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November 7, 2013

Mr. Matthew Hubicki
Environmental Engineer I
DER, Bureau C
New York State Department of Environmental Conservation
625 Broadway, 11th Floor
Albany, NY 12233-7014

Subject: Trial SVE System Shut Down and Revised Soil Vapor Investigation Work Plan
Hangar D1 Bay 1B, Westchester County Airport
White Plains, New York
Site #3-60-037

Dear Mr. Hubicki:

On behalf of ExxonMobil Environmental Services Co., Woodard & Curran is submitting this revised Work Plan to complete an updated vapor intrusion investigation for the Westchester Country Airport Hangar D1 Bay 1B site in White Plains, New York. This vapor intrusion investigation is being conducted per discussion with New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH) representatives pursuant to technical review of the April 30, 2013 Petition for Site Reclassification (2013 Petition). The proposed investigation was to incorporate a trial shut-down of the Soil Vapor Extraction (SVE) system operating at the site and is being expedited due to current operational problems with the system blower. This work will be conducted to supplement soil vapor investigation reports of April 20, 2006, March 16, 2007, June 25, 2008, and February 5, 2009 (refer to **Appendix A**). In a March 4, 2009 letter, NYSDEC delayed further soil vapor sampling until such time as the SVE system was to be taken off-line. This Work Plan has been revised in accordance with comments received from NYSDEC and NYSDOH by electronic mail on October 18, 2013.

The NYSDEC is administering the Westchester County Airport Hangar D1 Bay 1B site under Article 27, Title 13 of the Environmental Conservation Law of the State of New York ("ECL") entitled "Inactive Hazardous Waste Disposal Sites." This program addresses hazardous waste sites, including sites where the responsible parties have been completing the work with NYSDEC approval. A Record of Decision (ROD) for the site was issued by the NYSDEC in March 2002 and subsequently a Remedial Design/Remedial Action Final Work Plan (RD/RA Work Plan) was issued by ExxonMobil in January 2003. As outlined in the ROD and RD/RA Work Plan, remedial efforts were implemented at the hangar including subsurface applications of potassium permanganate in April 2001, September 2004, and November/December 2008, and start-up of a Soil Vapor Extraction (SVE) system in February 2004. A site location map is included as **Figure 1** and a Site Plan is included as **Figure 2**.

1.0 Field Work and Documentation

1.1 Soil Vapor Sampling and Remedial System Operation

A chronological summary of soil vapor investigations and remedial efforts conducted at Hangar D1 Bay 1B is presented in **Appendix A**.

Soil vapor samples for Hangar D1 Bay 1B were previously collected with the SVE system operating between 2005 and 2008, with the exception of an event in November 2006 when the system was found shut-down during a routine maintenance visit. (Sample results with and without operation of the SVE system were inconclusive at that time; refer to **Table 1**.) In the March 4, 2009 letter, NYSDEC delayed further soil vapor sampling until such time as the SVE system was to be taken off-line.

Subsequent to submission of the 2013 Petition that documented declining removal rates for the SVE system, the SVE blower failed during a routine maintenance visit on September 17, 2013. As discussed during the September 9, 2013 meeting with NYSDEC, NYSDOH and ExxonMobil representatives, the system will remain off-line effecting a temporary shut-down to enable evaluation of current soil vapor concentrations under static conditions.

A replacement blower has been located and will be installed to replace the non-operational blower in the interim. Upon SVE system re-start (refer to **Section 2.0**), vacuum will be measured at existing monitoring wells and vapor probes (see **Figure 2**) to verify comparable influence of the SVE system with the replacement blower as measured by the radial extent of vacuum in the vicinity of the SVE wells. These results will be included in the following quarterly Progress Report submitted for the site.

1.2 Site Compounds

Soil vapor sampling will be implemented in general accordance with the October 2006 NYSDOH *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (NYSDOH Guidance). Site compounds (refer to Section 3.1 of the 2005 Work Plan) are chlorinated solvents and their breakdown products, including: 1,1,1-Trichloroethane (1,1,1-TCA), Tetrachloroethene (PCE), Trichloroethene (TCE), 1,1-Dichloroethane (1,1-DCA), 1,1-Dichloroethene (1,1-DCE), cis-1,2-Dichloroethene (cis-1,2-DCE), trans-1,2-Dichloroethene (trans-1,2-DCE), Chloroethane and Vinyl Chloride.

1.3 Building Survey and Product Inventory

As described in the NYSDOH Guidance, a building survey and product inventory will be completed prior to collection of the sub-slab soil vapor and air samples to evaluate building conditions which may interfere with the collection of representative samples. The building survey will include evaluation of the following:

- Building construction, condition, and the presence of any utility conduits going through the slab (e.g. electrical, drainage);
- Evidence of any recent interior construction projects (e.g. carpeting, paint, recent cuts through slab);
- Mechanical equipment that may cause pressure gradients throughout the area to be investigated;
- Use or storage of petroleum or solvent based products; and
- Presence and description of any odors (e.g. solvent, mold, petroleum) and screening for volatile organic compounds using a ppbRAE unit or equal.

