Data Gaps Investigation Work Plan

Gerber Legendary Blades Site
14200 SW 72nd Avenue
Tigard, Oregon
DEQ ECSI ID 118

for
Oregon Department of Environmental Quality on behalf of Asgard, L.L.C.

March 5, 2024

GeoEngineers
Earth Science + Technology

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File No. 25941-001-04

March 5, 2024

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1.0 INTRODUCTION

On behalf of the owner of the industrial property located at 14200 SW 72nd Avenue in Tigard, Oregon (herein referred to as the "Gerber Legendary Blades [GLB] Site" [the Site]), Oregon Department of Environmental Quality (DEQ) Environmental Cleanup Site Information (ECSI) Site ID 118, as shown in the Vicinity Map, Figure 1, this Work Plan presents the proposed scope of work to conduct a data gaps investigation at the GLB Site. The owner of the GLB Site, Asgard, L.L.C. (Asgard), has entered into the Voluntary Cleanup Program (VCP) and seeks an expedited no further action (NFA) determination from DEQ.

GeoEngineers submitted a Strategy Recommendation Letter to DEQ on December 18, 2023 (further described in Section 2.2.4). The Strategy Recommendation Letter concluded that halogenated volatile organic compounds (HVOCs) originating from a trespasser plume on the neighboring upgradient Williams Control Site (DEQ ECSI ID 4081) and a suspected on-site HVOC release at a former floor drain have resulted in concentrations of HVOCs in soil vapor that are above DEQ's updated vapor intrusion risk-based concentrations (RBCs). The Strategy Recommendation Letter also identified data gaps discussed in this work plan and outlined a preliminary vapor intrusion (VI) mitigation strategy.

After the submission of the Strategy Recommendation Letter, Asgard and GeoEngineers met with DEQ on February 5, 2024 to discuss the letter's findings and next steps in the VCP process. At this meeting, DEQ concurred that previous remedial investigation activities have adequately delineated HVOCs in soil and groundwater at the Site. However, DEQ believes that further delineation of sub-slab soil vapor beneath the southern and eastern portion of the Site building is needed before considering VI mitigation options. This work plan presents details of planned activities to delineate the extent of sub-slab soil vapor at concentrations that exceed DEQ's updated soil vapor risk-based concentrations (RBCs) that became effective in June 2023 (DEQ 2023). Key Site features and proposed sub-slab soil vapor and air monitoring locations are depicted on Site Plan and Proposed Soil Vapor and Indoor Air Sample Locations, Figure 2.

2.0 BACKGROUND SUMMARY

The GLB Site is a 5-acre parcel comprised of Washington County tax lot 2S112AA00300 located to the east of SW 72nd Avenue, north of SW Bonita Road and west of Interstate 5 in the northeast quarter of Section 12, Township 2 South, Range 1 West of the Willamette Meridian (U.S. Geological Survey [USGS], 2020) (Figure 1).

2.1. Work Performed by Others—GLB Site

In 2021, Hahn and Associates, Inc. (HAI) conducted a Phase I Environmental Site Assessment (ESA) (HAI, 2021) at the GLB Site, which identified the historical use of a vapor degreaser as a recognized environmental condition.

A Phase II ESA was completed by Wood Environmental & Infrastructure Solutions, Inc (Wood) in August 2021 (Wood, 2021) that included installation of eight sub-slab soil vapor sampling points (Figure 2; SS-1 through SS-8). Elevated concentrations of tetrachloroethene (PCE) were detected in sub-slab soil vapor beneath the western portion of the GLB Site's building, with the highest concentrations present near a former floor drain (SS-4), ranging from 4,500 to 720,000 micrograms per cubic meter (µg/m^3). At the time of this investigation, DEQ's RBC for soil VI into occupational buildings was 47,000 µg/m^3 and only one of eight samples (SS-4) exceeded the RBC. However, in 2023 DEQ adopted new sub-slab soil VI RBCs and all eight locations now exceed occupational concentrations for PCE, trichloroethene (TCE) or chloroform. Indoor air samples were also collected and concentrations of HVOCs were less than applicable DEQ RBC screening values and Occupational Safety and Health Administration (OSHA) permissible exposure limits. Based on these data, Wood concluded that historical releases to the floor drain (initially identified as a sump) were a potential contributing HVOC source for the elevated HVOCs found in sub-slab soil vapor beneath the GLB building.

In December 2021, Partner Engineering and Science, Inc. (Partner) conducted a Phase I ESA (Partner, 2021) and identified the detections of HVOCs beneath the western portion of the GLB Site as a recognized environmental concern (REC) requiring additional characterization. In January 2022, Partner conducted a Phase II ESA (Partner, 2022) in which three direct-push borings (B1 through B3) were completed outside the southwestern portion of the building, and three borings (B4 through B6) were completed inside the building around the former floor drain where elevated PCE soil vapor was encountered by Wood (Figure 2). HVOCs were either not detected or detected at concentrations less than Construction and Excavation Worker RBCs.

The highest PCE concentration was detected at soil boring B6 (7.31 milligrams per kilogram [mg/kg]), located northwest of the former floor drain. Subsequently, Partner concluded that the historical “floor drain” may be an additional source area of HVOCs beneath the GLB Site building. Partner sampled and analyzed five indoor air samples from various locations around the GLB Site building for HVOCs. The results of their indoor air sampling confirmed that concentrations of HVOCs, including PCE, TCE and vinyl chloride (VC) were less than applicable occupational DEQ RBCs and OSHA permissible exposure limits. Partner concluded that the migration of HVOCs in soil vapor below the concrete floor into the ambient air of the building did not appear to be occurring at concentrations indicative of risk to workers.

