of the release.

4. *Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment*

Alternative 2 would not significantly nor permanently reduce the toxicity, mobility or volume of hazardous substances. Alternative 2 is designed to mitigate occupant exposure to contaminants of concern in indoor air primarily by preventing vapor intrusion. It is not intended to treat contaminants at the Site. The EPA expects the remedial actions for OU2 and OU3 to address reducing toxicity, mobility or volume of hazardous substances through treatment. Filtration of the mitigation effluent or indoor air treats contaminants[19] through capture, but filtration will not appreciably reduce the volume of hazardous substances at the Site.

5. *Short-term Effectiveness*

Alternative 2 could be implemented at impacted structures within a reasonable timeframe after the Interim Record of Decision is signed. For most structures where owners agree to installation of a vapor intrusion mitigation system, work could be complete within the first couple of years of the remedy. The installation of sub-slab depressurization systems can be completed in less than one day at residential structures and can take up to one week for the installation of larger commercial systems. If the vapor intrusion mitigation system continuously operates, and maintenance and monitoring of the system continues, building occupants would likely be protected from unacceptable vapor intrusion exposures and risks for the duration of the remedy.

The effectiveness of sub-slab depressurization systems has been demonstrated through sampling systems that have been installed at the Site as part of the EPA's previous removal actions. Comparing post-mitigation sampling with pre-mitigation sampling results for these systems shows a reduction in contaminants in indoor air and sub-slab concentrations to acceptable levels. Sub-slab vapors will be collected and diverted to the roofline of the property. In Area A, given the large number of vapor intrusion mitigation systems that will be installed, the vapors will be treated at the roofline using granular activated carbon to prevent vapors from accumulating in outdoor air.

The implementation of Alternative 2 would not be expected to result in short-term risks to the community, the workers installing the vapor intrusion mitigation systems, or the general environment. Any potential threats to the workers from encountering Site-related contaminants during vapor intrusion system installation would be evaluated and mitigated by preparation and implementation of a health and safety plan.

The EPA expects that within the first five years of the remedy period, most buildings where vapor intrusion mitigation occurs, or has the potential to occur, will be identified and appropriately addressed through public outreach efforts. The EPA will inform property owners of the availability of sampling and installation of vapor mitigation systems. Outreach and mitigation will continue after the first five years. The number of new buildings being sampled or mitigated is expected to decrease as the number of building owners that have either accepted or declined sampling and mitigation reaches a steady state. Some new buildings will continue to be added as properties

---

[19] Indoor air filtration was included as a potential process option for rare cases where it may be needed to supplement or replace sub-slab depressurization systems. An example could include a building with a wet basement meaning that groundwater is directly in contact with the slab and sub-slab suction points would not function.

change ownership or owners change their minds about sampling and vapor intrusion mitigation. Such instances will likely be few, relative to the initial sampling and mitigation efforts[20].

6. *Implementability*

Due to structure conditions that vary by building, the appropriate Alternative 2 remedial action for each building is determined on a case-by-case basis. Therefore, the degree of implementability will also vary by building. Despite this, Alternative 2 is generally considered to be readily implementable. Implementability of sub-slab depressurization systems has already been demonstrated by successful installations at 35 buildings within OU1, and these systems have demonstrated reductions in contaminant concentrations in indoor air and beneath the buildings. Poor slab and HVAC conditions, as noted at some buildings at the Site, may make implementation of various vapor intrusion mitigation processes more difficult. Further, larger scale buildings, like commercial buildings require greater engineering and planning. Services, equipment and materials for implementing appropriate vapor intrusion mitigation are generally readily available, and the remedial technologies included as options are generally proven.

No permits or other regulatory approvals are needed for most process options; however, local and state building permits may be required for modification of existing HVAC systems. Depending on the complexity of the modification, permitting could require significant engineering input, but permits are obtainable. If management of solid and hazardous waste is necessary, sufficient commercial resources are available to characterize and manage the waste.