To identify potential air sampling interferences located within or adjacent to the areas to be investigated, a product inventory will be conducted prior to sampling for chemical products used and/or

stored within the areas to be investigated. If any products are identified which may interfere with sampling, they will be moved out of the area.

1.4 Soil Vapor, Indoor and Outdoor Air Samples

Samples will be collected from the existing permanent sub-slab soil vapor probes SSV-1 and SSV-2 and a new permanent sub-slab soil vapor probe SSV-3[1] as located on **Figure 2**. Installation of the existing sub-slab soil vapor probes, tubing extending two inches into the aggregate below the slab and sealed, is reported in the soil vapor investigation report dated April 20, 2006. The new permanent sub-slab soil vapor probe SSV-3 will be installed in a comparable manner. The sampling point will be installed by drilling an approximately 3 inch diameter hole through the slab of the hangar floor and two inches into the sub-slab aggregate. Tubing will be extended to the bottom of the hole and the annular space will be backfilled with coarse sand. A stainless steel fitting will be attached to the tubing and cemented into the hole. The sampling point will be completed with a threaded cover installed flush to the floor slab and cemented into place. The new point will not be sampled for at least 24 hours following installation.

For sampling, the three sub-slab soil vapor probes will first be purged of three times the volume of the sampling point using an air sampling pump set at a maximum flow rate of 0.2 liters per minute to minimize infiltration of external vapors. A tracer gas screening using helium will be conducted at each sub-slab soil vapor sample location to determine the potential for short-circuiting in accordance with Section 2.7.5 of the NYSDOH Guidance. The sub-slab soil vapor samples will then be collected into Summa canisters set to collect samples over eight hours. During sample collection, conditions in the vicinity of the sampling point will be noted to allow for determination of the representativeness and comparability of the data collected. A record of conditions at the sampling location will be noted including:

- Use of any volatile chemicals in the vicinity of the sampling location;
- Whether heating or air conditioning systems are operational;
- Weather conditions;
- Air flow patterns in the office area using smoke tubes or similar devices; and
- Any other pertinent information including spills, floor stains or odors.

The field records will also note the following information concerning the sample collection:

- Sample ID;
- Date and time of collection;
- Sampling depth;
- Names of sampling team;
- Sampling methods and devices utilized;
- Soil vapor purge volumes and flow rates; and
- Vacuum of Summa canisters before and after collection.

[1] SSV-3 is shown in a location near the hangar wall to be away from active hangar floor space.

In parallel with sub-slab samples, indoor air samples will be collected into Summa canisters set to collect samples over eight hours from the office where sub-slab vapor probe SSV-1 is located, the reception desk near SSV-2, the lounge near SSV-2, and in the hangar bay near SSV-3 (refer to **Figure 2**). Summa canisters will be set on tables, desks, or cabinets to approximate the breathing zone.

Additionally, one outdoor air sample will be collected into a Summa canister set to collect the sample over eight hours outside the office area for this event (refer to **Figure 2**).

Standard Operating Procedures for sample collection are included in **Appendix B**.

1.5 Sample Analysis

Samples will be collected in Summa canisters supplied by the analytical laboratory and certified to be clean. Canisters will be sized to meet air sampling detection limits of 0.25 micrograms per cubic meter (ug/m^3) for TCE and Vinyl Chloride in indoor and outdoor air samples and 5 ug/m^3 for TCE and Vinyl Chloride in sub-slab soil vapor samples. Once the samples have been collected, they will be transported to the analytical laboratory under standard chain of custody procedures. The Summa canisters will be analyzed for the site compounds in **Section 1.2** via EPA Method TO-15 by an Environmental Laboratory Approval Program (ELAP) certified analytical laboratory.

2.0 Report

The NYSDOH Guidance provides matrices for use in determining if vapor sampling results warrant additional sampling, continued monitoring, or mitigation. These matrices are based on a combination of analytical results from sub-slab vapor and indoor air to make this determination. Woodard & Curran will use the analytical results of the sub-slab, indoor and outdoor air sampling to evaluate the need and/or options for the SVE system based on present, static conditions at this site and prepare a report that presents a detailed description of the undertakings and recommendations for further actions. The report will include site diagrams showing sampling locations and key building features, data tables, and laboratory analytical reports. Dependent upon sample results, the SVE system will either be re-started with the replacement blower in accordance with **Section 1.1** or the trial shut-down will continue for an additional six month period.

3.0 Schedule

Time Frame	Task
September 17, 2013	SVE system found shut-down during routine maintenance visit
On or About November 15, 2013 (Trial Shut-Down Approximately 60 days)	Conduct Building Survey, Product Inventory, Indoor Air, Outdoor Air and Soil Vapor Sampling Install replacement SVE blower
Upon Receipt of Laboratory Results	Provide Preliminary Laboratory Data to NYSDEC and NYSDOH
Within 60 days of Receipt of Sample Results	Submit Report to NYSDEC and NYSDOH

On behalf of ExxonMobil, we again want to express our appreciation for the time and assistance offered by all parties. Once this work plan is approved, implemented, and the results are available, it is ExxonMobil's intention to submit a Site Management Plan for review and approval in accordance with NYSDEC and NYSDOH comments on the 2013 Petition.