2.2. Work Performed by GeoEngineers—GLB Site

2.2.1. Former Floor Drain

In April 2022, GeoEngineers investigated the former floor drain and found a 3-foot-deep interior catch basin beneath a metal plate immediately adjacent to sub-slab sample SS-4 (Wood’s highest PCE vapor detection) and boring B6 (Partner’s highest PCE soil and groundwater detection). Piping associated with this interior catch basin did not extend to the north to the former plating and degreasing area as previously suspected, but instead extended approximately 10 feet to the south/southwest before terminating. This investigation determined that the catch basin was not a self-contained sump, but instead a floor drain that was likely severed during expansion of the building in 1976. The floor drain and exposed piping were backfilled with concrete in February 2023 (GeoEngineers, 2022a).

2.2.2. Sub-Slab Soil Vapor Investigations

Between April 2022 and December 2022, GeoEngineers conducted three sub-slab soil vapor sampling events at locations SS-3, SS-4 and GEI-SS-01 through GEI-SS-03 (GeoEngineers, 2022a and 2022b). According to the recently adopted DEQ VI RBCs, locations SS-3, SS-4, GEI-SS-01 and GEI-SS-02 contain TCE, PCE or chloroform at concentrations greater than either the Chronic or Acute Occupational Screening Values. HVOCs were either not detected or detected at concentrations less than the DEQ VI RBCs at GEI-SS-03.

2.2.3. Indoor and Outdoor Air Monitoring

Indoor air monitoring was conducted at two indoor locations (near Wood sub-slab soil vapor locations SS-3 and SS-4) in April and November 2022. Select HVOCs were either not detected or detected at concentrations less than DEQ Occupational RBCs with the exception for PCE. Due to the detection of PCE at a concentration greater than DEQ RBCs, a subsequent event was scheduled during non-business hours in December 2022 to reduce the impact from manufacturing processes or personnel. The December 2022 event expanded the indoor air sampling to five locations (one in the location of the former floor drain (GEI-IA-01) and one to the south of the former plating and degreaser area (GEI-IA-02), one near the center of the production area (GEI-IA-03), one in the southeastern offices (GEI-IA-04), one in the cafeteria (GEI-IA-05) and one location to analyze outdoor air in the western parking lot (GEI-OA-01). During the December 2022 event, TCE was detected at a concentration greater than DEQ Occupational RBC in two of the indoor locations. Remaining HVOCs were either not detected or detected at concentrations less than DEQ Occupational RBCs. However, these indoor air TCE detections were obtained from the central and northeastern margins of the GLB building, which are over 100 to 200 feet east of any known areas of elevated HVOCs in sub-slab soil vapor.

2.2.4. Strategy Recommendation Letter

GeoEngineers summarized the Site history, previous investigations, and nature and extent of HVOC contamination; identified data gaps; and presented a conceptual site model and a preliminary cleanup strategy recommendation in the 2023 Strategy Recommendations Letter that was submitted DEQ on December 18, 2023 (GeoEngineers, Inc., 2023b). The data gaps identified in the letter included the need for further sub-slab soil vapor sampling to delineate the extent of sub-slab HVOC concentrations that exceed DEQ VI RBCs.

2.3. Williams Controls Site—ECSI Site No. 4081

A trespasser plume originates from the Williams Controls Facility (ECSI Site No. 4081) located north adjacent to the GLB Site. Several groundwater monitoring wells are located across the western portion of the GLB Site, as shown in Figure 2. In October 2022, Williams Controls contracted Ramboll US Consulting, Inc. (Ramboll) to conduct groundwater monitoring at these monitoring wells. GeoEngineers' review of Ramboll's groundwater sampling report (Ramboll, 2022) concludes the following relative to groundwater quality beneath the GLB Site:

- Detected concentrations of TCE and/or VC in shallow groundwater exceed the excavation worker RBCs in GLB Site monitoring wells MW-11 and MW-13.
- At the time of the Ramboll investigation, detected concentrations of HVOCs in the GLB Site monitoring wells were less than DEQ's volatilization to indoor air RBC screening values, except for VC concentrations in MW-11, which is located to the west of the GLB Site western loading docks. Following DEQs 2023 updates to the VI RBCs, concentrations of TCE in MW-10, cis-1,2 DCE in MW-11, cis-1,2 DCE and VC in MW-11, and cis-1,2 DCE in MW-17 exceed respective occupational volatilization to indoor air chronic exposure RBCs.

3.0 DATA GAPS INVESTIGATION

The purpose of the data gaps investigation is to delineate the extent of sub-slab HVOC concentrations that exceed DEQ VI RBCs, collect updated indoor air HVOC concentrations, and evaluate sub-slab and indoor air pressures. This data will facilitate an updated human health risk evaluation and provide data for the design and evaluation of remedial alternatives to address HVOCs in soil vapor beneath the GLB Site building. The data gaps investigation activities are organized into four general tasks consisting of: (1) pre-field activities; (2) sub-slab soil vapor and indoor air assessment; (3) laboratory analysis; and (4) reporting.

3.1. Pre-field Activities

Several actions are necessary to prepare for the sub-slab soil vapor assessment field activities. The proposed pre-field activities are described below:

- Update the Health and Safety Plan.
- Coordinate and schedule all field activities with GLB Site personnel and private utility locating services.
- Obtain necessary laboratory containers for sub-slab soil vapor sample collection from Pace National Analytical of Mt. Juliet, Tennessee (Pace).
- Obtain necessary equipment for sub-slab soil vapor sample collection, Vapor Pin™ installation and differential pressure measurement.
- Evaluate weather conditions and attempt to perform sampling during a period of falling atmospheric pressure. However, the work will occur on the weekends to not interfere with manufacturing operations, so scheduling options may be limited. The sampling will be delayed no more than 6 weeks to coincide with an approaching low-pressure system.

