GHD

West Bank VI Source & Landfill Gas Evaluation Work Plan

Wausau Water Supply NPL Site
Wausau, Wisconsin

City of Wausau

February 21, 2025

Revision 2

→ **The Power of Commitment**

Contents

Figure Index

Appendices

1. Introduction

In response to the U.S. Environmental Protection Agency's (EPA) letter of January 5, 2024, this Revised Work Plan provides the proposed scope of work and field procedures for conducting the west bank vapor intrusion (VI) investigation and landfill gas methane evaluation activities associated with the Wausau Water Supply Superfund Site in Wausau, Wisconsin (Site). The other action items listed in the EPA letter were addressed in a separate response to comments letter dated January 31, 2024.

This Work Plan addresses action items #3 and #6 identified in EPA's January 5, 2024 letter. These EPA action items are provided below:

> *(#3) West Bank VI Source Identification and Action – According to the Region 5 Vapor Intrusion Handbook, pre-emptive VI mitigation is warranted if sub-slab vapor concentrations exceed Removal Management Levels (RMLs), which are a 10-4 cancer risk and a hazard index of 3 or a hazard index of 1 in the case of TCE, even if indoor air concentrations are below VISLs. The sub-slab vapor concentrations of TCE at both Building A and Building B exceed a hazard index of 1. Moreover, the sub-slab concentrations of TCE at Building B have increased significantly over the last six years, indicating a significant and currently undefined source of TCE. EPA requests the Settling Defendants identify potential sources in groundwater and/or soil leading to continued and increasing VI. This will likely involve performing sub-slab, soil gas, and soil sampling in west bank locations where historical activities may have resulted in significant "hot spots" of TCE contamination. The locations of possible historical activities are approximated in a diagram provided by EPA and attached to this letter. The final sampling locations will be detailed in a vapor and soil sampling work plan submitted to EPA no later than May 1, 2024. Pending the collection and review of these additional data, additional action (e.g., VI mitigation or source control) may be required to address VI at this area of the Site.*

> *(#6) Methane Gas Information – To EPA's knowledge, the former city landfill on the west bank has not been sampled for methane and currently possesses no infrastructure for methane venting. EPA requests the Settling Defendants prepare a work plan to test and assess the west bank area at and surrounding the landfill for methane gas no later than February 29, 2024 to be able to address risks posed to human health or the environment.*

Specific tasks to be conducted include:

- Advancement of soil borings and installation of temporary soil gas probes and vapor pins at west bank locations where historical activities may have resulted in significant "hot spots" of TCE contamination. Samples will be collected at the proposed soil boring, sub-slab sampling, and indoor air sampling locations as well as certain existing locations as outlined in this Work Plan.
- Installation of temporary landfill gas probes to monitor for methane levels within the vicinity of the existing landfill. Methane monitoring will be completed at the proposed temporary landfill gas probe locations as outlined in this Work Plan.

1.1 Site Contaminants of Potential Concern

Site contaminants of potential concern (COPC) are limited to the following chlorinated VOCs:

West Bank

- Trichloroethylene (TCE)
- Cis-1,2-Dichloroethylene (c12DCE)
- Carbon tetrachloride (CT)
- Chloroform

2. Field Investigation Activities

2.1 West Bank VI Source Investigation

This work plan outlines the procedures for implementing the VI source investigation and evaluations. The data obtained during this investigation will be used to update the conceptual site model relative to VI and attempt to locate potential VI source areas which may be impacting sub-slab soil gas beneath the Marathon Electric Buildings A and B. Existing groundwater data do not suggest an immediate VI risk to off-site residential or commercial/industrial properties. Proposed field activities include:

1. Advance five soil borings to groundwater and install temporary soil gas probes at each of the soil gas locations depicted on Figure 1. Install six vapor pins at the proposed sub-slab sampling locations depicted on Figure 1.
2. Collect sub-slab, indoor air, and soil gas samples from the proposed sampling locations and from existing sampling locations where soil gas detections previously exceeded the screening level, which include (SS-01/IA-01, SS-02/IA-02, SS-05/IA-05, SS-11/IA-11, SS-13/IA-13, and SS-15/IA-15), as depicted on Figure 1.
3. Soil analytical samples well be collected from each soil boring from a shallow (0-2 ft) interval, deep interval (14-16 ft), and an intermediate interval observed to be most impacted. Soil gas and indoor air samples will be collected at a depth of approximately 10 ft bgs.
4. Samples will be analyzed for TCE, C12DCE, CT, and Chloroform.

