SOIL VAPOR INTRUSION ASSESSMENT WORK PLAN

Rainier Avenue Facility
Seattle, Washington

Prepared for: Darigold, Inc.

Project No. 090066-003-05 • February 4, 2011

Aspect CONSULTING

earth + water

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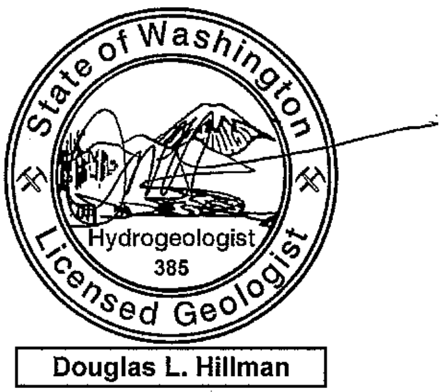

David A. Heffner, PE
Associate Engineer
dheffner@aspectconsulting.com

Doug Hillman, LHG
Principal Hydrogeologist
dhillman@aspectconsulting.com

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1 Introduction

This document presents a work plan for assessing the potential for soil vapor intrusion (VI) into the basement of the large Darigold building located at 4058 Rainier Avenue South in Seattle. Releases from former underground storage tank (UST) systems have impacted the North Yard of the facility with petroleum hydrocarbons in the gasoline and diesel ranges, as well as the gasoline additive methyl tertiary-butyl ether (MTBE). Environmental investigations have detected contaminants adsorbed to soil, dissolved in groundwater, and floating on the groundwater table as separate-phase hydrocarbon (SPH) near the northwest corner of the building (see Figure 1). In addition, a soil vapor survey conducted in 1990 detected elevated concentrations of total petroleum hydrocarbon (TPH) between the building's northwest corner and the former UST location.

Volatile organic compounds (VOCs), including MTBE and gasoline-range petroleum hydrocarbons, can migrate through the subsurface in the vapor phase and enter buildings through joints/cracks in the floor slab, utility penetrations, and other openings. Soil vapor samples will be collected from beneath the basement's floor slab to evaluate the potential for unacceptable impacts to indoor air via VI.

2 Basis for Sub-Slab Vapor Sampling

Ecology's draft *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action* (Ecology, 2009) establishes a "Tier I" process in which shallow groundwater and/or soil vapor concentration data can be compared to screening levels to evaluate the need for further assessment or action to address the VI pathway. The groundwater screening level for benzene is 2.4 micrograms per liter (µg/L). A benzene concentration of 1,700 µg/L was measured in a groundwater sample collected from Well PE-01 (located within several feet of the building's north wall – see Figure 1) in May 2010. Therefore, application of Ecology's Tier I process using groundwater concentration data indicates that VI is a potential concern. (The soil vapor samples collected in the 1990 investigation were analyzed for TPH only, for which no screening level is provided.)

The decision to collect sub-slab soil vapor samples rather than indoor air samples at this stage of VI assessment is consistent with the tiered remedial investigation approach described in the guidance document. Sub-slab sampling has potential advantages over indoor air sampling, including the following:

- It is less likely to result in "false positives." That is, potential contaminant sources located inside the building (cleaning products, new carpets, etc.) are less likely to impact sub-slab vapor than indoor air.

- Since Ecology guidance allows application of a soil vapor attenuation factor to conservatively estimate indoor air concentrations, required analytical method reporting limits are more readily achieved (see Section 4 discussion).
- Sub-slab vapor concentrations are less likely to be influenced by weather conditions and changes in barometric pressure, so that reasonable “worst-case” sampling conditions are more readily captured.

On the other hand, sampling indoor air provides a direct indication of building occupant exposure levels, whereas sub-slab vapor sampling does not. Ecology assumes a cross-slab attenuation factor of 10 for conservatively estimating indoor air concentrations based on sub-slab soil vapor sampling results. However, cross-slab attenuation factors are usually much higher than 10, typically on the order of 1,000 according to a study of 218 U.S. homes (Sager, et.al., 1997). Therefore, sub-slab vapor concentrations that exceed Ecology’s Tier I screening levels do not necessarily mean that indoor air is unacceptably impacted. As stated in the Ecology guidance document, if sub-slab sampling indicates a potential VI concern, then follow-up indoor air sampling may be warranted.

3 Sampling Methodology

Sampling will be conducted in general conformance with the Standard Operating Procedure (SOP) for Sub-Slab Soil Vapor Sampling, provided as Appendix B to this work plan. Leak testing with helium will not be conducted. Semi-permanent sampling points (vapor probes) will be installed so that repeated sampling can be conducted, if necessary. Vendor information on the vapor probe assembly is provided as Appendix A.