Many retained process options (**Table 2**) provide flexibility when implementing mitigation at a given building. Should vapor intrusion mitigation systems be insufficient to protect human health and the environment, other process options are available to reach adequate protection.

7. *Cost*

A net present worth analysis was conducted for the Focused Feasibility Study and resulted in an estimated present worth cost of $33,608,000 over 35 years[21]. The actual duration of the OU1 remedy is unknown but was estimated to be 35 years until the Site-wide remedy is complete. Since the cost of the remedy is highly dependent on tenant and owner's willingness to allow the EPA access for monitoring and installation, there is a high level of uncertainty associated with the number of structures that will have a vapor intrusion mitigation system installed by the EPA in the cost estimate. For this reason, the estimated cost is an order-of-magnitude engineering cost estimate that is expected to be within –30 to +50 percent of the actual project cost.

---

[20] No case studies were found to provide data on rate of acceptance for pre-emptive vapor intrusion mitigation, and it is unknown how much interest there will initially be. Therefore, if interest exceeds the capacity of the EPA's contractor, criteria may need to be developed to prioritize installations. While the criteria will be developed as part of the remedial action, factors such as age of occupants, length of time occupants have lived in the structure, age of structure, use of basement, and integrity of the foundation will be considered.

[21] See Appendix D of the Focused Feasibility Study for detailed line items and basis for the cost estimate.

The cost to implement each process option was estimated per building, and the following were assumed to be applied to the total estimation:

- Institutional Controls (**Table 3**)
    - Development and implementation of deed notifications
    - Development of an ordinance with the City of Billings
    - Public outreach including mailing fact sheets and informational packets, door-to-door communication and public meetings
    - Consent for access forms provided to property owners to provide the EPA access to the properties to inspect and maintain the vapor intrusion mitigation systems.
- Air sampling and analysis
    - Sampling in structures that have not previously been sampled to assess the need for vapor intrusion mitigation
    - Sampling in structures where vapor intrusion has been mitigated to assess the effectiveness of the vapor intrusion mitigation strategy
- Sealing the structure envelope
- Sub-slab depressurization
    - Installation and commissioning of a sub-slab depressurization system
    - Routine inspections and repair
    - Effluent filtration

8. *State Agency Acceptance*

State acceptance of the Preferred Alternative will be evaluated after the public comment period ends and will be described in the Interim Record of Decision. Based on DEQ's initial review, DEQ agrees with the analysis and recommendations outlined in the Proposed Plan and will continue to review and provide comment during the public comment period. The EPA will assess this criterion based on State comments received on this Proposed Plan.

9. *Community Acceptance*

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends and will be described in the IROD through a responsiveness summary.

Preferred Alternative

Based on multiple lines of evidence, vapor intrusion is occurring at some structures at concentrations which pose unacceptable risks to human health. Additionally, structures not yet sampled but with the potential for complete and significant vapor intrusion exist within OU1.

The EPA's Preferred Alternative, Alternative 2: Appropriate Vapor Intrusion Mitigation, would address the Remedial Action Objectives by mitigating vapor intrusion using the appropriate remedial technologies for each structure from a variety of process options. This alternative is recommended because it will reduce unacceptable risk to human health in the shortest timeframe.

The Preferred Alternative identified in this Proposed Plan may change in response to public and state comments or new information provided during the public comment period.

It is the lead agency's current judgment that the Preferred Alternative identified in this Proposed Plan is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Based on the information currently available, the EPA believes the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the alternatives evaluated with respect to balancing and modifying criteria. The EPA expects the Preferred Alternative to satisfy the following statutory requirements of CERCLA §121(b): (1) be protective of human health and the environment; (2) comply with ARARs; and (3) be cost-effective.

Community Participation

The EPA relies on public input to ensure that the remedy selected for each Superfund site meets the needs and concerns of the local community.

To assure that the community's concerns are being addressed, a public comment period lasting 60 calendar days will open on July 28, 2025, and close on September 26, 2025. During this time the public is encouraged to submit comments to the EPA on the Proposed Plan. Written comments can be emailed to BillingsPCEComments@epa.gov or mailed to the following address: Roger Hoogerheide and Layla Landeros, U.S. EPA, 10 W 15th St, Suite 3200, Helena, MT 59626.