2.2 Landfill Methane Gas Investigation

This work plan also presents the procedures for conducting the landfill methane gas investigation to assess the west bank area surrounding the landfill for the presence of methane gas. Proposed field activities include:

1. Installation of six temporary landfill gas probes within the vicinity of the existing landfill as shown on Figure 2.
2. Collection of methane data using Gas Extraction Monitor (Landtec GEM or equivalent) from each temporary landfill gas probe to measure and record combustible gas (methane), carbon dioxide, and oxygen) readings.

The elements of the field procedures are detailed in Section 3. The quality assurance (QA) objectives are presented in Appendix A.

3. Sampling Equipment and Procedures

The following sections describe the installation of sampling devices and sampling procedures for each media to be evaluated during field investigation activities.

3.1 West Bank VI Source Investigation

3.1.1 Soil Boring Installation and Sampling

Five soil borings and temporary soil gas probes will be advanced near the locations of possible historical activities as found in the diagram provided by EPA in the letter dated January 5, 2024. The proposed locations are depicted on Figure 1. At each proposed location, a boring will be advanced using direct push drilling methods (i.e. Geoprobe), which utilizes a dual-tube direct push technique. This technique is used to minimize formation disturbance. The total depth of the borings will range from 0 to 16 feet bgs. Soil samples will be collected using disposable acetate sleeves. The borings will be continuously sampled to provide stratigraphic descriptions for the entire length of each boring. The soil samples will be inspected and classified by a GHD field staff using the USCS.

Soil samples will be field screened by placing the soil in a Ziploc® bag for headspace screening using a photoionization detector (PID). The PID readings will be documented in the field notes and provided in our field investigation report. Upon completion of soil sampling, the soil borings will be backfilled with hydrated bentonite chips.

Soil samples will be field screened with a PID, and for soil staining or odors. Lab samples will be collected from the most impacted interval in addition to 0 to 2 ft below ground surface (bgs), and 14 to 16 ft bgs. If no field evidence of impacts is identified the “middle sample” will be collected at 6 to 8 ft bgs. Soil samples will be analyzed for TCE, C12DCE, CT, and Chloroform.

3.1.2 Temporary Soil Gas Probe Installation and Sampling

Five soil gas samples will be collected on the west bank near the locations of possible historical activities as depicted on Figure 2. The soil gas samples will be collected from temporary soil gas probe locations advanced during this phase of work. The soil gas samples will be collected from approximately 10 ft bgs to obtain data from a depth corresponding to the base of a typical residential basement.

To minimize soil disturbance, temporary soil gas samples will be collected using the Geoprobe Post Run Tubing (PRT) soil vapor extraction system. This system entails driving drill rods, using a direct push rig, to the target depth and then inserting the PRT adapter connected to tubing extending to the surface. The PRT system utilizes O-rings to deliver a vacuum tight seal the prevents sample contamination from above the sample collection point. In addition to the PRT O-rings, GHD will apply a bentonite slurry and place it around the top of the drill rod prior to collecting of the sample. Utilizing the PRT O-ring and the bentonite slurry seal will ensure a vacuum tight seal and eliminate ambient air. Soil gas is drawn through the point holder, through the adapter, and into the sample tubing. Upon completion of sample collection, PRT sampling assembly will be removed and the soil boring backfilled with hydrated bentonite chips.

Once the PRT tooling has been placed at the target depth, a sampling canister will be affixed to the tubing using Swagelok fittings in preparation for sample collection. Soil gas samples from the temporary probes will be collected using the following procedures:

1. Temporary soil gas samples will be collected using batch certified clean vacuum canisters. Only canisters certified clean at the 100 percent level will be used for soil gas sampling activities. Vacuum canisters will have a capacity of 1-liter or 6-liters depending on laboratory requirements and availability.
2. The canisters will be fitted with a laboratory-calibrated critical orifice flow regulation device sized to restrict the maximum soil gas sample collection flow rate to approximately 100 milliliters per minute (mL/min). The 100 mL/min maximum flow rate is equivalent to a sample collection time of 10 minutes for a 1-liter canister and 60 minutes for a 6-liter canister, respectively.
3. A vacuum gauge will be supplied by the laboratory and used during sample collection to measure the initial canister vacuum, canister vacuum during sample collection, and residual canister vacuum at the end of sample collection.
4. The canister will be connected to the temporary soil gas probe using a short length of ¼-inch Teflon or Teflon lined tubing. The canister will be connected to the soil probe along with the vacuum gauge. New tubing will be used for each sample.
5. To ensure some residual vacuum in each canister following sample collection, the canister vacuum will be recorded after approximately 8 minutes of the expected 10-minute sample collection duration. A maximum residual vacuum of 10-inches Hg is allowed. A canister residual vacuum above this value will require continued sampling until the vacuum reading is below this threshold. A minimum 1-inch Hg residual vacuum will be required for the sample to be considered valid, or the sampling will be repeated using a fresh Summa™ canister. Once the vacuum is measured, the safety cap must be securely tightened on the inlet of the vacuum canister prior to shipment to the laboratory under chain-of-custody procedures.
6. The critical orifice flow regulation devices (provided by the laboratory) and sampling assembly fittings/valves will not be re-used during sampling.