Additional details on sampling methodology and logistics are as follows:

- Vapor probes will be installed through the basement’s floor slab at the three approximate locations shown on Figure 1 (SSV-1 through SSV-3). The proposed probe locations are spaced at 35- to 40- foot intervals. SSV-1 is near Catch Basin No. 8968, which receives water from the building’s perimeter drain system. SSV-2 is near Well MW07, where SPH is typically observed floating on the groundwater table. Located in the northeast corner of the building, SSV-3 is nearest the former UST location.
- At each probe location, one sub-slab vapor sample will be collected in a certified-clean evacuated 6-liter Summa canister provided by the analytical laboratory.
- Flow controllers will be used with the Summa canisters in order to collect 1-hour time-integrated samples. (Note: Indoor air samples at commercial/industrial facilities are typically collected over an 8-hour sampling period to accurately monitor exposures of individuals occupying the space. Conditions in the sub-slab vapor space are expected to have considerably less variability over the course of a work day, so a shorter sampling period can be used to monitor those conditions.) Samples will be collected at a sampling rate of less than 0.1 liter per minute. This

low flow rate ensures that the sampling-induced pressure difference across the floor slab will be minimal.

- The Summa canisters will be packed in their original shipping container and shipped by FedEx to Air Toxics, Limited (ATL), in Folsom, California, for VOC analysis using modified EPA Method TO-15-LL (Sp).

4 Laboratory Analysis and Evaluation of Results

The Summa canister samples will be analyzed for the following potential compounds of concern (PCOCs):

MTBE	ethylbenzene	1,3,5-trimethylbenzene
n-hexane	xylenes (total)	1,2,4-trimethylbenzene
benzene	cumene	naphthalene
toluene		

This list includes all gasoline-range petroleum hydrocarbons (plus MTBE) that: 1) are on ATL's standard analyte list for modified EPA Method TO-15-LL (Sp); and 2) are found in Ecology's Cleanup Levels and Risk Calculations (CLARC) database.

Sampling results will be evaluated against the screening levels shown in Table 1. For each PCOC, the screening level is 10 times the most stringent corresponding MTCA Method B air cleanup level. Thus, these screening levels conservatively account for soil vapor attenuation across the floor slab in accordance with the Tier I methodology specified in Ecology guidance. Because it is quite volatile and, as a carcinogen, has an extremely low air cleanup level, benzene is the PCOC most likely to be detected at concentrations above its screening level.

Laboratory-specific reporting limits for the analytical method are also provided in Table 1. Reporting limits are below the corresponding screening levels for all compounds.

Regardless of the outcome of the above evaluation, a VI assessment report will be prepared that documents sampling results and recommends next steps. If any screening levels are exceeded, indoor air sampling will likely be recommended.

5 References

Ecology, 2009, Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action, Washington State Department of Ecology, Toxics Cleanup Program, Review DRAFT, October 2009.

Sager, S.L., Braddy, L.D., and Day, C.H., 1997, The Infiltration Ratio in Vapor Intrusion Calculations, Proceedings of the Society for Risk Analysis Annual Meeting, Washington, D.C., December 9, 1997.

6 Limitations

Work for this project was performed and this report prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Darigold, Inc., for specific application to the referenced property. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

Table 1 - Screening Levels and Reporting Limits for Potential Compounds of Concern

Soil Vapor Intrusion Assessment Work Plan, Darigold Rainier Avenue Facility

Potential Compound of Concern (PCOC)	MTCA Method B Air Cleanup Level, Standard Formula Value		Screening Level for Sub-Slab Vapor(2)	Reporting Limit Cited by Air Toxics, Ltd.(3)	Reporting Limit (Approx.) after Accounting for Canister Pressurization (4)
	Carcinogen	Non-Carcinogen			
Methyl tertiary-butyl ether	9.6	1,400	96	0.36	0.58
n-Hexane	NR	320	3,200	0.35	0.56
Benzene	0.32	140	3.2	0.32	0.51
Toluene	NR	2,200	22,000	0.38	0.61
Ethylbenzene	NR	460	4,600	0.43	0.69
Xylenes (total)	NR	46	460	0.86	1.38
Cumene	NR	180	1,800	0.49	0.78
1,3,5-Trimethylbenzene	NR	2.7	27	0.49	0.78
1,2,4-Trimethylbenzene	NR	2.7	27	0.49	0.78
Naphthalene	NR	1.4	14	2.6	4.2