3.2. Sub-slab Soil Vapor and Indoor Air Assessment

There are 11 existing sub-slab vapor sampling points inside the GLB Site building. GeoEngineers will install and sample six new sub-slab soil vapor sampling points, and then collect 11 sub-slab soil vapor samples from previously installed sub-slab soil vapor sampling points (total of 17 sample). In addition, GeoEngineers will collect six indoor air samples. The locations of the existing and proposed sub-slab soil vapor sample locations are shown in Figure 2. The sub-slab soil vapor assessment includes the following initial activities:

- GeoEngineers will install six sub-slab soil vapor sample points according to Vapor Pin™ Standard Operating Procedure—Installation and Extraction of the Vapor Pin™ (Appendix A).
- Record the position of each sub-slab soil vapor sample location by locating the exploration to known site features using hand measurement techniques.
- Deploy a differential pressure recorder (Omniguard 4 Differential Pressure Recorder or similar) at select locations to measure the pressure differential between sub-slab and indoor air for a 2-week period. Relevant meteorological data that can influence soil vapor concentration patterns will be collected during the sub-slab pressure monitoring. These data may be helpful qualitatively in data interpretation and in reconciling soil vapor sample data collected on multiple occasions. Barometric pressure data over the 2-week time span before the sub-slab soil vapor sampling event will be reviewed using readily available data sources (e.g., regional weather stations). If feasible, sub-slab soil vapor sampling will be attempted when the sub-slab vapor pressure is higher than the atmospheric pressure. General weather

conditions such as wind speed, snow or ice cover, and significant precipitation will be obtained at the time of sampling from using direct observation or readily available data sources (e.g., regional weather stations).

- Collect 11 sub-slab soil vapor samples from previously installed sub-slab soil vapor sampling locations (SS-1 through SS-8 and GEI-SS-01 through GEI-SS-03) and the six new vapor points (GEI-SS-04 through GEI-SS-09) shown in Figure 2. Pre-sampling quality control procedures (shut in test, helium leak testing and purging) will be conducted prior to sample collection. The sub-slab soil vapor samples will be collected using an evacuated 1-liter SUMMA® canister and a regulator set to less than or equal to approximately 200 milliliters per minute.
- Collect up to six indoor air samples: three in the production area, one in the wet room (southwest corner addition), one in the cafeteria (northeast corner) and one in the offices (southeast corner). The indoor air samples will be collected using a 6-liter SUMMA canister equipped with an 8-hour flow controller.
- Submit the sub-slab soil vapor and indoor air samples to Pace for chemical analysis of select HVOCs; PCE, TCE, 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (cis 1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), chloroform and VC by U.S. Environmental Protection Agency (EPA) Method TO-15. Additionally, the sub-slab soil vapor samples will be analyzed for helium by ASTM International (ASTM) Standard Practices Test Method D 1946.

Detailed sampling procedures are described in the Sampling and Analysis Plan included as Appendix A.

3.3. Analytical Program, Data Management and Quality Control

GeoEngineers will use Pace to conduct the sub-slab soil vapor and indoor air laboratory analysis. Table A-1 presents the proposed analytical plan. The following analytical methods will be used for the sub-slab soil vapor and indoor air sampling:

- Select HVOCs (PCE, TCE, 1,1-DCE, cis 1,2-DCE, trans-1,2-DCE, chloroform and VC) by EPA Method TO-15.
- Helium by ASTM Standard Practices Test Method D 1946.

Method Reporting Limit (MRL) goals will be based on DEQ criteria for occupational exposure scenarios and are detailed in Table A-3.

3.3.1. Quality Assurance and Quality Control

Quality assurance and quality control procedures to be followed during this investigation are presented in the Quality Assurance Project Plan included as Appendix B. Field and laboratory quality control sampling and testing criteria are presented in Table A-2.

3.3.2. Data Management

Upon receipt of the final analytical laboratory data and completion of the data quality review, the data will be entered into a comprehensive database in Microsoft Excel. The data set will be organized in a manner that will facilitate risk screening and statistical manipulation.

4.0 REPORTING

GeoEngineers will prepare a Focused Feasibility Study (FFS) report following completion of the field activities and receipt of the laboratory analytical data. The FFS report will include the following:

- Summary of the field activities and analytical data;
- Comparison of chemical analytical data to DEQ RBCs;
- Updated discussion on the nature and extent of HVOC contamination at the Site;
- Updated conceptual site model; and
- Streamlined evaluation of remedial alternatives to address any potential risk posed to human health and the environment by HVOCs present at the Site.

5.0 SCHEDULE

We anticipate being able to begin coordinating the data gap investigation immediately upon receiving approval of this Work Plan from DEQ. Close coordination with the Site facilities manager will be required and will dictate the sampling schedule. The timing of the investigation will also depend on forecast weather conditions. We anticipate the investigation will be conducted over 3 weeks and begin within 2 weeks of receiving DEQ approval of this work plan. The goal is to complete the investigation by the end of April 2024. DEQ will be updated as activities at the Site are scheduled and completed. The FFS report will be submitted to DEQ within 4 weeks of receiving final analytical results.

6.0 LIMITATIONS

We have prepared this Work Plan for use by Asgard. This Work Plan is not intended for use by others, and the information contained herein is not applicable to other sites.

Within the limitations of scope, schedule and budget, our services were executed in accordance with generally accepted environmental science practices in this area at the time this work plan was prepared. No warranty or other conditions expressed or implied should be understood.

Any electronic form or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers.

7.0 REFERENCES

Oregon Department of Environmental Quality (DEQ), 2023. Guide to Tables of Vapor Intrusion RBCs Based on EPA VISL Calculations. June 2023.

GeoEngineers, Inc. 2022a. Letter Report, Former Sump Cleanout, Sub-Slab Soil Vapor and Indoor Air Sampling, Fiskars Manufacturing Facility, 14200 SW 72nd Avenue, Tigard, Oregon, dated May 10, 2022.

GeoEngineers, Inc., 2022b. Letter Report, Sub-Slab Vapor and Indoor/Outdoor Air Sampling – November and December 2022, Fiskars Manufacturing Facility, 14200 SW 72nd Avenue, Tigard, Oregon. Dated December 28, 2022.