7. The vacuum canister samples will be labelled noting the unique sample designation number, date, time, and sampler's initials. A bound field logbook will be maintained to record all soil gas sampling data.

Soil gas samples will be analyzed for TCE, C12DCE, CT, and Chloroform.

3.1.3 Vapor Pin Installation

Six sub-slab vapor pins will be installed in the locations marked as proposed sub-slab sampling locations on Figure 1. The following describes the procedures for the installation of sub-slab pins.

1. Prior to drilling holes in a foundation or slab, utilities coming into the building from the outside (e.g., gas, water, sewer, refrigerant, and electrical lines) will be located. The sample location will be cleared using knowledgeable site personal or a private utility locate company.
2. Prior to installation of the sub-slab Vapor Pin™, a rotary hammer drill will be used to drill a 1.5-inch diameter outer hole to a depth of approximately 1 inch below the surface that partially penetrates the slab. This outer hole will allow the protective cap to be flush with the concrete surface.
3. A small portable vacuum cleaner will be used to remove cuttings from the hole.
4. A rotary hammer drill with a 5/8-inch bit will be used to drill an inner hole through the remainder of the slab to a depth of 4 inches below the slab. Drilling into the sub-slab material will create an open cavity, which will prevent the obstruction of any pins during sampling.
5. A 3/4–inch diameter bottle brush and a small portable vacuum cleaner will be used to remove cuttings from the hole.
6. The thickness of the slab will be measured and recorded.
7. A Vapor Pin™ assembly will be driven into the 5/8-inch hole. The Vapor Pin™ creates an airtight seal without the need for cement.
8. The Vapor Pin™ will be capped to prevent air exchange between the subsurface and indoor air and a flush-mount cap will be placed at the concrete surface so as to not interfere with day-to-day use of the building.

3.1.4 Vapor Pin Sampling

A total of twelve sub-slab vapor probes will be sampled, including the six newly installed vapor pins and six existing locations (SS-01, SS-02, SS-05, SS-11, SS-13, and SS-15) that recently had detections over the SLs.

1. The sub-slab sampling assembly will be connected to the Vapor Pin™. Once connected, the sampling assembly will consist of the soil gas pin, Teflon tubing, vacuum gauge supplied by the laboratory, personal sampling pump, and vacuum canister, all connected in series (i.e., in the order of soil gas pin, vacuum gauge, pump, and canister), using T-connectors or T-valves.
2. A personal sampling pump, or similar, will be used to conduct a vacuum test. The SOP for vacuum testing is presented in Appendix D.
3. If the vacuum is not sustained for at least 1 minute, all fittings and tubing will be checked for tightness (or replaced) and the vacuum test will be repeated.
4. Sub-slab vapor samples will be collected using the water dam method to prevent potential air leaks during sampling. The SOP for the water dam method is presented in Appendix D.
5. Sub-slab vapor samples will be collected using batch certified clean vacuum canisters. Only canisters certified clean at the 100 percent level will be used for soil gas sampling activities Vacuum canisters will have a capacity of 1-liter or 6-liters depending on laboratory requirements and availability.
6. The canisters will be fitted with a laboratory-calibrated critical orifice flow regulation device sized to restrict the maximum soil gas sample collection flow rate to approximately 100 milliliters per minute (mL/min). The 100 mL/min maximum flow rate is equivalent to a sample collection time of 10 minutes for a 1-liter canister and 60 minutes for a 6-liter canister, respectively.