MTCA Model Toxics Control Act
NR not researched

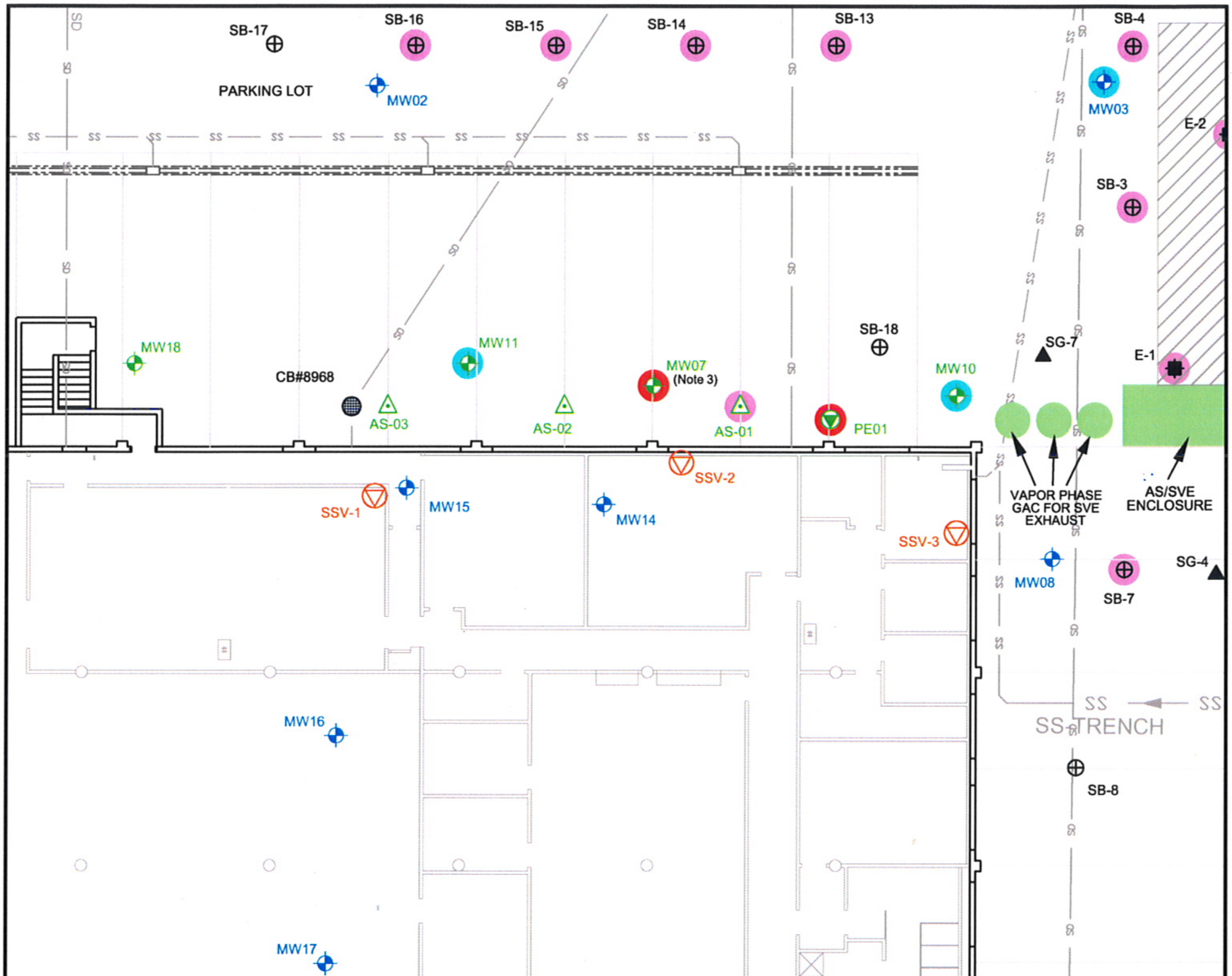
Notes:

1) All concentrations are in units of micrograms per cubic meter ($\mu g/m^3$).

2) Values in this column were obtained by multiplying the most stringent MTCA Method B air cleanup level by 10, to conservatively account for soil vapor attenuation across the floor slab in accordance with Ecology's *Guidance for Evaluating Soil Vapor Intrusion in Washington State.*

3) Reporting limits cited by Air Toxics, Ltd., for analysis by modified EPA Method TO-15 LL (Sp). These limits do not take into account sample dilution due to canister pressurization. Per Air Toxics, the dilution factor from pressurization will typically raise reporting limits by a factor of 1.5 to 1.7 when using a 6-liter canister.

4) Values in this column were obtained by simply multiplying the previous column values by 1.6 (the average of 1.5 and 1.7; see Note 3).



NOTE: COMPONENTS OF THE AIR SPARGE/SOIL VAPOR EXTRACTION (AS/SVE) SYSTEM INSTALLED IN AUGUST 2008 ARE COLORED GREEN ON THIS FIGURE

REFERENCES: SES, FIELD MEASUREMENTS, 2004-2009 DARIGOLD, INC, FACILITY DRAWINGS, 2005.CITY OF SEATTLE, SEWER CARD NOS. 1442, 1443, AND 5412, 2001. SD&C, UNDERGROUND STORAGE TANK SITE ASSESSMENT REPORT, 1998.

N

0 20 40
Feet

LEGEND

- SSV-1 — PROPOSED VAPOR PROBE LOCATION (SUB-SLAB)
- B-1 — SOIL BORING
- E-1 — SOIL EXCAVATION BASE OR SIDEWALL SAMPLE
- SG-1 — SOIL VAPOR SAMPLE (ENVIROS, 1990)
- MW01 — GROUNDWATER MONITORING WELL
- PE01 — PILOT TEST WELL

NOTE: Green wells have been incorporated into the soil vapor extraction (SVE) system.

- AS-01 — AIR SPARGING WELL
- CATCH BASIN OR CURB INLET
- MANHOLE
- SS — SANITARY SEWER
- SD — STORM SEWER
- ZIPPER DRAIN
- APPROXIMATE FORMER UST EXCAVATION (SES, 2004)
- UST — UNDERGROUND STORAGE TANK

DETECTION OF MTCA METHOD A CLEANUP LEVEL EXCEEDENCES

- SOIL ONLY
- GROUNDWATER ONLY
- SOIL AND GROUNDWATER

NOTES:
1. Among the explorations, only the monitoring wells (MWs) and Well PE01 have groundwater sampling results.
2. Groundwater cleanup level exceedences are based on the four monitoring rounds between August 2009 and May 2010.
3. Separate-phase hydrocarbon (SPH) is typically observed in Well MW07.