GeoEngineers, Inc., 2023a. Contaminated Media Management Plan, Fiskars Manufacturing Facility, 14200 SW 72nd Avenue, Portland, Oregon. Dated March 20, 2023.

GeoEngineers, Inc., 2023b. Strategy Recommendation. Gerber Legendary Blades, 14200 SW 72nd Avenue, Portland, Oregon. Dated December 18, 2023.

Hahn and Associates, Inc. (HAI), 2021. Phase I Environmental Site Assessment, Gerber Blades Property, 14200 SW 72nd Avenue, Tigard, Washington County, Oregon. Dated March 12, 2021. Ramboll US Consulting, Inc. (Ramboll), 2022. Groundwater Sampling Report. Williams Controls Industries, Inc. Portland, Oregon. Dated October 2022.

Partner Engineering and Science, Inc. (Partner), 2021. Phase I Environmental Site Assessment, Tigard Industrial, 14200 SW 72nd Avenue, Tigard, Oregon 97224. Dated December 13, 2021.

Partner, 2022. Phase II Subsurface Investigation Report, Gerber Tigard, 14200 SW 72nd Avenue, Tigard, Oregon 97224. Dated February 14, 2022.

United States Geological Survey (USGS), 2020. Lake Oswego Quadrangle, Oregon, 7.5-minute Series Map. USGS, Washington, D.C.

Wood Environmental & Infrastructure Solutions, Inc. (Wood), 2021. Phase II Environmental Site Assessment, Fiskars Facility, 14200 SW 72nd Avenue, Tigard, Oregon, dated August 24, 2021.

FIGURES

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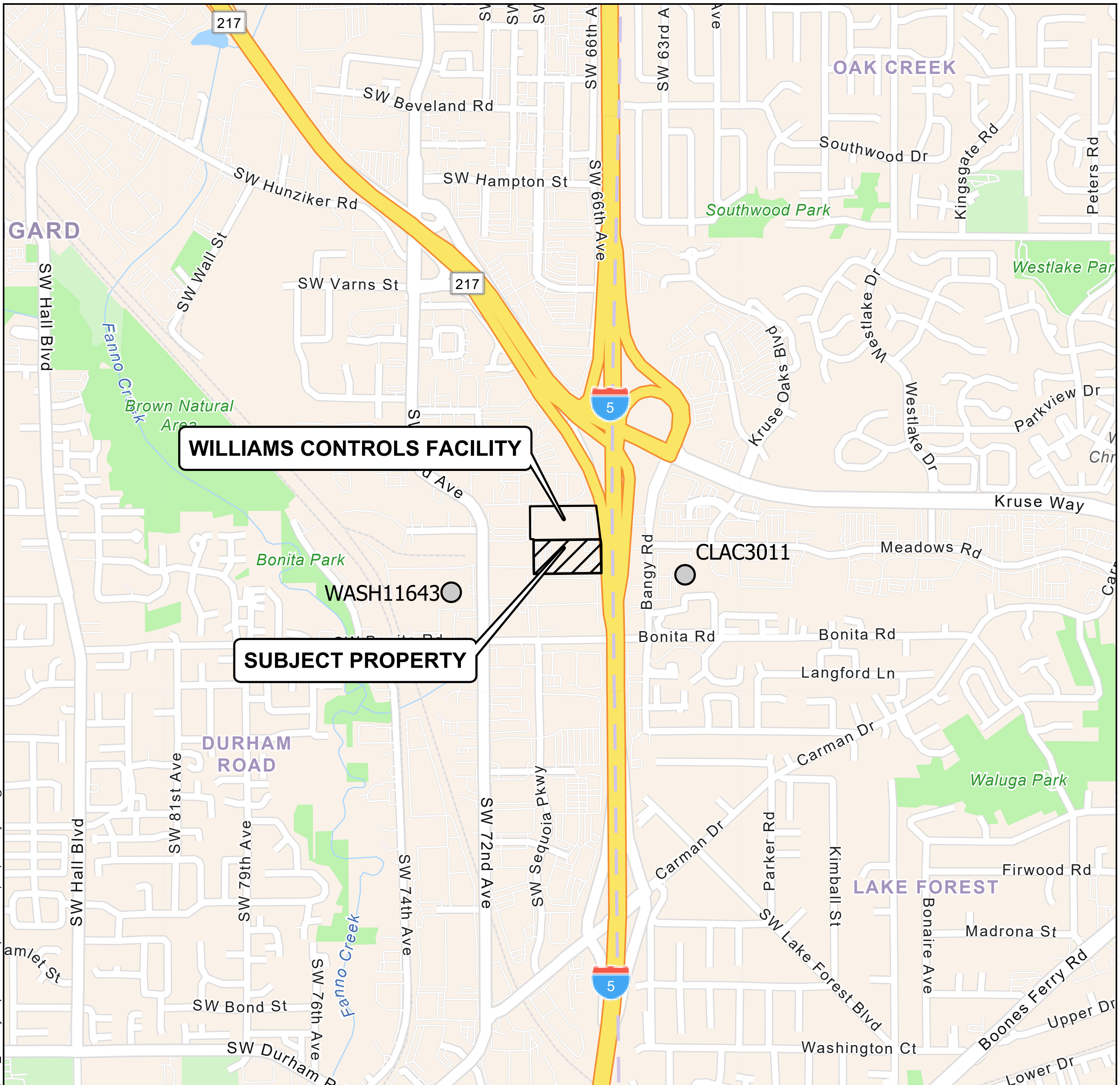