Please contact the undersigned if we can respond to any questions or comments, or if you require any additional information for approval of this revised work plan.

Sincerely,

WOODARD & CURRAN, INC.

Anne E. Proctor, PE
Principal Project Manager

Enclosures:
Table 1: Sub-slab Soil Vapor Sample Results
Figure 1: Site Location Map
Figure 2: Site Map
Appendix A: Chronology of Soil Vapor Investigations
Appendix B: Standard Operating Procedures

Copy:
N. Walz – NYSDOH (electronic copy)
N. van Dyke – Quantum
J. Inserra – WCA
E. Faulkner – Landmark Aviation
M. DeGloria – GES (electronic copy)

TABLE 1

Sub-slab Soil Vapor Sample Results
Hangar D, Westchester County Airport

Chemicals of Concern	Sample Point SSV-1					Sample Point SSV-2				
	Feb-06	Nov-06	Nov-07	Mar-08	Dec-08	Feb-06	Nov-06	Nov-07	Mar-08	Dec-08
Chloroethane	<0.53	<0.53	<4.2	<0.42	<0.88	<4.2	<2.6	<4.2	<0.42	<0.52
1,1-Dichloroethane	<0.81	<0.81	<6.5	<0.64	<1.4	<6.5	<4	<6.5	<0.64	<0.79
1,1-Dichloroethylene	<0.79	<0.79	<6.3	<0.63	<1.3	<6.3	<4	<6.3	<0.63	<0.78
cis-1,2-Dichloroethylene	<0.79	<0.79	<6.3	<0.63	<1.3	<6.3	<4	<6.3	<0.63	<0.78
trans-1,2-Dichloroethylene	<0.79	<0.79	<6.3	<0.63	<1.3	<6.3	<4	<6.3	<0.63	<0.78
1,1,1-Trichloroethane	<1.1	**2.7**	<8.7	<0.86	<1.8	**3.2 J**	**2.9 J**	<8.7	<0.86	**3.4**
Tetrachloroethylene	**1.3 J**	**11**	<11	**1.3**	**14**	**33**	**59**	**52**	**3.9**	**3.9**
Trichloroethylene	<1.1	**9.1**	<8.6	**15**	**1.2**	<8.6	**7**	<8.6	**28**	**3.4**
Vinyl chloride	<0.51	<0.51	<4.1	**0.039 J**	<0.086	<4.1	<2.6	<4.1	<0.040	<0.050

All results are in micrograms per cubic meter.
2008 Soil Vapor Samples were analyzed by Air Toxics. All other samples analyzed by Accutest.
2008 Soil Vapor Samples were collected over 8 hours. All other samples collected over 4 hours.
J = Estimated below the detection limit. E = Estimated over the detection limit.
Detections are in bold type.