7. A vacuum gauge will be supplied by the laboratory and used during sample collection to measure the initial canister vacuum, canister vacuum during sample collection, and residual canister vacuum at the end of sample collection.
8. The canister will be connected to the soil vapor pin using a sampling assembly comprised of short lengths of ¼-inch Teflon or Teflon lined tubing and polypropylene valves and fittings. The canister will be connected to the soil vapor pin along with the vacuum gauge and a purge pump (for soil vapor pin purging), in series. A T-valve will be used to connect the purge pump, which allows the pump to be isolated from the sampling assembly during sample collection. New tubing will be used for each sample.
9. Prior to collecting a soil gas sample, the stagnant air in the sampling assembly tubes and soil gas pin will be removed. The soil gas pins will be purged prior to sampling using a sampling pump at a flow rate of not more than 200 mL/min. Prior to sample collection, three purge volumes will be drawn from the pin/sample assembly.
10. At the start and the end of the purging period, the total concentration of volatile organic vapors of the pump exhaust gas should be monitored using a (PID). The PID will be connected in series after the personal sampling pump. PID readings will be recorded and entered in the field logbook. If VOCs are detected by the PID, the laboratory will be advised whether a sample could require dilution before analysis.
11. Following purging, the valve to the purge pump will be closed, and the valves to the soil gas pin and vacuum canister opened to draw the soil gas sample into the canister. This should be completed concurrent with continued application of the leak-testing water dam.
12. To ensure some residual vacuum in each canister following sample collection, the canister vacuum will be recorded after approximately 8 minutes of the expected 10-minute sample collection duration. A maximum residual vacuum of 10-inches Hg is allowed. A canister residual vacuum above this value will require continued sampling until the vacuum reading is below this threshold. A minimum 1-inch Hg residual vacuum will be required for the sample to be considered valid, or the sampling will be repeated using a fresh Summa™ canister. Once the vacuum is measured, the safety cap must be securely tightened on the inlet of the vacuum canister prior to shipment to the laboratory under chain-of-custody procedures.
13. The critical orifice flow regulation devices (provided by the laboratory) and sampling assembly fittings/valves will not be re-used during sampling.
14. The vacuum canister samples will be labeled noting the unique sample designation number, date, time, and sampler's initials. A bound field logbook will be maintained to record all soil gas sampling data.

Vapor samples will be analyzed for TCE, c12DCE, CT, chloroform, and vinyl chloride.

3.1.5 Indoor Air Sampling

A total of twelve indoor air samples will be collocated and collected concurrently with sub-slab samples in accordance with WDNR guidance. All indoor air samples will be held by the laboratory and will only be analyzed if there are exceedances in sub-slab for TCE, c12DCE, CT, chloroform, or vinyl chloride.

A summary of the steps involved in the indoor air sampling is presented below:

1. As with the soil gas samples, the indoor air samples will be collected using laboratory-certified pre-cleaned 6-liter stainless steel vacuum canisters. Canisters will be certified as pre-cleaned at the 100 percent level in accordance with EPA Method TO-15.
2. Sample canisters will be fitted with laboratory-calibrated critical orifice flow regulators sized to restrict the maximum air sample collection flow rate into the canister and provide a sample collection duration of approximately 24 hours.
3. The laboratory will supply a vacuum gauge for each canister and will be used during sample collection to measure the initial canister vacuum, canister vacuum during sample collection, and residual canister vacuum at the end of sample collection.
4. The canisters will be deployed at a typical breathing zone height of approximately 4 to 5 ft. above the floor/ground surface.

5. Collection of field duplicate indoor air samples will be achieved by deploying two canisters side by side simultaneously with a single inlet and a T-connection. Field duplicate samples will be collected at a frequency of 1 in 20 indoor air and outdoor ambient air samples per sampling event.
6. Indoor air sampling will be continued until the vacuum reading is between -10 and -5 in Hg. The vacuum gauge reading must not be greater than -1 in Hg for the sample to be considered valid. After recording the final canister vacuum reading, the canister valve will be closed and the safety cap securely tightened on the inlet of the canister. Sample canisters will be shipped to the laboratory under chain-of-custody procedures.
7. The canister serial numbers will be recorded, and a unique sample identification number will be assigned to each canister/sample identifying the sample number, date, time, and sampler's initials. A bound field logbook will be maintained to record all indoor air/outdoor ambient air sampling field measurements.

Indoor air samples will be analyzed for TCE, c12DCE, CT, chloroform, and vinyl chloride.