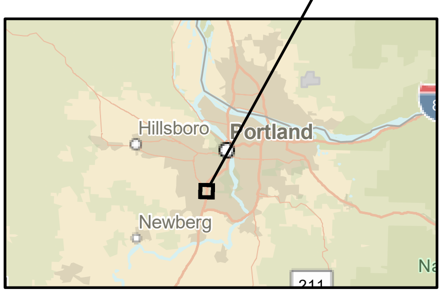

Legend

- Water Supply Wells

N W E S

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Feet

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

Gerber Legendary Blades Site
14200 SW 72nd Avenue, Tigard, Oregon

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Figure 1

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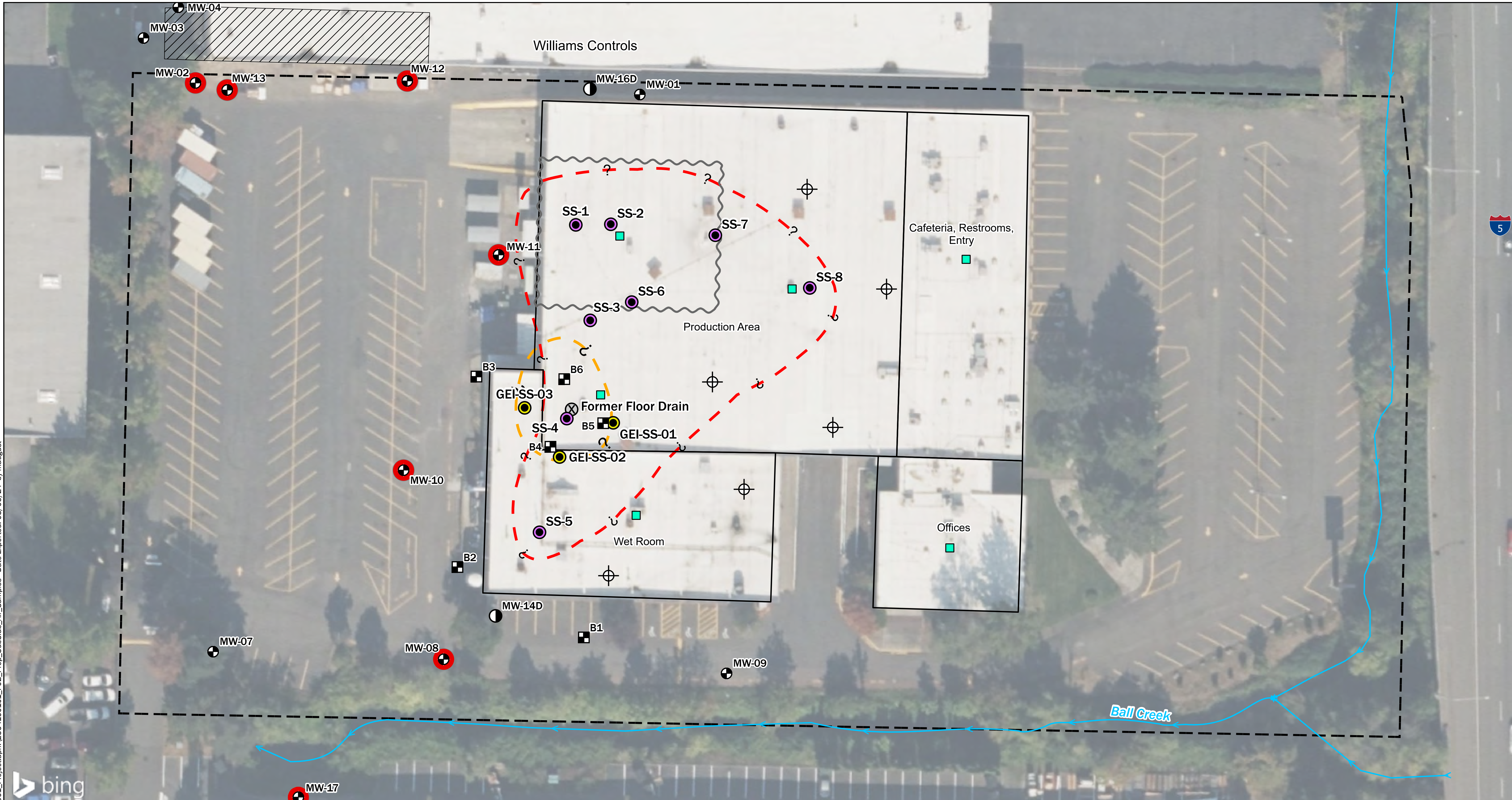

Notes:
1. The locations of all features shown are approximate.
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3. HVOC= Halogenated volatile organic compounds

Data Source: Bing Imagery
Projection: NAD 1983 StatePlane Oregon North FIPS 3601 Feet

Legend

- Proposed Sub-Slab Soil Vapor Sample
- Proposed Indoor Air Sample
- Former Floor Drain
- Approximate Location of GeoEngineers Sub-Slab Soil Vapor Sample
- Approximate Location of Wood Environment and Infrastructure Solutions, Inc. Sub-Slab Soil Vapor Sample
- Partner Soil Boring Location (2022)
- Shallow Groundwater Monitoring Well
- Deep Groundwater Monitoring Well
- Groundwater Analysis Indicated that One or More HVOCs Were Detected at Concentrations Greater than or Equal to Applicable DEQ RBCs
- HVOC Concentration in Sub-Slab Soil Vapor Greater than Commercial DEQ RBCs
- Area of Possible Soil Contamination
- Approximate Former Plating and Degreaser Area
- Approximate Location of Source Area for the Williams Control Industries, Inc. Facility
- Subject Property Boundary

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Site Plan and Proposed Sub-Slab Soil Vapor and Indoor Air Sample Locations

Gerber Legendary Blades Site
14200 SW 72nd Avenue, Tigard, Oregon

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Figure 2

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APPENDICES

Appendix A
Sampling and Analysis Plan

APPENDIX A
SAMPLING AND ANALYSIS PLAN

Sub-Slab Soil Vapor Probe Installation

Sub-slab soil vapor samples will be collected inside the building using Vapor Pin™ sampling devices. The Vapor Pins are installed following the manufacturers' standard operating procedures (SOPs) attached to this appendix. The Vapor Pins will be left in place with flush-mounted stainless-steel covers for potential future use if necessary.