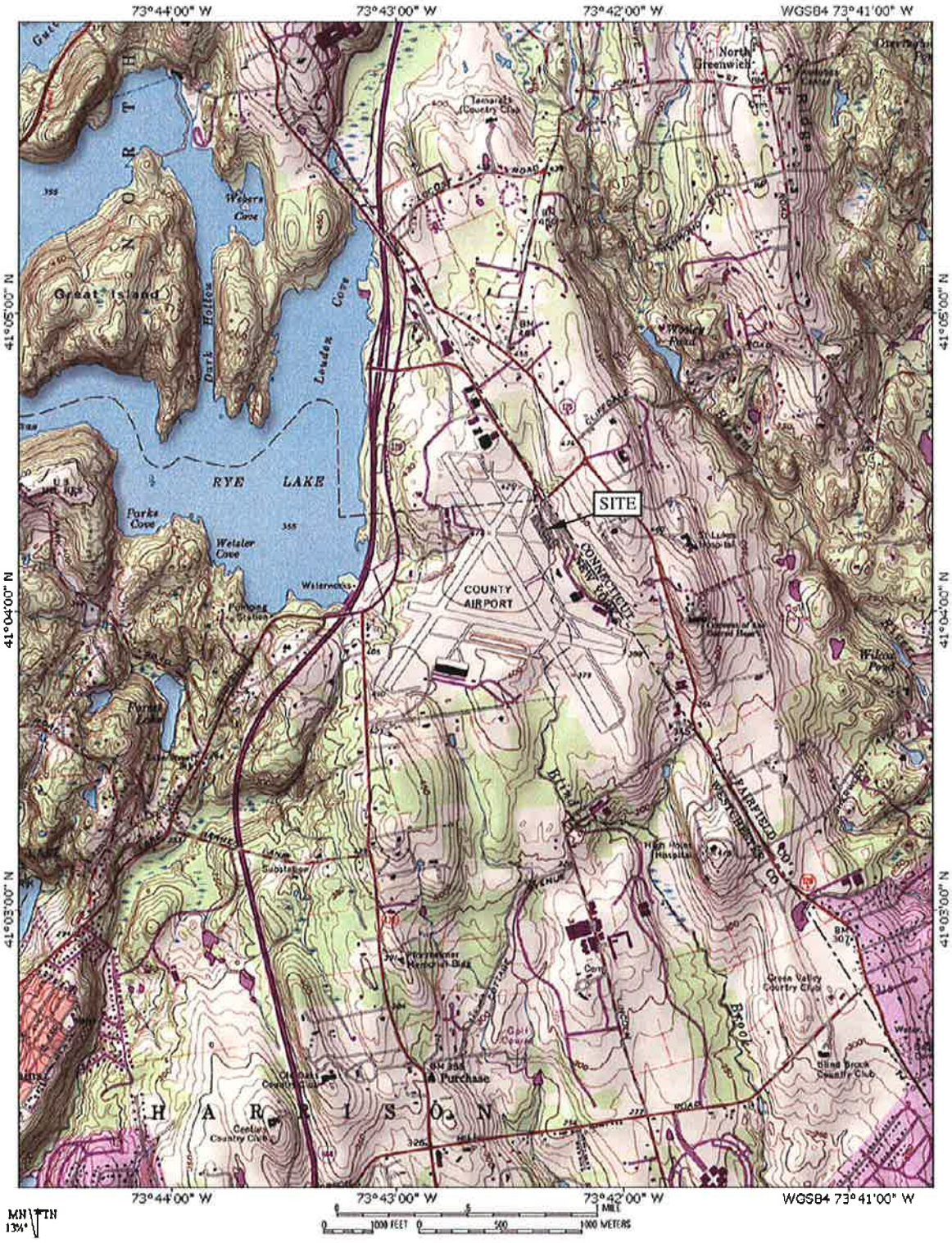
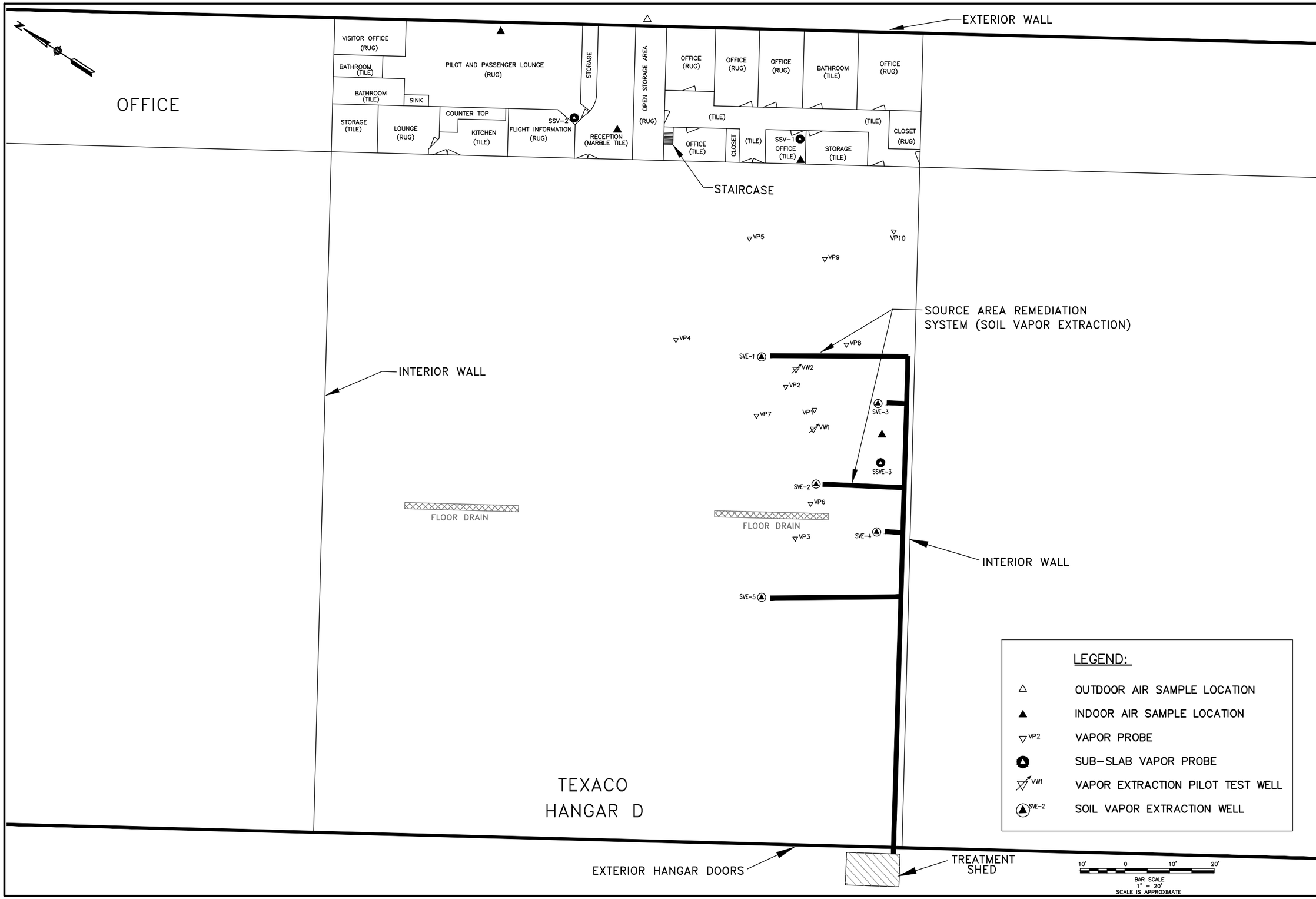