A public meeting will be held to discuss the Proposed Plan on August 27, 2025, at 5:30 PM, at the Billings Public Library, located at 510 N Broadway, Billings, MT 59101.

An electronic copy of the Administrative Record files can be accessed at the Billings Public Library located at 510 N Broadway, Billings, MT 59101. Electronic copies of the Administrative Record files are also available on our Site webpage at http://www.epa.gov/superfund/billings-pce under "Site Documents & Data."

All comments received during the public comment period will be considered and addressed by the EPA before an interim remedy is selected for OU1. The EPA will respond in writing to all significant comments in a Responsiveness Summary, which will be part of the OU1 Interim Record of Decision. The EPA will announce the selected cleanup alternative in local newspaper advertisements and will be available for review at the local information repository at the Billings Public Library. The IROD will also be available electronically on the EPA's website at http://www.epa.gov/superfund/billings-pce.

Questions and requests for information can be sent to the EPA representatives below:

Table 6. Site Contacts for the Billings PCE Superfund Site

Organization	Name	Mailing Address	Phone	Email
U.S. EPA	Roger Hoogerheide, Project Manager	U.S. EPA, Region 8 10 West 15th Street Suite 3200 Helena, MT 59626	406-457-5031	hoogerheide.roger@epa.gov
U.S. EPA	Layla Landeros, Project Manager	U.S. EPA, Region 8 10 West 15th Street Suite 3200 Helena, MT 59626	406-970-4805	landeros.layla@epa.gov
U.S. EPA	EPA Superfund Records Center	U.S. EPA, Region 8 10 West 15th Street Suite 3200 Helena, MT 59626	866-457-2690	Not applicable
U.S. EPA	Kate Tribbett, Community Involvement Coordinator	U.S. EPA, Region 8 1595 Wynkoop Street, Denver, CO 80202	303-312-6661	tribbett.kate@epa.gov
Montana Department of Environmental Quality	Breana Pabst, Project Officer	Montana DEQ P.O. Box 200901, Helena, Montana 59601	406-444-0215	breana.pabst@mt.gov
Montana Department of Environmental Quality	Nolan Lister, Public Information Officer	Montana DEQ P.O. Box 200901, Helena, Montana 59601	406-444-6469	nolan.lister@mt.gov

Glossary of Terms

Administrative Record: Encompass all documents and information used or considered by the EPA when making a decision or taking action. They include both supporting and opposing evidence and are compiled to provide a comprehensive record of the agency's decision-making process.

Applicable or Relevant and Appropriate Requirements (ARARs): The specific environmental standards that must be met during the cleanup of Superfund sites. Applicable Requirements are existing environmental laws that directly apply to the cleanup activities at a specific site. Relevant and Appropriate Requirements are environmental standards that, while not directly applicable, are suitable for the site conditions and cleanup activities. These requirements ensure that the cleanup process protects human health and the environment by adhering to established environmental laws.

Attenuation: The reduction in concentration of a contaminant as it moves from one medium to another, such as from soil gas to indoor air.

Background sources: Sources of contaminants that are not related to the site being investigated, such as those from regional pollution or natural occurrences. For example, household chemicals are common sources of background indoor air contamination.

Baseline human health risk assessment: An evaluation to estimate the health risks to humans if no cleanup is done at a contaminated site.

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act, also known as Superfund. It is a federal law passed in 1980 that grants the EPA authority to investigate and clean up sites where hazardous substances threaten public health or the environment.

CERCLIS ID: A unique identification number assigned to a site listed in the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS).

Chemical oxidant: In chemistry, oxidation refers to a process where a substance loses electrons, or gains oxygen, or increases in oxidation state. It's one part of a broader process called redox, where oxidation and reduction occur simultaneously. A substance that is oxidized is said to be a reducing agent, as it provides the electrons needed for another substance to be reduced.

Cleanup levels: Specific contaminant concentrations that must be achieved to protect human health and the environment.