General installation procedures for the sub-slab sampling device are as follows:

- Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding. A subcontractor will perform a private utility locate to clear the sub-slab soil vapor sample locations.
- Set up vacuum to collect drill cuttings.
- Drill a 1.5-inch-diameter hole at least 1.75 inches into the slab.
- Drill a ⅝-inch-diameter hole through the slab and approximately 1 inch into the underlying soil to form a void.
- Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.
- Place the lower end of sampling device assembly into the drilled hole. Place the small hole located in the handle of the extraction/installation tool over the sampling device to protect the barb fitting and cap and tap the sampling device into place using a dead blow hammer. Make sure the extraction/installation tool is aligned parallel to the sampling device to avoid damaging the barb fitting.
- During installation, the silicone sleeve forms a slight bulge between the slab and the sample device shoulder creating a seal. Place a protective cap on sampling device to prevent vapor loss prior to sampling.
- Cover the sampling device with a stainless-steel secured cover.
- Allow at least 60 minutes for the sub-slab soil vapor conditions to equilibrate prior to sampling.

Sub-Slab Soil Vapor Sampling Procedure

The following procedure is followed to collect sub-slab soil vapor samples:

- Connect new fluoropolymer (Teflon®) tubing to the sub-slab soil vapor probe, using the barb fitting on the top of the sampling device.
- Connect the tubing (aboveground) to a sampling manifold.
- Vacuum test the sampling manifold (shut-in test) by briefly introducing a vacuum to the aboveground portion of the sampling train and checking for loss of vacuum. If vacuum loss is observed, connections and fittings in the sample train are checked and adjusted, then vacuum-tested again. This test is repeated until the sampling train has demonstrated that tightness is achieved.

- A tracer gas shroud (clear plastic bag) is placed around the entire sample train (that is, the sub-slab soil vapor probe where it enters the ground surface, the 6-liter SUMMA canister and associated tubing and manifold).
  - The shroud is charged (filled) with a tracer gas (spec-grade 99.995 percent helium gas) and the tracer gas concentration within the shroud is measured using a hand-held monitor (Dielectric MGD-2002 Multi-Gas Leak Detector), which is capable of measuring helium in air to a concentration of 0.5 percent) prior to, during and after completion of the sampling event. To charge the shroud, a Teflon tube with a ball valve is inserted under the shroud to connect with the compressed helium bottle. This same tube is used to monitor the helium concentration within the shroud periodically throughout the sampling process. The purpose of the periodic monitoring is to make sure helium is in contact with the sample train and the ground surface while the sub-slab vapor sample is collected.
- The sampling train (aboveground and belowground components) is purged using a vacuum purge pump or a multi-gas meter. Purge volumes are calculated based on the flow rate of the purge pump and the volume of the soil vapor probe and sample train. After purging three sampling train volumes, the helium concentration within the sampling train is measured and recorded. If the helium concentration in the sample train is greater than or equal to 5 percent of the helium concentration in the shroud, the bentonite seal is re-applied, fittings re-tightened, and the previous purging and measurement tests are repeated.
- The soil vapor sample is obtained using a 1-liter evacuated SUMMA canister (with approximately 30 inches of mercury vacuum set by the laboratory) with a regulated flow rate of less than or equal to approximately 200 milliliters per minute. The canister is filled with soil vapor for approximately 5 minutes or until a vacuum equivalent of approximately 5 inches of mercury remains in the SUMMA canister, whichever comes first. The initial and final canister vacuums are recorded on a soil vapor sampling field form.
- The canisters are provided by the subcontracted analytical laboratory.

Air Sampling Methodology

Indoor air samples are obtained by placing a laboratory-supplied evacuated 6-liter SUMMA canister equipped with an 8-hour flow controller. Tubing is connected to each canister and is used to elevate the sample intake into the breathing zone at approximately 4 to 5 feet above the ground surface. Initial canister pressure, start date and start time are recorded on a field data form. The inlet valve on the canister is opened to collect the sample. The canisters are filled until a vacuum equivalent of between 4 and 10 inches of mercury remains in each canister. At that time, the sample team closes the inlet valve and records the canister pressure, stop date and stop time on the field data form. Canisters are then prepared and delivered to the laboratory under chain-of-custody procedures for chemical analysis.

Table A-1

Test Methods, Sample Containers, Preservation and Hold Times for Air and Soil Vapor Samples

Gerber Legendary Blades Site

Tigard, Oregon

Matrix	Analytes	Analysis Method	Bottle Size	Preservation	Holding Times
Air	VOCs	EPA TO-15	6 Liter Summa Canister	None	30 days
Soil Vapor	VOCs	EPA TO-15	1 Liter Summa Canister	None	30 days
	Helium	ASTM-D1946	1 Liter Summa Canister	None	30 days

Notes:

Extraction holding time is based on elapsed time from date of sample collection.
VOCs = volatile organic compounds
EPA = U.S. Environmental Protection Agency
ASTM = ASTM International Standard Practices

Table A-2

Quality Control Samples - Type and Frequency for Air and Soil Vapor Samples

Gerber Legendary Blades Site

Tigard, Oregon

Matrix	Field QC			Laboratory QC			
	Field Duplicates	**Trip Blanks**	**Rinseate**	**Laboratory/Method Blanks**	**LCS/LCSD**	**MS/MSD**	**Lab Duplicates**
Air	None Proposed	None Proposed	Not Applicable	1 per batch	1 per batch	Not Applicable	Not Applicable
Soil Vapor	None Proposed	None Proposed	Not Applicable	1 per batch	1 per batch	Not Applicable	Not Applicable

Notes:

An analytical batch is defined as a group of samples taken through a preparation procedure and sharing a method blank, LCS and lab duplicate.