FIGURE 1
SITE LOCUS

Hangar D, Westchester County Airport
White Plains, New York



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SITE PLAN

DESIGNED BY: AP
DRAWN BY: SH/PFF
CHECKED BY: AP
206565_U2 SITE 10-13.dwg

WESTCHESTER COUNTY AIRPORT
HANGAR D

SOIL VAPOR
SAMPLING LOCATIONS

JOB NO: 206824
DATE: OCTOBER 2013
SCALE: 1"= 20'

FIGURE 2

Appendix A
Chronology of Soil Vapor Investigations
Hangar D1 Bay 1B, Westchester County Airport, New York
Rev. 5, November 2013

1991	January	Soil Gas Survey (Target Environmental Services) - 19 locations at 2 feet deep - Primary COCs: 1,1,1-TCA, PCE, 1,1-DCA and 1,1-DCE
	April	Soil Vapor Extraction Pilot Test (Vapex Environmental Technologies)
1997	July, Dec.	Soil Vapor Probes VP-1 through VP-10 and vapor extraction wells VW-1 and VW-2 were sampled in July and December (Xpert Design & Diagnostics) - 17 locations at 1.5 to 9 feet deep - Primary COCs: : 1,1,1-TCA, PCE, 1,1-DCA and 1,1-DCE
2001	April	Potassium Permanganate Applications in the vicinity of well MW-01 and MW-02
2004	February	SVE System Start-up
	September	Potassium Permanganate Applications in the vicinity of well MW-01 and MW-02
2005	January	NYSDEC faxed November 16, 2004 letter from NYSDOH: - Expressed concern over suspending operation of the SVE system during Potassium Permanganate Application. - Requested sampling plan for review to evaluate the potential for vapor intrusion and subsequent human exposures within the office spaces based on review of historic data. Response to Nov. 16, 2004 NYSDOH letter sent to NYSDEC: - Reason for suspending operation SVE system explained. - Migration pathways discussed: remedial efforts, groundwater flow, indoor sources
	February	*Draft Guidance for Evaluating Soil Vapor Intrusion in the State of New York* posted on the NYSDOH website for public comment.
	March	NYSDEC faxed February 8, 2005 letter from NYSDOH: - Cited 1997 vapor data as evidence of plume under slab - Concern over limited influence of the SVE system - Migration pathways discussed: VOCs in groundwater, coarse material under slab, measures to isolate indoor sources of VOCs during sampling - Requested Soil Vapor Investigation Plan for state review
	April	Vapor samples were collected to update the 1997 vapor data and sub-slab vapor pressure monitoring was expanded to update SVE operating parameters cited in the Feb. 8, 2005 NYDSOH letter.

		ExxonMobil submitted comments on the *Draft Guidance for Evaluating Soil Vapor Intrusion in the State of New York* to the NYSDOH
	May	Woodard & Curran submitted comments on the *Draft Guidance for Evaluating Soil Vapor Intrusion in the State of New York* to the NYSDOH
	June	Response to Feb. 8, 2005 NYDSOH letter sent to NYSDEC: Data from the April monitoring event provided: - Vapor concentrations have decreased 2-3 orders of magnitude since 1997 - SVE system radius of influence is upwards of 50 feet under actual operating conditions - Migration pathways discussed: remedial activities reiterated, sampling conducted specific to soil vapor NYSDEC faxed June 23, 2005 letter from NYSDOH reiterating request for Soil Vapor Investigation Work Plan for state review - Problems with April event: samples not sub-slab, SVE system operating, not during the heating season, not at the office area, high analytical detection limits, not enough details (methods, tracer compounds, weather conditions) - Referenced *Draft Guidance for Evaluating Soil vapor Intrusion in New York State* - Levels of VOCs in soil vapor indicate the need to further evaluate vapor intrusion. Options are to either conduct sampling and monitoring or provide a sub-slab depressurization system.
	July	Meeting with NYSDEC, NYSDOH and ExxonMobil on July 19, 2005
	September	Submit Soil Vapor Investigation Work Plan dated Sept. 30, 2005
	October	NYSDEC approves Sept. 2005 Work Plan incorporating NYSDOH comments in letter dated Oct. 5, 2005
2006	February	Install sub-slab soil vapor sampling probes (SSV-1 and SSV-2) and conduct sub-slab soil vapor sampling event on Feb. 21 and 22, 2006 *Note: The SVE system was in operation.*
	April	Issue soil vapor investigation report dated April 20, 2006 Receive comments from NYSDEC in electronic mail of April 24, 2006
	May	Respond to NYSDEC comments via electronic mail on May 4, 2006 Proposed to conduct a second soil vapor sampling event.