Aspect CONSULTING

Site Plan Showing Cleanup Level Exceedances and Proposed Vapor Probe Locations

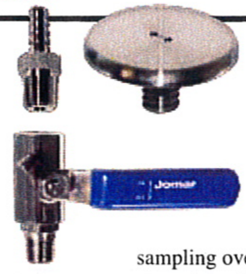
Darigold - Rainier Avenue Facility
Seattle, Washington

DATE:	January 2011
DESIGNED BY:	DAH
DRAWN BY:	SCC
REVISED BY:	SCC
PROJECT NO.	090066
FIGURE NO.	1

Q:\Darigold\090066 Rainier Avenue Facility\2011-01 VI Workplan\090066-01.dwg Figure 1 (8x11)
Jan 14, 2011 4:41pm scudd

APPENDIX A

Vendor Information, Sub-Slab Vapor Probe Assembly



AMS Sub-Slab GVP Kit

Sample for volatile organic compounds (VOCs) beneath floor slabs.

Sub-slab sampling and VOC monitoring have become an integral part of vapor intrusion investigations. The AMS sub-slab GVP kits provide a semi-permanent probe, designed to allow repeated sampling over time in order to assess the potential of contaminated vapor intrusion beneath the floor slab of a building.

The tamper-resistant kit includes a screw-in top cap that will help prevent vandalism or other unwanted use of the sampling point.

The sub-slab GVP installation kit (*below*) contains everything you need to install up to five permanent sampling points. It includes all the components of five sub-slab GVP tamper-resistant kits, two SDS-Max bits, and a ball-valve adapter.

- **Sub-Slab GVP Basic Kit Includes: Stainless steel 3" (length) implant, rubber shaft plug, connectors, top plug, hose barb adapter, 1/4" x 12" x 0.35" stainless steel tube**
- **Sub-Slab GVP Tamper-Resistant Kit Includes: Tamper-resistant top cap, stainless steel 3" (length) implant, rubber shaft plug, connectors, top plug, hose barb adapter, 1/4" x 12" x 0.35" SST tube**
- **Sub-Slab GVP Installation Kit Includes: Five stainless steel 3" (length) implant, five rubber shaft plugs, connectors, five top plugs, five hose barb adapter, five 1/4" x 12" x 0.35" stainless steel tubes, five tamper-resistant top caps, mini stainless steel ball-valve adapter, 1" x 16" x 21" SDS-Max bit, 2" x 3" x 16" SDS-Max core bit, screw driver, and a tee-handle allen wrench**

52956

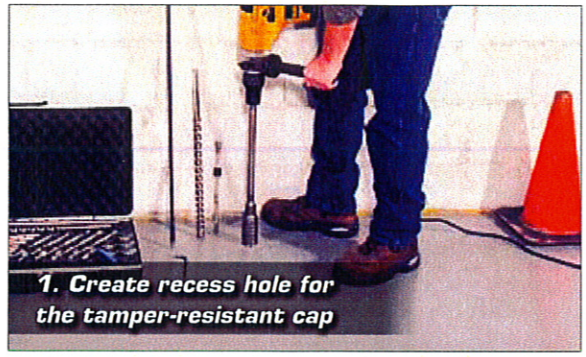
AMS Sub-Slab Gas Vapor Probe Kits

52954	Sub-Slab GVP Basic Kit	0.8 lb.	$ 149.00
52955	Sub-Slab GVP Tamper-Resistant Kit	1.0 lb.	$ 240.00
52956	Sub-Slab Gas Vapor Probe Installation Kit	14.7 lb.	$ 1,518.49

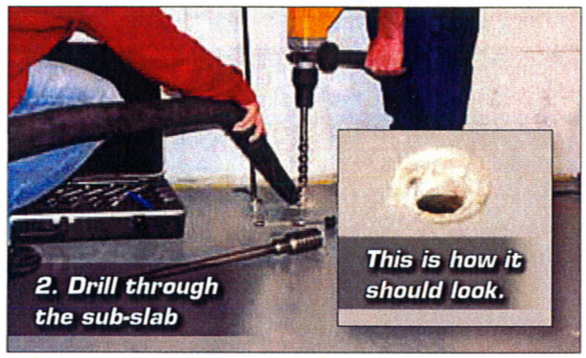
AMS Sub-Slab GVP Kit Replacement Parts and Accessories