3.1.6 Installation of Temporary Landfill Gas Probes – Landfill Gas Investigation

Six temporary landfill gas probes will be installed within the vicinity of the existing landfill boundary, as depicted on Figure 2. In order to minimize soil disturbance on the existing landfill, the Geoprobe PRT soil vapor extraction system or temporary soil gas implant points will be utilized to collect the combustible gas readings. This system entails driving drill rods, using a direct push rig, to the target depth and then inserting the PRT adapter connected to tubing extending to the surface. The PRT system utilizes O-rings to deliver a vacuum tight seal that prevents contamination and/or infiltration from above the sample collection point. In addition to the PRT O-rings, GHD will apply a bentonite slurry and place it around the top of the drill rod prior to collecting of the sample. Utilizing the PRT O-ring and the bentonite slurry seal will ensure a vacuum tight seal and eliminate ambient air. Soil gas is drawn through the point holder, through the adapter, tubing, and then into the field screening device. If using soil gas implant points, the temporary landfill gas probes will be installed using direct push drilling methods to the target depth of eight to ten feet. Once the target depth is reached, the drilling tools will be removed and a 6-inch, stainless steel, implant screen will be installed to the selected interval. A 1-foot sand pack will be placed around and above the implant screen and a 2-foot hydrated bentonite seal will be placed above the sand pack to seal off ambient air from potentially entering the sample interval. After collecting the combustible gas readings, the PRT sampling assembly or implant point will be removed, and the soil boring will be backfilled with hydrated bentonite chips.

3.1.7 Screen for Combustible Gas (Methane), Oxygen, and Carbon Dioxide

A Gas Extraction Monitor (Landtec GEM or equivalent) will be used to draw a sample from each landfill gas probe to measure and record the combustible gas (methane), carbon dioxide and oxygen readings. The Landtec GEM is industry-standard equipment that uses an infrared sensor for detection of methane on a percent by volume basis. The monitoring procedures will be implemented in the following order:

– A gas extraction monitor (LandTec GEM or equivalent) will be used to draw a sample from each temporary landfill gas probe to measure and record combustible gas (Methane), Oxygen, and Carbon Dioxide readings.
– The combustible gas meter will be turned on and allowed to acclimatize. The unit will be purged with fresh air and the zero is checked and adjusted if necessary. The combustible gas meter hose will be connected to the gas probe valve assembly, and the stopcock valve will then be opened. Care will be exercised to avoid drawing liquids into the portable combustible gas meter, as this will damage the sensors.
– The combustible gas concentration will be monitored after purging, and the stabilized reading will be recorded. Combustible gas monitoring will begin with the gas meter set to measure the high concentration range (usually 0 to 100 percent by volume). If the reading is less than 5 percent by volume, the instrument should be set to measure the low range (usually 0 to 100 percent LEL). Following this procedure will avoid damaging the instrument. The meter will be fully purged with fresh air after each reading.

- After the readings for combustible gas are recorded, then the readings for other parameters (carbon dioxide and oxygen) will be recorded.

4. Reporting

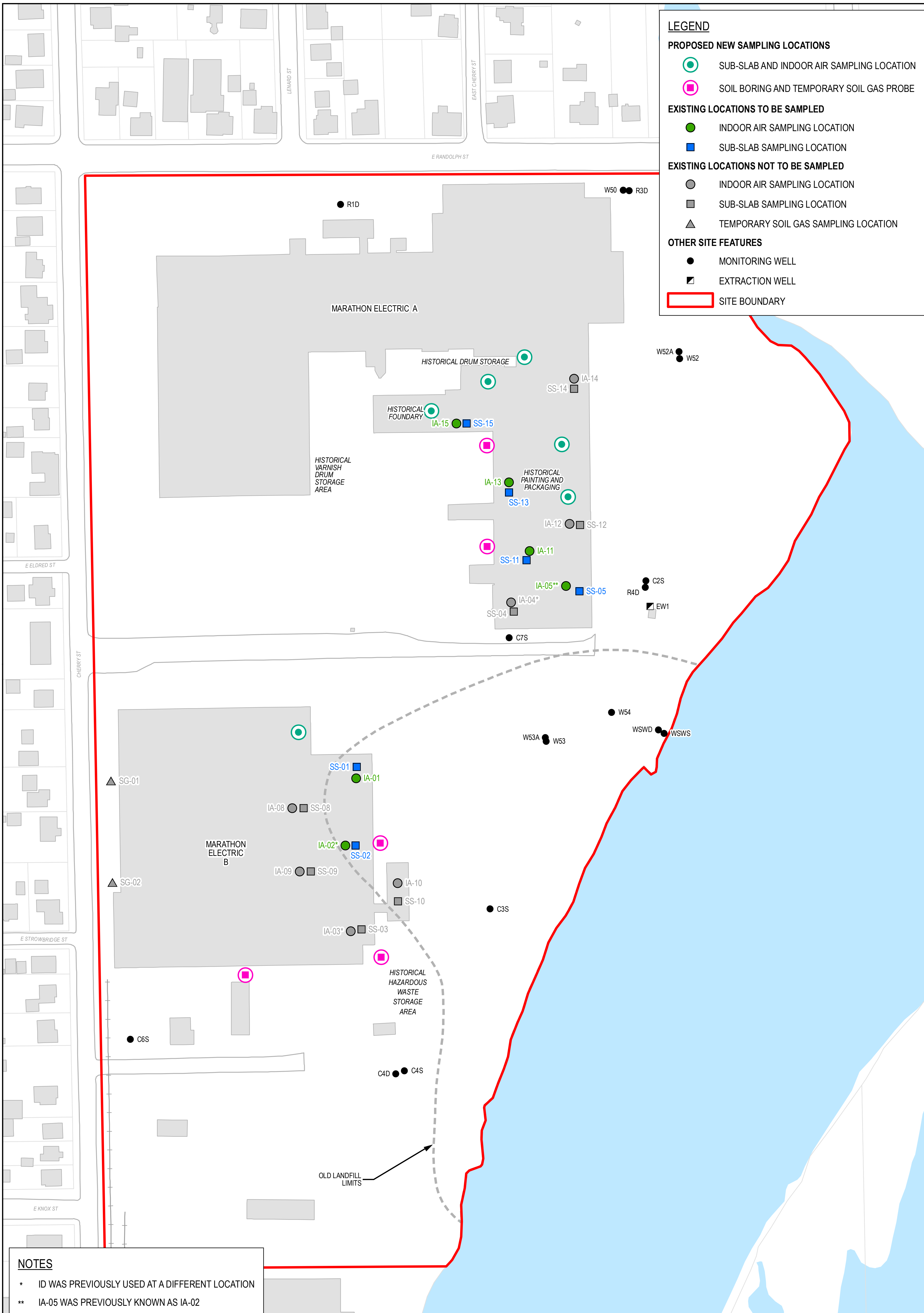
After completing the scope of work described herein, a field investigation report will be prepared for submittal to WDNR and EPA. The report will include a narrative of the field investigation activities, tabulated data, figures, data interpretation, laboratory reports, and recommendations.