Appendix A
Chronology of Soil Vapor Investigations
Hangar D1 Bay 1B, Westchester County Airport, New York
Rev. 5, November 2013

November		The SVE system was off upon arrival for the November monthly field visit. The blower had failed and needed to be replaced. With the system off, soil vapor samples were collected in the vicinity of the SVE system area to support system remedial data.
		Soil vapor sampling event, including sub-slab and soil vapor samples, conducted Nov. 27 and 28, 2006 *Note: The SVE system was <u>not</u> in operation.*
2007	March	Issue soil vapor investigation report dated March 16, 2007 Proposed to conduct a third soil vapor sampling event in November 2007. SVE system restarted on March 23, 2007.
	April	Receive comments from NYSDEC of April 6, 2007
	May	Respond to NYSDEC comments on May 23, 2007
	November	Conference call between ExxonMobil, NYSDEC and NYSDOH to discuss the pending sampling event. Following a pre-sampling product inventory on November 16, ExxonMobil agreed to conduct indoor and outdoor air sampling in conjunction with sub-slab soil vapor sampling, confirmed by electronic mail on November 25, 2007. The NYSDOH responded on November 28, one day in advance of the sampling event that the indoor air samples needed to be collected over eight (8) hours and analyzed with a detection limit of 0.25 mcg/m3 for TCE and VC. The sampling event proceeded with the summa canisters in-hand, ordered with 4-hour regulators, and the indoor air samples were sub-contracted to a lab that could meet the specified detection limit.
		Soil vapor sampling event, including sub-slab vapor samples, indoor air and outdoor air, conducted Nov. 29, 2007
2008	January	Preliminary results from the November sampling event were provided in the Oct.-Dec. 2007 Progress Report. The results were inconclusive and another sampling event was proposed with sub-slab vapor samples and indoor air samples collected over eight hours and to have all samples analyzed with the specified detection limit for TCE and VC.
	February	Receive comments from NYSDEC of February 1, 2008. Respond to NYSDEC comments on February 6, 2008 confirming sampling plan.
	March	Soil vapor sampling event, including sub-slab vapor samples and indoor air, conducted March 28, 2008.
	June	Issue soil vapor investigation report dated June 25, 2008. Proposed to conduct a vapor sampling event around November 2008.

Appendix A
Chronology of Soil Vapor Investigations
Hangar D1 Bay 1B, Westchester County Airport, New York
Rev. 5, November 2013

	November	Regular office personnel for the hangar operator, Landmark Aviation, moved out of Hangar D1 Bay 1B in November 2008. Vapor sampling event schedule for December 2008 after the move.
	Nov., Dec.	Investigation and Potassium Permanganate Application in the vicinity of well MW-01.
	December	Vapor sampling event, including sub-slab vapor samples and indoor air, conducted December 19, 2008. Hangar D1 Bay 1B office area still occupied infrequently by passengers and flight crew members.
2009	February	Issue soil vapor investigation report dated February 5, 2009.
	March	NYSDEC letter issued delaying further soil vapor investigation until SVE system is taken off-line.
2011	June	Investigation upgradient of Hangar D1 Bay 1B.
2012	June	Investigation in Hangar D1 Bay 1A.
2013	April	Submit Petition to Reclassify Hangar D1 Bay 1B.
	July	NYSDEC technical review denying petition.
	September	Meeting with NYSDEC and NYSDOH to discuss technical review of petition.

APPENDIX B

STANDARD OPERATING PROCEDURE FOR THE COLLECTION OF SUB-SLAB VAPOR, INDOOR AIR, AND AMBIENT AIR SAMPLES USING SUMMA CANISTERS

1.0. SCOPE AND APPLICATION

1.1 This Standard Operating Procedure (SOP) describes procedures for obtaining sub-atmospheric time integrated sub-slab vapor, indoor air, and ambient air samples for the analysis of volatile organic compounds (VOCs) by United States Environmental Protection Agency (USEPA) Method TO-15 (TO-15).

1.2 Although the specific procedures recommended in this SOP are not mandatory, adequate quality control measures must be instituted in all cases to ensure and document the integrity of collected samples. These measures must include, at a minimum, steps that provide assurance of the original cleanliness and non-contamination of sample containers and any hardware touching the sample, the assurance of accurate flow measurements and sample volumes and the assurance that a sample as delivered for analysis is not altered physically or chemically from when it was taken in the field.