52952	Sub Slab Vapor Shaft Tube	0.1 lb.	$ 18.50
52953	Sub Slab Rubber Plug	0.1 lb.	$ 13.50
13460	Connector SS-400-7-4	0.1 lb.	$ 36.50
13462	Plug HH-1/4 NPT	0.1 lb.	$ 14.50
13463	Hose Barb Adapter SS-4-AC-1-4	0.1 lb.	$ 23.50
21008	3" Implant w/ 1/4" SS Compression	0.1 lb.	$ 56.50
56958	Sub-Slab GVP Tamper-Resistant Top Cap	0.1 lb.	$ 90.00
208.63	Spanner Screwdriver	0.2 lb.	$ 14.04
424.62	AMS Small Carrying Case	5.7 lb.	$ 135.00
22011	Mini SST Ball-Valve Adapter	0.3 lb.	$ 46.25
214.43	1" x 16" (usable length) x 21" (total length) SDS-Max Bit	2.3 lb.	$ 87.70
260.51	2" x 3" (usable length) x 16" (total length) SDS-Max Core Bit	3.7 lb.	$ 165.00
260.52	Tee Handle Allen Wrench	0.1 lb.	$ 10.50
213.89	Bosch 11264EVS 1 x 5/8" SDS-Max Rotary Hammer Drill	14.3 lb.	$ 876.00

Installing the AMS Sub-Slab GVP

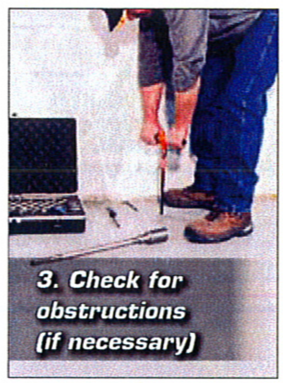


1. Create recess hole for the tamper-resistant cap

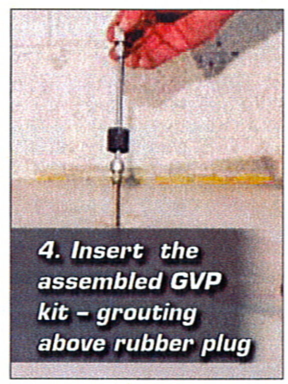


2. Drill through the sub-slab

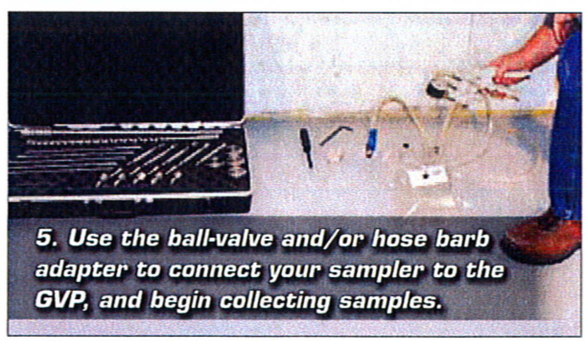
This is how it should look.



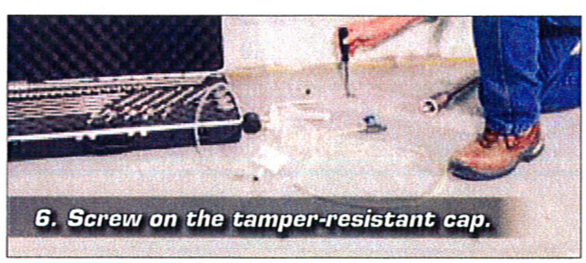
3. Check for obstructions (if necessary)



4. Insert the assembled GVP kit – grouting above rubber plug



5. Use the ball-valve and/or hose barb adapter to connect your sampler to the GVP, and begin collecting samples.



6. Screw on the tamper-resistant cap.

APPENDIX B

SOP for Sub-Slab Soil Vapor Sampling

Standard Operating Procedure
Sub-Slab Soil Vapor Sampling

Purpose

The purpose of this SOP is to provide field personnel with an outline of the specific information needed to collect and document representative sub-slab soil vapor samples. The recommended sub-slab soil vapor sampling technique, as presented in this SOP, is based on the assumption that soil vapor samples should be representative of chemicals that may volatilize from the uppermost aquifer into the vadose zone or from soil contamination within the vadose zone.

Sampling Equipment and Materials

The following equipment and materials are necessary to properly conduct sub-slab soil vapor sampling (see Figure B-1):

- Rotary hammer drill with a 1-inch and a 1/2-inch carbide tipped bit.
- Extension cord and generator (if no power outlets are available).
- 6-inch (length) stainless steel (SS) screen with barbed connection.
- 1/4-inch outside diameter (OD) Teflon®-lined tubing.
- #15 silicone tubing.
- 3-inch nipple, brass (1/8-inch).
- Female pipe reducing coupling, brass (1/4-inch x 1/8-inch).
- Allen head plug, brass (1/4-inch).
- Hose barb, brass (1/4-inch).
- Teflon® tape.
- Sikaflex® sealant, or suitable substitute, to seal vapor port borehole annulus.
- Concrete hole patch, to seal vapor port borehole annulus.
- Air pump and appropriate connection tubing, tee fittings, valves, and flow metering device for purging and sampling vapor ports.
- 1-liter Tedlar® bags to collect purged vapors.
- Sufficient number of Summa canisters and appropriate flow controllers to collect samples per the sampling and analysis plan.
- Equipment required for collection of samples using Summa canisters, including appropriate wrenches and pressure gauges.
- An accurate and reliable watch that has been properly set.