5. Schedule

The installation and sampling of all points described above is expected to occur in late February 2025 and is anticipated to take three to five days, although property access issues could delay portions of the investigation. A second event encompassing only indoor air and sub-slab sampling is expected in the summer of 2025, and is anticipated to take approximately 3 days.

Unvalidated laboratory analytical results will be submitted to the WDNR and EPA within 10 business days of receival. Upon completion of the field investigations, a field investigation report will be submitted to WDNR and EPA within 60 days after receipt of the final laboratory report.

Figures



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WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

PROPOSED SOIL BORINGS AND TEMPORARY SOIL GAS PROBES
VI SOURCE INVESTIGATION

Project No. 12655584
Revision No. -
Date 01/30/2025

FIGURE 1

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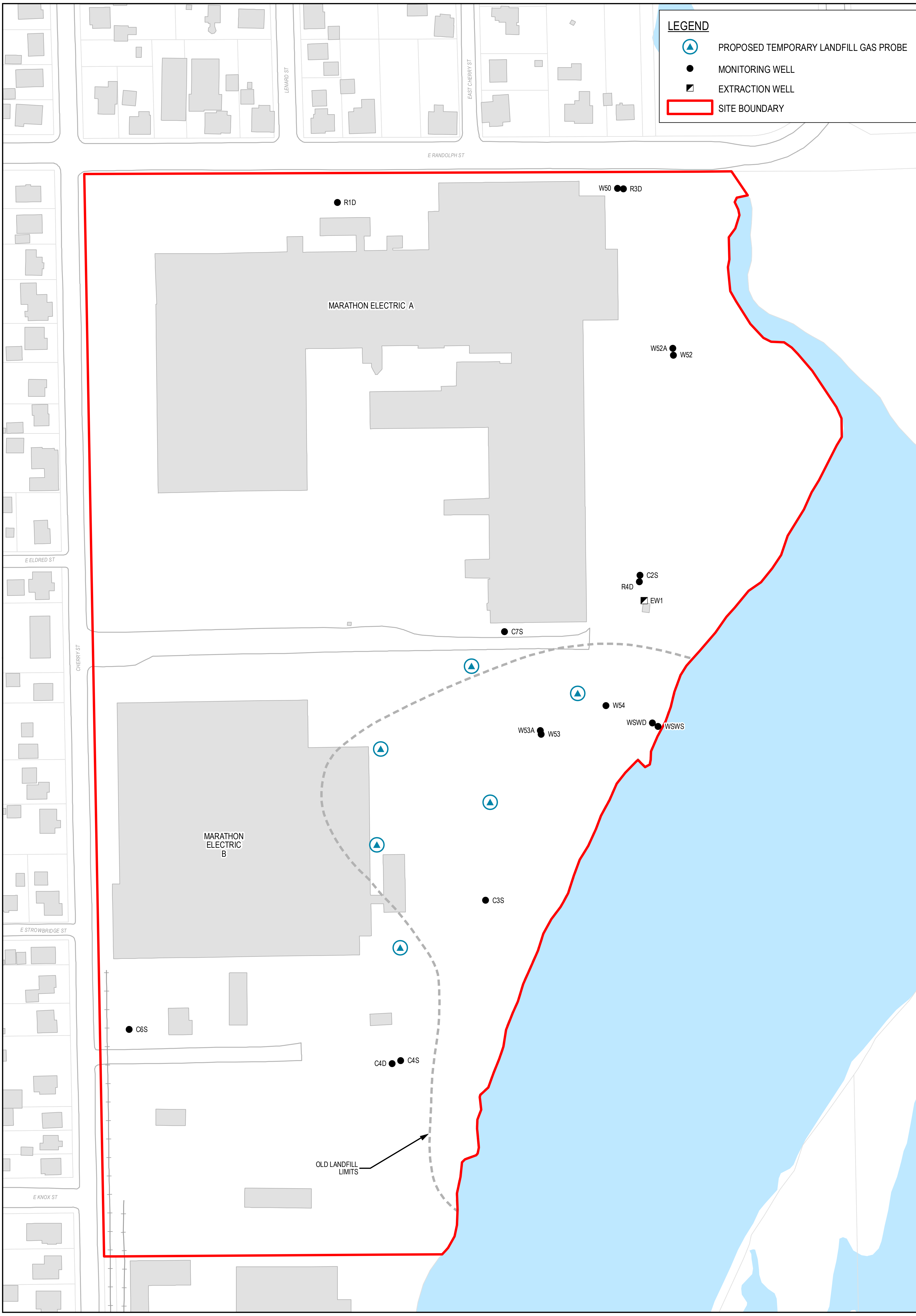