1.3 This SOP is based upon the U.S. Environmental Protection Agency (USEPA) Region 1 Laboratory's "Standard Operating Procedure – Sampling Volatile Organic Compounds Using SUMMA Polished Stainless Steel Canisters" and the October 2006 New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York.

2.0 SUB-ATMOSPHERIC TIME-INTEGRATED CANISTER SAMPLES (For Indoor Air and Ambient Air Samples)

2.1 Equipment

2.1.1 Sample Inlet Line - Chromatographic-grade stainless steel tubing.

2.1.2 Sample Canister(s) - Certified clean and leak free 6-liter[1] stainless steel SUMMA® polished or silica lined passivated air sampling canisters.

2.1.3 Vacuum/Pressure Gauge – Configured with appropriate fitting to attach to canister to measure vacuum before and pressure (or vacuum) after the sampling event.

2.1.4 Particulate Matter Filter – 7 micrometer pore size in-line stainless steel filter to be attached to sample inlet line.

2.1.5 Fixed Rate Flow Controller – Fixed orifice flow controller capable of reliably controlling flow rate under vacuum (-30 inches Hg [0 mm Hg] to -5 inches Hg [633 mm Hg)]) and under flow rates of at least 3.5 cubic centimeters per minute over a 24 hour period.

[1] Ensure canister is sized to meet air sampling detection limits and modify procedure accordingly if needed.

2.1.6 Calibrated Flow Measuring Device – Mass flowmeter or calibrated rotameter accurate in the 0 to 100 cubic centimeters per minute range.

2.2 Flow Measurement

2.2.1 Average flow rate throughout the sampling event can be determined using the following equation

$$F = (P)(V)/T$$

where:

F = average flow rate (cubic centimeters [cc]/minute)

P = final canister pressure in atmospheres absolute (maximum 0.83 for sub-atmospheric sample)

V = Canister Volume (cc); [6 Liter Canister = 6000 cc]

T = Time (minutes)

and where:

P = - 30 in - Final Vacuum (in Hg) / -30 in - for subambient samples

P = Gauge Pressure (psig) + 14.7 psia / 14.7 psia - for pressurized samples

P = Final Pressure (mm Hg) / 760 mm Hg - for either type

2.2.2 Flow rate measurements must be made before and after the sampling event (and during if necessary) to verify that the average flow rate is consistent throughout the sampling interval.

2.2.3 Target flow rates for sub-atmospheric time-integrated samples should be projected and set based on an initial canister vacuum of –30 inches Hg and a final vacuum of -5 inches Hg. The residual vacuum is required to provide a flow driving force until the end of the sampling event.

2.2.4 The following are target flow rates for several event times using a 6 liter canister as calculated from the formula above.

2 Hours = 41.7 cc/min

8 Hours = 10.4 cc/min

24 Hours = 3.5 cc/min

2.2.5 Adjustable mechanical flow controllers are not likely to be stable below 10 cc/minute. Fixed orifice or low range electronic mass flow controllers would perform better for this application. Fifteen (15) liter stainless steel canisters allow higher flow rates and may be preferable for longer sampling events.

2.2.6 Flow controllers should be functionally checked and calibrated with a certified flow measuring device prior to the sampling event and rechecked in the same manner after the event. Flow rates are checked before and after sampling events using non-project

evacuated canisters. Periodic flow rate checks (minimally once per hour) should be made using a non-contaminating certified rotameter or mass flowmeter during the sampling event when adjustable mechanical flow controllers are used. These measurements should be recorded and the flow rate should be adjusted up to the original set point if a significant drop is observed.

2.3 Sub-atmospheric Time-Integrated Sampling Procedures

2.3.1 Collect time-integrated samples from the breathing zone(s) of potentially impacted structures, or in a manner otherwise consistent with sampling and data quality objectives.

2.3.2 To start the sampling event:

2.3.2.1 Note canister and flow controller serial number on chain of custody.

2.3.2.2 Properly site the canister and verify the vacuum (–30 inches Hg or 0 mm Hg) with a vacuum gauge.

2.3.2.3 Attach the flow controller device (with filter in line), open the canister bellows valve and note the start time. Start co-located canisters at the same time if possible. Immediately check the flow rate and adjust to set point, if necessary. Note the initial flow rate.

2.3.3 To complete the sampling event:

2.3.3.1 Check and note the final flow rate. Close canister bellows valve and note the final time.

2.3.3.2 Note final vacuum on chain of custody.

2.3.3.3 Detach the flow controller and check the remaining vacuum with the gauge. Vacuum and flow rate should be observed at the end of the event. Ambient pressure (0 psig or 760 mm Hg) indicates an excessively high flow rate set point or a leak. This observation compromises the time - integrated aspect of the sample.

2.3.4 If an automatic timer (with an electronic solenoid) is employed to time the sampling event (i.e., unattended operations), all procedures above are valid. However, extra care must be taken to ensure the accuracy of the average flow rate during the event and that the event occurred during the designated time. An elapsed time recorder/indicator should be employed with such a set up.