- A calculator.
- Field notebook, applicable sampling analysis plan, and Chain of Custody.
- Health-and-safety equipment and supplies (e.g., personal protective equipment [PPE]) as described in the relevant site health-and-safety plan (HSP).
- Shipping package for the Summa canisters.

When leak testing is required, additional equipment and materials include:

- Leak test shroud of sufficient size to cover soil gas vapor probe and sampling train (including Summa canister).
- A soft gasket to seal the leak test shroud to the floor.
- Tracer gas (helium), supplied in a 20 cubic foot gas cylinder with flow regulator.
- Flow regulator with 1/8-inch barbed outlet and tubing to connect the helium gas cylinder to the shroud.
- MGD-2002 helium meter or equivalent.

Sampling Procedure

Preparation

- Prior to beginning, clear sampling locations for utilities, verify access agreements are in place, and obtain required permits, as appropriate.
- Install sub-slab soil vapor sampling ports at locations described in the sampling and analysis plan as follows:
  - Drill a 1/2-inch borehole through the concrete floor of the building foundation to a depth of approximately 12-inches below the surface.
  - Over-drill a 1-inch borehole centered over the top of the 1/2-inch hole to a depth of approximately 3-inches.
  - Construct the vapor point as shown in Figure B-1 using the brass fittings and tubing described and insert in borehole. The vapor point should fit snug in the 1/2-inch borehole.
  - Seal the vapor port by installing approximately 1-inch of sealant above the vapor point and 2-inches of concrete patch flush to the floor surface to minimize short-circuiting.
- Assemble sampling train. The sampling train will be set up so that the Summa canister is in-line between the vapor port and the air pump, with a valve between the canister and the pump (see Figure B-1):
  - Verify the Summa canister number engraved on the canister matches the number listed on the certified clean tag to insure proper decontamination of the canister was completed. Fill out the sample tag.
  - Verify the canister valve is closed tightly and remove the threaded cap at the inlet of the canister.

  - Attach the flow controller to the inlet of the canister, the flow controller will have a built in pressure gauge.
  - Connect the tubing from vapor port to inlet of a 1/4-inch tee fitting.
  - Connect the Summa canister/flow controller to one outlet of the tee fitting.
  - Connect air pump to the other outlet of the tee fitting, insert a 1/4-inch shutoff valve between the tee fitting and the air pump.
- Where leak testing is required, a shroud will be placed over the vapor port and the Summa canister to keep tracer gas in contact with the vapor port and fittings. The shroud consists of a plastic bin of a known volume. Two holes will be drilled near the top of the shroud, one for connection of the helium gas cylinder and one for connection of the air pump located outside the shroud. A third hole will be drilled near the base of the shroud to monitor the helium concentration inside during sampling (see Figure B-1).

Sampling Methodology

Sample Collection

- Purge the vapor port and sampling train at approximately 100 ml/min using the air pump to ensure the sample is representative of subsurface conditions. Capture purged vapor in 1-liter Tedlar® bags at the outlet of the air pump and release the vapor outdoors. Three-five tubing volumes should be removed. Use the following equation to calculate volume to be purged:

$$\mathbf{V = \pi \times r^2 \times l}$$

Where:

V = Volume of tubing

r = the inner radius of the tubing being used [inches]

l = the length of the tubing being used [inches]

π = 3.14

(Convert to ml using 1-inch^3 = 16.387 ml to determine how long to purge port)

- If the sampling and analysis plan calls for Tedlar® bag samples to be collected for analysis, these samples will be collected at the outlet of the air pump following purging of the vapor port.
- Begin sample collection by closing the 1/4-inch shutoff valve between the Summa canister and the air pump and opening the valve on the Summa canister. Immediately record the pressure on the gauge as the “initial pressure” on the tag attached to the canister.
- After sampling begins and the apparatus is verified to be operating correctly, leave the canister to fill.
- Record all sample information in the field book and/or applicable field forms including the following:

- Canister number and sample identification,
- Sample start date and times,
- Location of sample (distance from walls shown on building floor plan),
- Initial and final pressure of canister,
- Notes regarding leak test, if applicable.

- Return to check canisters periodically (depending on length of sample period), to ensure proper operation. It is necessary to check the canister prior to completion because the accuracy of the flow regulators can vary, causing the canisters to fill faster than expected. The final pressure at the end of sampling should be approximately -5 to -6 inches mercury (Hg). If the canister has already reached this point, sampling is complete, the canister valve should be closed, and the pressure recorded as the "final pressure" on the sample tag, the field book, and applicable field forms. Sample collection will be considered complete, regardless of final pressure, after the stated sample period has elapsed.
- Record the exact pressure of the canister and time at the end of sampling on the sample tag for that canister, in the field book and on the applicable field forms.
- Verify that the canister valve is closed tightly, remove the flow controller, and replace the threaded cap at the top of the canister. Discard all sample tubing.
- Abandon vapor port by removing vapor screen and tubing, backfilling with glass bead, and patching with concrete.