No more than 20 field samples can be contained in one batch.

LCS = Laboratory control sample

MS = Matrix spike sample

MSD = Matrix spike duplicate sample

QC = Quality Control

Table A-3

Methods of Analysis and Target Reporting Limits for Air and Soil Vapor Samples

Gerber Legendary Blades Site

Tigard, Oregon

Matrix	Air			Sub-Slab Soil Vapor		
Analysis Method	EPA TO-15			EPA TO-15		
Analyte	Chronic Screening Value - Occupational ($\mu g/m^3$)	Acute Screening Value - Occupational ($\mu g/m^3$)	Target Reporting Limit - 6 L ($\mu g/m^3$)[1]	Chronic Screening Value - Occupational ($\mu g/m^3$)	Acute Screening Value - Occupational ($\mu g/m^3$)	Target Reporting Limit - 1 L ($\mu g/m^3$)[1]
Chloroform	0.53	1,500	0.973	18	50,000	0.973
Tetrachloroethene (PCE)	47	120	1.36	1,600	4,000	1.36
Trichloroethene (TCE)	3	6.3	1.07	100	210	1.07
1,1-Dichloroethene	880	600	0.793	29,000	20,000	0.793
cis-1,2-Dichloroethene	180	Not Established	0.793	5800	Not Established	0.793
trans-1,2-Dichloroethene	180	2,400	0.793	5,800	80,000	0.793
Vinyl chloride	2.8	3,900	0.511	93	130,000	0.511

Notes:

[1] Laboratory reporting limits were obtained from Pace Analytical, an Oregon Department of Environmental Quality-approved laboratory.

$\mu g/m^3$ = micrograms per cubic meter

EPA = United State Environmental Protection Agency

Standard Operating Procedure Installation and Extraction of the Vapor Pin®

Updated March 16, 2018

Scope:

This standard operating procedure describes the installation and extraction of the VAPOR PIN® for use in sub-slab soil-gas sampling.

Purpose:

The purpose of this procedure is to assure good quality control in field operations and uniformity between field personnel in the use of the VAPOR PIN® for the collection of sub-slab soil-gas samples or pressure readings.

Equipment Needed:

- Assembled VAPOR PIN® [VAPOR PIN® and silicone sleeve(Figure 1)]; Because of sharp edges, gloves are recommended for sleeve installation;
- Hammer drill;
- 5/8-inch (16mm) diameter hammer bit (hole **must** be 5/8-inch (16mm) diameter to ensure seal. It is recommended that you use the drill guide). (Hilti™ TE-YX 5/8" x 22" (400 mm) #00206514 or equivalent);
- 1½-inch (38mm) diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent) for flush mount applications;
- ¾-inch (19mm) diameter bottle brush;
- Wet/Dry vacuum with HEPA filter (optional);
- VAPOR PIN® installation/extraction tool;
- Dead blow hammer;
- VAPOR PIN® flush mount cover, if desired;
- VAPOR PIN® drilling guide, if desired;
- VAPOR PIN® protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel for repairing the hole following the extraction of the VAPOR PIN®.

Figure 1. Assembled VAPOR PIN®

Installation Procedure:

1) Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.

2) Set up wet/dry vacuum to collect drill cuttings.

3) If a flush mount installation is required, drill a 1½-inch (38mm) diameter hole at least 1¾-inches (45mm) into the slab. Use of a VAPOR PIN® drilling guide is recommended.

4) Drill a 5/8-inch (16mm) diameter hole through the slab and approximately 1-inch (25mm) into the underlying soil to form a void. Hole **must** be 5/8-inch (16mm) in diameter to ensure seal. It is recommended that you use the drill guide.

5) Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.

6) Place the lower end of VAPOR PIN® assembly into the drilled hole. Place the small hole located in the handle of the installation/extraction tool over the vapor pin to protect the barb fitting, and tap the vapor pin into place using a dead blow hammer (Figure 2). Make sure the installation/extraction tool is aligned parallel to the vapor pin to avoid damaging the barb fitting.

Figure 2. Installing the VAPOR PIN®

During installation, the silicone sleeve will form a slight bulge between the slab and the VAPOR PIN® shoulder. Place the protective cap on VAPOR PIN® to prevent vapor loss prior to sampling (Figure 3).

Figure 3. Installed VAPOR PIN®

7) For flush mount installations, cover the vapor pin with a flush mount cover, using either the plastic cover or the optional stainless-steel Secure Cover (Figure 4).

Figure 4. Secure Cover Installed

8) Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to re-equilibrate prior to sampling.

9) Remove protective cap and connect sample tubing to the barb fitting of the VAPOR PIN®. This connection can be made using a short piece of Tygon™ tubing to join the VAPOR PIN® with the

Nylaflow tubing (Figure 5). Put the Nylaflow tubing as close to the VAPOR PIN® as possible to minimize contact between soil gas and Tygon™ tubing.

Figure 5. VAPOR PIN® sample connection

10) Conduct leak tests in accordance with applicable guidance. If the method of leak testing is not specified, an alternative can be the use of a water dam and vacuum pump, as described in SOP Leak Testing the VAPOR PIN® via Mechanical Means (Figure 6). For flush-mount installations, distilled water can be poured directly into the 1 1/2 inch (38mm) hole.

Figure 6. Water dam used for leak detection

11) Collect sub-slab soil gas sample or pressure reading. When finished, replace the protective cap and flush mount cover until the next event. If the sampling is complete, extract the VAPOR PIN®.

Extraction Procedure:

1) Remove the protective cap, and thread the installation/extraction tool onto the barrel of the VAPOR PIN® (Figure 7). Turn the tool clockwise continuously, don't stop turning, the VAPOR PIN® will feed into the bottom of the installation/extraction tool and will extract from the hole like a wine cork, DO NOT PULL.

2) Fill the void with hydraulic cement and smooth with a trowel or putty knife.