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Map Projection: Lambert Conformal Conic
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Grid: NAD 1983 HARN WISCRS Marathon County Feet

WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

PROPOSED TEMPORARY
LANDFILL GAS PROBE LOCATIONS
METHANE INVESTIGATION

Project No. 12655584
Revision No. -
Date 11/20/2024

FIGURE 2

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Appendices

Appendix A

Quality Assurance Objectives

Appendix A Quality Assurance

1. Data Quality Objectives

The QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and laboratory reporting that will provide results that can be used to make decisions regarding potential risks related to soil vapor intrusion of commercial/industrial and residential buildings. Shallow groundwater contaminants will be further delineated, vadose zone vapor will be characterized, and buildings will be assessed to determine occupancy and construction features.

The data will be used to support decisions about whether additional groundwater delineation is needed, if the vapor characterization area should be expanded, or if sub-slab and indoor air sampling should be conducted; and whether vapor intrusion mitigation should be pursued in buildings.

1.1 Precision

1.1.1 Field Precision Objectives

Field precision for measurements associated with groundwater monitoring and vapor sampling will be assessed through the collection and measurement of duplicate samples or calibration check solutions at a frequency of one per ten groundwater samples. The precision control limits for field measurements obtained during the field investigation activities are summarized in the field investigation SOPs in Appendix D.

1.1.2 Laboratory Precision Objectives

Precision in the laboratory will be assessed through the calculation of relative percent differences (RPDs) for replicate/duplicate samples. The equations for RPD calculations are presented in the laboratory SOP for each method, which are provided in Appendix B.

1.2 Accuracy

1.2.1 Field Accuracy Objectives

Groundwater sampling accuracy in the is assessed through the use of field and trip blank samples and is ensured by observing all sample handling procedures, preservation requirements, and holding time periods. Accuracy of field measurements associated with groundwater monitoring will be assessed by analyzing calibration check solutions. Accuracy control limits for the field measurements obtained during the field investigation activities are summarized in the field investigation SOPs in Appendix D.

1.2.2 Laboratory Accuracy Objectives

Laboratory accuracy will be assessed by determining percent recoveries from the analysis of matrix spikes or laboratory control samples (LCS). The accuracy of the organics analyses will be monitored through the analysis of surrogate compounds. Surrogate compounds are added to each sample, standard, blank, and QC sample prior to sample preparation and analysis. Surrogate compounds are not expected to be found occurring naturally in the samples, but behave analytically similar to the compounds of interest. Consequently, surrogate compound percent recoveries will provide information on the effect that the sample matrix exhibits on the accuracy of the analyses. Corrective measures, if needed, are described in the method SOPs (Appendix B).