Leak Testing

- Before purging or sampling begins, place the leak test shroud over the vapor port/Summa canister sampling apparatus. The tubing from the tee connection above the canister will pass through the wall of the shroud to connect with the air pump outside.
- Connect the helium cylinder to the leak test shroud using tubing from the flow regulator on the cylinder, through a hole in the wall of the shroud. Be sure to keep the cylinder in an upright position at all times.
- Connect the helium meter to the leak test shroud using the hole near the base.
- Use the flow regulator to slowly release helium into the leak test shroud until a predetermined concentration of helium is contained within the enclosed area. The helium concentration will be measured using the helium meter. Maintain helium concentrations throughout the sampling period by continuously bleeding cylinder gas into the shroud as needed.
- Prior to collecting the canister sample, the vapor port will be purged as described in the previous section. Purged vapor contained in the Tedlar® bags will be field screened using the helium meter to ensure that the concentration of helium inside the bags is less than 5-percent of the shroud concentration. If leakage is detected, the vapor port seal will be enhanced and connections will be inspected and tightened. This process will be repeated until no significant leakage has been demonstrated.

- After confirming no significant leakage, the 1/4-inch shutoff valve between the Summa canister and the air pump will be closed and the canister valve will be opened to begin collecting the sample.

Post-Sample Collection Procedures

Label all sample containers with the following information: sample identification, date and time sample was collected, the starting and ending canister pressure, the site name, and the company name. Include all this information in the field book plus the ending time of sample collection, and transfer pertinent information to the chain-of-custody record. Pack all Summa canisters in the original shipping containers, sealed with a custody seal, and send to the lab for analysis. The official holding time for this analysis is 30 days. However, attempt to get samples to the lab as soon as possible to allow lab time to conduct re-runs, dilutions, and low-level analyses, as necessary prior to sample expiration.

Analysis

The soil gas samples should be analyzed using EPA Methods TO-14 or TO-15, and when necessary/possible, low-level analysis or Selective Ion Mode (SIM) analysis to obtain the lowest achievable detection and reporting limits. Note the desired analytical methods on the Chain of Custody form, and be sure analysis for helium is specified for leak-tested samples.

Decontamination

The equipment used for soil gas sampling does not require decontamination in the field. The Summa canisters will be individually cleaned and certified to 0.02 ppbv THC for the project-specific analyte list by the contract laboratory prior to shipment. Insure that documentation of this certification is included on a tag attached to the canister and in the paperwork that accompanies the canister shipment from the lab.

Documentation

Record all field activities, environmental and building conditions, and sample documentation on the appropriate field forms and field notebook.

References

EPRI, Reference Handbook for Site Specific Assessment of Sub-Surface Vapor Intrusion to Indoor Air, March 2005.

Department of Environmental Protection, Commonwealth of Massachusetts, Indoor Air Sampling and Evaluation Guide, WSC Policy #02-430, Boston, Massachusetts, April 2002.

New Jersey Department of Environmental Protection, Vapor Intrusion Guidance, October 2005.

New York State Department of Health, Guidance for Evaluation Soil Vapor Intrusion in the State of New York, October 2006.

USEPA, Center for Environmental Research Information, Office of Research and Development, Compendium of Methods for Determination of Toxic Organic Compounds in Ambient Air, Second Edition, Compendium Method To-14A, Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using Specially Prepared Canisters with Subsequent Analysis by Gas Chromatography, January 1999.

USEPA, Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway Form Groundwater and Soils, EPA530-F-02-052, November 2002.