Containment: The action of keeping something harmful under control or within limits.

Contaminants of concern: A substance found in the environment that is suspected to be causing or potentially causing harm to human health or the environment, and where there is ongoing research and assessment to better understand its risks.

Contaminant plume: An area of contaminated groundwater that spreads from a source over time.

Crawlspace air: The air found in the small, often unfinished space under a building's floor.

Dehalogenation: A process that removes a halogen atom (like fluorine, chlorine, bromine, or iodine) from a molecule. Dehalogenation can occur through various mechanisms, including enzymatic reactions, chemical reactions with metals, or biologically. It plays a crucial role in the degradation of PCE and TCE in the environment.

Depressurization: The process of becoming lower in air pressure or causing a closed space, especially the inside of an aircraft, to become lower in air pressure.

Dewatering - The process of removing excess water, either groundwater or surface water, from a basement. This is typically achieved by pumping water out of wells or sumps, or by using other methods like evaporation or filtration.

Dichloroethene (DCE): One of several types of chlorinated solvents often found as contaminants in groundwater due to industrial activities.

Direction of groundwater flow: The path that groundwater takes as it moves through soil and rock layers. Groundwater flows from where the elevation of the water table is higher ("upgradient") to where the elevation of the water table is lower ("downgradient").

Direct outreach: Refers to reaching out to owners and tenants directly, typically through personalized emails, phone calls, face to face or other methods, to establish a relationship. It contrasts with outreach efforts like fact sheets and post cards which are intended to reach a larger audience.

Exposure assumptions: Involves estimating the amount of time and frequency of contact with a contaminant. It's a crucial step in understanding potential health effects from environmental exposures.

Exposure pathways: The routes by which people can come into contact with contaminants, such as breathing, drinking, eating or touching.

Exposure point concentration: A representative contaminant concentration used in risk assessments to estimate how much of a chemical a person might be exposed to. It's essentially a conservative estimate of the average contaminant concentration in an environmental medium (like air, soil, or water) where people might be exposed.

Extra case: An additional case or instance of something, or a situation that is beyond the usual or expected. It can refer to a specific situation requiring attention or action, or a scenario that is outside the norm.

Focused Feasibility Study: A document that characterizes a site and its contamination, proposes cleanup alternatives, and evaluates those alternatives with respect to specific criteria.

Free-phase liquid: Contaminants in liquid form that are present in soil or rock below the surface, not dissolved or mixed. Free-phase liquids are more commonly present in source areas near the location of a contaminant release and consist of chemicals that do not mix well with water.

Groundwater fluctuations: Refers to changes in the depth of the water table in the upper boundary of the saturated zone in an aquifer. These fluctuations can be caused by natural factors like precipitation, evapotranspiration, and seasonal variations, as well as human activities like groundwater pumping.

Indoor air: The air inside buildings where people live or work. Vapor intrusion investigations focus on the "breathing space" (3 to 5 feet from the floor) – the air inside rooms that are regularly occupied, as opposed to closets, utility rooms, etc., where occupancy is minimal.

Institutional controls: Non-engineered instruments such as administrative and legal controls that help minimize the potential for human exposure to contamination and/or protect the integrity of the remedy.

Interim Record of Decision (IROD): A document describing a partial remedy for a contaminated site. For example, a partial remedy could address only one environmental material (soil, groundwater, air) or a specific location (such as a contaminant source area). A partial remedy is acceptable only if other remedies (and their related RODs) will comprehensively address site contamination.

Monitoring wells: Wells drilled to collect groundwater samples and measure groundwater elevations and the levels of contaminants over time.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): A framework for the federal government to respond to both oil spills and releases of hazardous substances. It outlines procedures for preparing for and responding to incidents, including coordinating with state and local governments and private entities.

Operable Unit (OU): A portion of a Superfund site that is managed separately from the rest of the site for cleanup purposes.

Preferred Alternative: The cleanup option proposed by the EPA that best addresses the contamination at a site.