Figure 7. Removing the VAPOR PIN®

- Prior to reuse, remove the silicone sleeve and protective cap and discard. Decontaminate the VAPOR PIN® in a hot water and Alconox® wash, then heat in an oven to a temperature of 265° F (130° C) for 15 to 30 minutes. For both steps, **STAINLESS – ½ hour, BRASS 8 minutes**

3) Replacement parts and supplies are available online.

APPENDIX B
Quality Assurance Project Plan

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

Introduction

This Quality Assurance Project Plan (QAPP) has been prepared to identify the air sampling and analysis methods to be performed during the indoor air and sub-slab soil vapor sampling for the GLB Site building located in Tigard, Oregon.

Field Documentation

Soil Gas and Air Sample Containers and Labeling

The Field Coordinator will manage field protocols related to sample collection, handling and documentation. Sub-slab soil vapor and indoor samples will be submitted for chemical analysis of select halogenated volatile organic compounds (HVOCs) (tetrachloroethene [PCE], trichloroethene [TCE], 1,1-dichloroethene [1,1-DCE], cis-1,2-dichloroethene [cis 1,2-DCE], trans-1,2-dichloroethene [trans-1,2-DCE], chloroform and vinyl chloride [VC]) by U.S. Environmental Protection Agency (EPA) Method TO-15. Soil gas samples will also be analyzed for helium by ASTM International [ASTM] Standard Practices Test Method D 1946 for quality control leak detection purposes.

Sample containers are listed in Table A-1. Sample containers will be labeled with the following information at the time of sample collection:

- Project number
- Sample name, which will include a reference to the building name, sample type (indoor or soil vapor) and sample date.
- Date and time of collection.
- Sampler's initials.

Sample collection activities will be noted on the field logs and the Field Coordinator will monitor consistency between sample containers/labels, field logs and chain-of-custody forms. Sample numbering conventions are described below:

Sample Labeling: Indoor air samples will be identified as "IA" and sub-slab soil vapor samples will be identified as "SS." Each sub-slab soil vapor sample will be labeled according to the sub-slab soil vapor sampling location (either SS-1 through SS-8 or GEI-SS-01 through GEI-SS-09). Each indoor air sample will be labelled according to the sampling location (GEI-IA-01 through GEI-IA-06).

Sample Handling

Samples will be placed in the canister shipping container after collection. Each sample will be documented on an air or soil vapor sample collection form, including sample name, sample collection date and time, canister identification and canister vacuum.

Field personnel will provide for the security of samples from the time the samples are collected until the samples have been received by the courier service or laboratory personnel. A chain-of-custody form will be completed for each group of samples being shipped to the laboratory per standard chain-of-custody protocol. Samples will be transported and delivered to the analytical laboratory in the laboratory-provided shipping container. The samples will be transported by a shipping company.

Field Observations Documentation and Records

Field documentation provides important information about potential problems or special circumstances surrounding sample collection. Field personnel will record information for each air sample on field logs and will maintain a daily field report. Entries in the field logs will be made in pencil or water-resistant ink on water-resistant paper, and corrections will consist of line-out deletions. Individual logs and reports will become part of the project files at the conclusion of the fieldwork.

At a minimum, the following information will be recorded during the collection of each sample:

- Sample location and description
- Sampler's name(s)
- Date and time of sample collection
- Sample matrix (indoor air or soil vapor)
- Type of sampling equipment used
- Field instrument (e.g., photoionization detector [PID]) readings
- Weather conditions (temperature, barometric pressure, wind direction, wind speed and humidity) from a local weather station
- Surface conditions
- Groundwater elevation measurements in monitoring wells in close proximity to the soil gas probes will be documented during soil gas sampling.
- Field observations and details that are pertinent to the integrity/condition of the samples (e.g., performance of the sampling equipment, etc.).

In addition to the sampling information, the following specific information will also be recorded in the field log for each air sample or in a daily field report:

- Sampling team members
- Time of arrival/entry on site and time of site departure
- Other personnel present at the site
- Summary of pertinent meetings or discussions with contractor personnel
- Deviations from sampling plans and Health and Safety Plan
- Air monitoring results
- Changes in field personnel and responsibilities with reasons for the changes
- Levels of safety protection.

Decontamination

Non-disposable tools and equipment will not be required for indoor air and soil vapor sampling, so decontamination will not be required.

Disposal of Investigation-Derived Waste

Incidental waste generated during sampling activities includes items such as gloves, sample tubing, paper towels and similar expended and discarded field supplies. These materials are considered *de-minimis* and will be disposed of in a local trash receptacle or county disposal facility.

Quality Assurance and Quality Control

Environmental measurements will be conducted to produce data that are scientifically valid, of known and acceptable quality and that meet established objectives. QA/QC procedures will be implemented so that the precision, accuracy, representativeness, completeness and comparability of the data generated meet the specified data quality objectives within standard industry guidelines as described in Tables A-1 through A-3.

Field Quality Control

Field duplicates are not planned for this sampling effort. Trip blanks and rinsate blanks are not required for air sampling.

Data Management and Documentation

Data logs and data report packages will be located in the project file system in GeoEngineers' Sharepoint. Laboratory data reports will include internal laboratory quality control checks and sample results. Data logs and packages that are anticipated to be generated during the investigation include laboratory data report packages, field reports, field sampling data sheets, site plan of sample locations and chain-of-custody forms.

Analytical data will be supplied to GeoEngineers in both electronic data deliverable (EDD) format and PDF format. The PDF will serve as the official record of laboratory results. The EDDs will contain only data reported in the hard copy reports (e.g., only reportable results).

Upon receipt of the analytical data, the EDD will be uploaded to a project database and reduced into summary tables for each group of analytes and media. Upon completion of the summary tables, the accuracy of the data reduction will be verified using the hard copy of the data received from the laboratory. Any exceptions will be noted, and corrections will be made.