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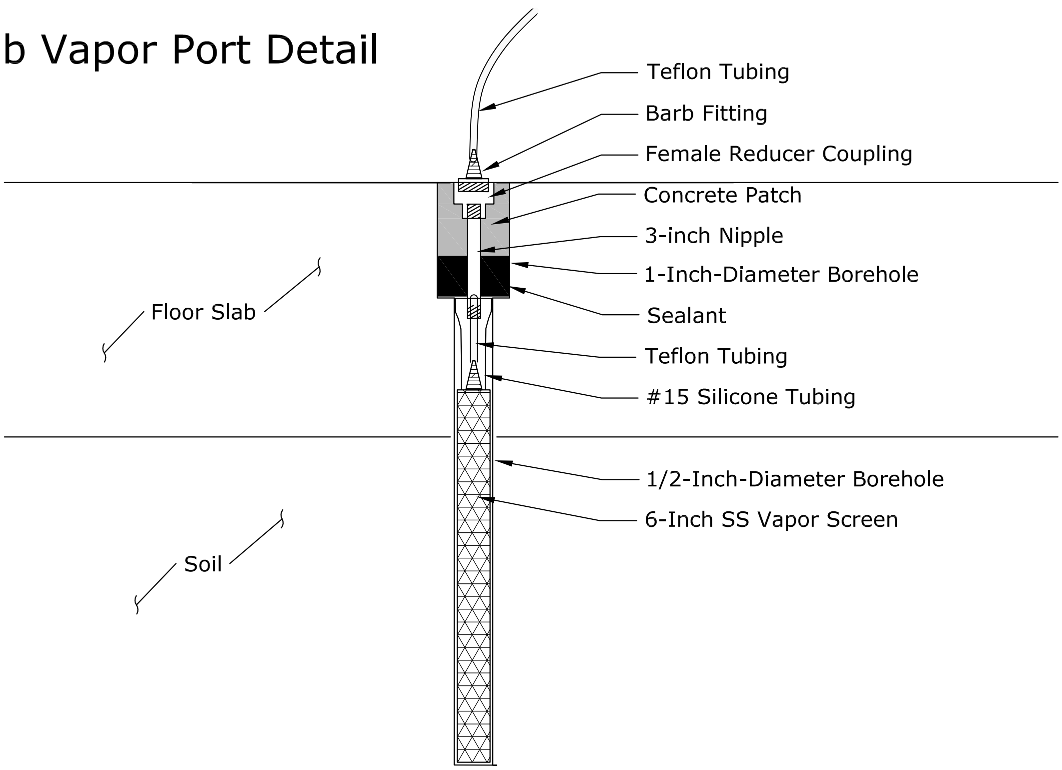
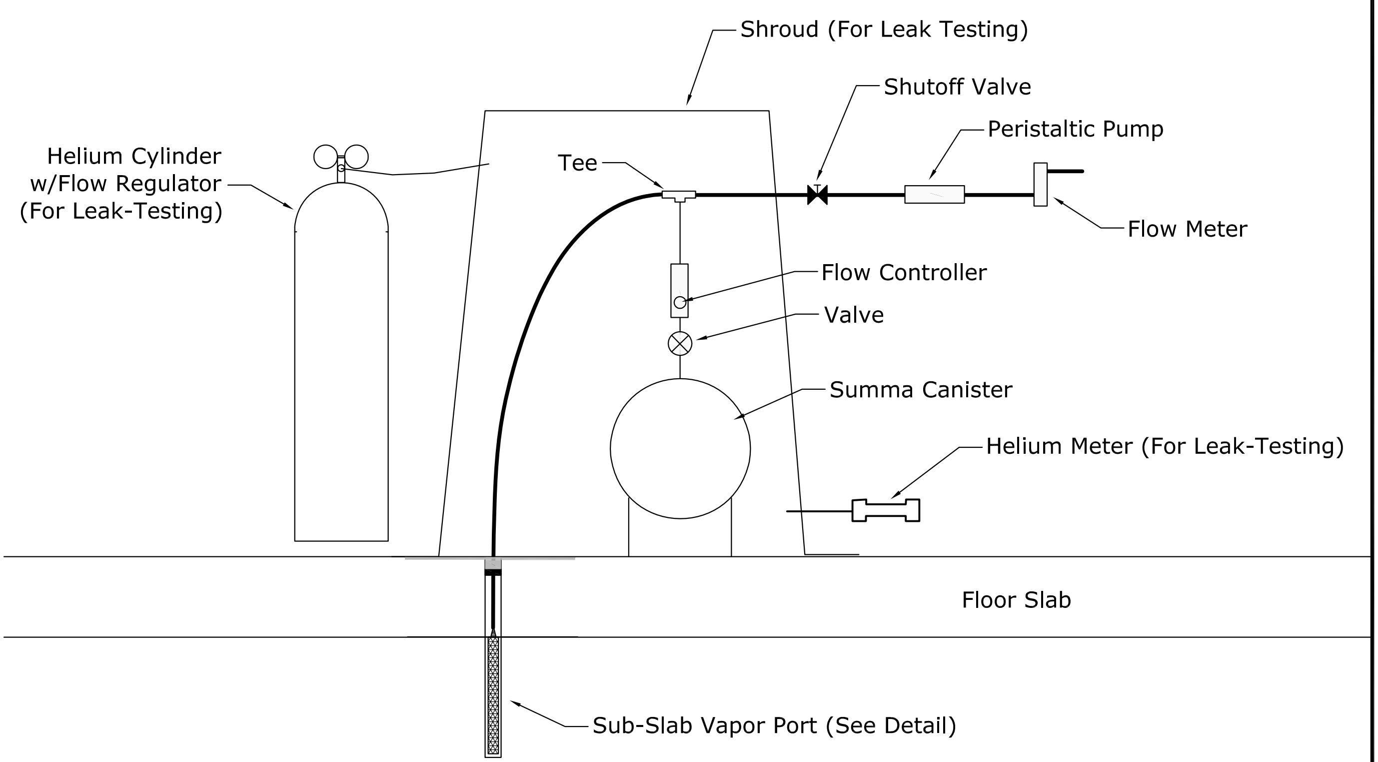
Sub-Slab Vapor Port Detail



Subslab Vapor Sampling Train



Aspect CONSULTING

Sub-Slab Vapor Sampling Apparatus
Soil Vapor Intrusion Assessment Work Plan
Crownhill Elementary School
Bremerton, Washington

DATE:	July 2010
DESIGNED BY:	EJM
DRAWN BY:	SCC
REVISED BY:	EJM
PROJECT NO.	100067
FIGURE NO.	B-1

Q:\Crown Hill Elementary\100067 Crown Hill Elementary School\2010-06 Vapor Sampling\100067-B1.dwg 8.5x11 Portrait

Jul 20, 2010 9:18am emarhofer