1.3 Completeness

1.3.1 Field Completeness Objectives

Field completeness is a measure of the amount of valid field measurements obtained from all the measurements taken during the project. The equation for completeness is presented in the laboratory SOPs. The field completeness objective for this project will be 90 percent or greater.

1.3.2 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid laboratory measurements obtained from all the measurements taken during the project. The laboratory completeness objective for this project will be 95 percent or greater.

1.4 Representativeness

1.4.1 Measures To Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program. Representativeness will be ensured by following the procedures described in this work plan and using proper sampling techniques.

1.4.2 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and assessing field duplicate samples. The sampling network is designed to provide data representative of Site conditions.

1.5 Decision Rules

1.5.1 Decision Rule Objectives

If detectable concentrations of COPCs are detected in groundwater, the data will be screened using EPA's groundwater to indoor air VISL Calculator for residential and/or commercial/industrial scenarios. If detectable concentrations of COPCs are detected in soil vapor, the data will be compared to EPAs VISL for soil vapor to indoor air utilizing the EPA-recommended attenuation factors for residential and/or commercial/industrial scenarios. If COPC vapor concentrations exceed the screening levels, additional vapor monitoring will be conducted, including potential sub-slab and indoor air.

If the COPCs are detected in indoor air at concentrations above the action levels and corresponding outdoor ambient air results do not contain COPCs, then vapor mitigation may be required.

If COPCs are not detected in sub-slab vapors or indoor air (including crawl spaces) at concentrations above the action levels, then vapor mitigation will not be pursued.

1.6 Comparability

1.6.1 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be ensured by using proper sampling techniques.

1.6.2 Measures to Ensure Comparability of Laboratory Data

The laboratory data to be obtained during the VI field investigation activities will be comparable to previous data when similar sampling and analytical methods are used. Comparability is also dependent on similar QA objectives.

1.7 Level of Quality Control Effort

Trip blank, equipment blank, field duplicate, matrix spike, method blank, and laboratory duplicate samples will be analyzed to assess the quality of the laboratory's data resulting from the field sampling and analysis program for the VI field investigation. Trip blank samples are used to assess the potential for contamination of samples resulting from contaminant migration during sample shipment and storage. Trip blank samples pertain only to aqueous VOC samples. Trip blank samples that consist of ultra-pure water are prepared in sample containers at the laboratory prior to the sampling event and are kept with the groundwater samples collected throughout the sampling event. Trip blank samples will be packaged for shipment with other groundwater samples and submitted to the laboratory for analysis. Trip blank sample containers will not be opened prior to analysis at the laboratory.

Method blank samples are generated within the laboratory and are used to assess contamination resulting from laboratory procedures. Field duplicate samples are analyzed to assess overall sampling and analytical reproducibility. Groundwater field duplicate samples are collected by alternately filling the sample containers for each parameter to be analyzed from the same sampling device. Vapor duplicate samples are collected by using a T-connector to join two vacuum canisters to one vapor source.

Matrix spikes provide information about the effect of the sample matrix on the preparation and measurement methodology. Matrix spike samples generally are analyzed in duplicate and are referred to as matrix spike/matrix spike duplicate (MS/MSD) samples. MS/MSD samples are investigative samples which have been fortified (spiked) by the laboratory with a known amount of the analyte(s) of interest. MS/MSD analysis is not applicable to air or vapor samples. Aqueous MS/MSD samples must be collected at triple the usual volume for VOCs.

The level of the QC effort for groundwater samples will be one equipment blank sample and one field duplicate sample for every 10 or fewer samples. One VOC trip blank sample consisting of laboratory-prepared ultra-pure water will be included along with each shipment of groundwater VOC samples. One MS/MSD sample will be submitted with every 20 or fewer samples collected for organic analyses.

The level of QC effort for field pH and conductivity measurements will include periodic calibration verification of the instrument using standard solutions of known pH and conductivity. Temperature measurements are obtained with pH and/or conductivity and field calibration is neither possible nor practical.

The level of QC effort for the vapor sampling program will be one field duplicate sample for every 20 or fewer vapor samples. Field duplicate samples will be collected by using a T-connector to split the sample into two canisters. Field blank and trip blank samples will not be collected because the canisters and flow controllers will be individually cleaned and certified by the laboratory prior to being shipped to the project location. In addition, pre-shipping and post-shipping vacuum measurements, post-sampling vacuum measurements in the field and at the laboratory, and the use of a tracer (sub-slab vapor sampling only) will indicate if sample integrity has been compromised during sampling or shipping. Consequently, field and trip blank sample data will not be required to evaluate sample integrity.