Preliminary Remediation Goals (PRGs): Initial targets set for reducing contamination to protect human health and the environment. PRGs are used in the Focused Feasibility Study to evaluate remedial alternatives and are presented in the Proposed Plan along with the Preferred Alternative. The EPA considers the PRGs, along with public comment on the Proposed Plan, when setting the Cleanup Levels in the Record of Decision.

Pre-mitigation sampling: Involves collecting environmental samples before any mitigation measures are implemented to establish a baseline of contamination and inform the design of effective mitigation strategies. This process helps determine the extent and nature of the contamination and informs decisions about the type and location of mitigation systems.

Reasonable maximum exposure: The highest level of exposure that is reasonably expected to occur at a site under current or future land use conditions.

Reference concentration: An estimate of a continuous inhalation exposure to the human population that is likely to be without an appreciable risk of adverse health effects during a lifetime.

Remedial action objectives: Provide a general description of what the cleanup will accomplish.

Removal management levels: Chemical-specific concentrations for individual contaminants in tap water, air and soil. They are derived using similar methodologies as the tools used in the remedial program but are calculated with risk levels and exposure scenarios that align with identifying areas, contaminants, and conditions where a removal action may be appropriate.

Sealing the structure envelope: Refers to the process of minimizing air and water infiltration through the exterior shell of a building, often using materials like caulk, tape and weather stripping.

Site-related: Refers to contaminants or conditions that originate from the site and/or source areas being investigated or remediated. Background chemicals, chemicals stored inside a building, for example, are not site related.

Soil vapor: Gases that move through the soil, which can come from volatile contaminants in the ground.

Source area: The location where contamination originated, such as a spill or leak site.

Stack effect: The movement of air into and out of buildings due to temperature differences between indoor and outdoor air. During the heating season, when the air inside buildings is warmer and less dense than the outside air, the stack effect reduces the air pressure inside a building relative to the air outside and beneath the building. This can increase the amount of soil vapor that enters a building.

Sub-slab soil gas: The gases present in the soil directly beneath a building's foundation.

Sub-slab depressurization system: A mitigation system that creates a negative pressure beneath a building's floor slab to prevent radon and other soil gases from entering the structure. This is achieved by drawing air from beneath the slab and venting it outside using a fan and piping system.

Superfund: A federal program established to clean up the nation's uncontrolled hazardous waste sites. Also called the Comprehensive Environmental Response, Compensation, and Liability Act or CERCLA.

Target groundwater concentrations: Screening levels for contaminant concentrations in groundwater that correspond to concentrations of concern for indoor air. Target Groundwater Concentrations are calculated using conservative assumptions about how vapors are diluted as they move between the water table and indoor air.

Target hazard index: A measure used to assess the potential non-cancer health hazards associated with exposure to contaminants.

Target risk levels: Represents the desired or acceptable level of risk to achieve after implementing vapor intrusion mitigation strategies.

Tetrachloroethene (PCE): A solvent commonly used in dry-cleaning and industrial processes, often found as a contaminant in soil and groundwater.

Toxicity: The degree to which a chemical substance or a particular mixture of substances can damage an organism.

Trichloroethene (TCE): A solvent used in industrial degreasing that can contaminate soil and groundwater.

Uncertainty: Things we do not know about data or the outcome of a risk assessment due to known or unknown factors. Uncertainty is inherent in risk assessment. People's actual amount of exposure to a site contaminant over their lifetime cannot be measured directly. It must be estimated using, for example, results of sampling and estimates of how much time people spend in an area with contamination. Such estimates includes some amount of uncertainty. Risk managers (people who make decisions about how to manage a contaminated site) consider the type and amount of uncertainty in a risk assessment when making decisions. For example, they may adjust the remedy to be more protective when uncertainty is high.

Vapor intrusion: The process by which vapor-forming chemicals in soil or groundwater move into the indoor air of overlying buildings.

Vinyl chloride: A chemical commonly used to make PVC plastic. Vinyl chloride also forms when bacteria break down tetrachloroethene, trichloroethene and dichloroethene in soil and groundwater.