2.3.5 All sub-ambient pressure canister samples should be pressurized to at least 5 psig (1020 mm Hg) with humidified clean nitrogen or ultra zero air for analysis. The initial and final pressures associated with this procedure must be accurately measured and documented so that the dilution effect can be adequately compensated for during final concentration calculations.

3.0 SUB-ATMOSPHERIC TIME-INTEGRATED CANISTER SAMPLES (For Sub-Slab Vapor Samples)

3.1 Equipment

3.1.1 Sample Inlet Line - Chromatographic-grade stainless steel tubing.

3.1.2 Sample Canister(s) - Certified clean and leak free 6-liter stainless steel SUMMA® polished or silica lined passivated air sampling canisters.

3.1.3 Vacuum/Pressure Gauge – Configured with appropriate fitting to attach to canister to measure vacuum before and pressure (or vacuum) after the sampling event.

3.1.4 Particulate Matter Filter – 5 micrometer pore size in-line stainless steel filter to be attached to sample inlet line.

3.1.5 Fixed Rate Flow Controller – Fixed orifice flow controller capable of reliably controlling flow rate under vacuum (-30 inches Hg [0 mm Hg] to -5 inches Hg [633 mm Hg)]) and under flow rates under 0.2 liters per minute.

3.1.6 Portable vacuum pump capable of producing low flow rates (e.g., 100 to 200 mL/min) with flow gauge.

3.1.7 Photoionization detector (PID) ppbRAE unit or equal.

3.1.8 Tracer gas (helium).

3.1.9 Tracer gas portable monitor.

3.2 Sub-Slab Vapor Sampling Procedure

3.2.1 Prior to sample collection, at a minimum, three (3) sampling train volumes of soil vapor will be purged prior to sample collection using the portable pump at a rate of approximately 100 mL/min. During purging, elapsed time and purge flow rate will be recorded in the field logbook.

3.3.2 Temperature, barometric pressure, weather conditions, and depth to groundwater (measured in nearby monitoring wells, if available) will also be recorded in the field logbook.

3.3.3 Periodic total VOC readings of the purged soil vapor will be measured in the field using a PID. The periodic PID readings will be obtained from the effluent side of the vacuum pump and recorded in the field logbook.

3.3.4 Following purging, a sample of vapor will be collected using a dedicated 6-liter SUMMA canister. The canister vacuum will be used to “pull” the soil vapor sample into the canister. The vacuum pump assembly will be disconnected from the dedicated tubing and the canister will be connected in its place for sample collection.

3.3.5 After collection of the sample, cap tubing and replace flush-mount cover.

3.3.6 The field sampling team will maintain a sub-slab vapor sample collection log sheet for each sample summarizing the following:

Sample identification (location);

Date and time of sample collection;

Identity of samplers;

Sampling methods and devices;

Purge volumes;

Volume of soil vapor extracted;

Vacuum before and after samples were collected;

Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone; and

Chain of custody protocols and records.

4.0 ADDITIONAL QUALITY CONTROL PROCEDURES

4.1 Care should be taken to separate each sampling zone while sampling is occurring (e.g., keep doors between floors shut).

4.2 Carefully note conditions under which the sample is taken which might affect the interpretation of the results including unusual weather conditions, air temperature, current building ventilation status and the presence of petroleum related products on site.

4.3 Tracer gas (helium) will be used as a QA/QC measure to verify the integrity of the sub-slab vapor seal. The atmosphere in the immediate vicinity of the area where the tubing intersects the slab will be enriched with the tracer gas and a vapor sample will be collected from the sub-slab for the presence of high concentrations (>10%) of the tracer gas. A plastic container will be placed over the tubing and will be used to keep the tracer gas in contact with the tubing during the testing. A portable monitoring device (detection limits in the low ppm range) will be used to field screen sub-slab vapor for the tracer gas prior to and after sampling for the compounds of concern. If concentrations (>10%) of tracer gas are observed in a sample, then the seal will be enhanced to reduce the infiltration of air.

4.4 The PID used in the survey will be calibrated at the beginning and end of each day according to the calibration procedures outlined in the project QAPP.

4.5 Sampling equipment and laboratory SUMMA canisters will be visually inspected for integrity prior to sample collection.

4.6 Prior to sampling, it will be verified that the Summa canister is evacuated (between 25" to 30" Hg) and the initial vacuum will be recorded on the Chain-of-Custody. The verification procedure will consist of:

- Verify that the canister valve is closed.
- Remove the brass plug and attach the vacuum gauge tightly.
- Open and close the canister valve; the gauge will register the level of vacuum present.

- Verify that the canister valve is closed, remove the gauge and replace the brass plug. If the canister vacuum is less than 25" Hg, do not use the canister.

4.7 Prior to sampling, all connections in the sampling train will be checked to ensure that they are tight, in order to avoid leaks that may dilute the sample.

4.8 The brass plug which comes with each canister shall be removed prior to sampling and reinstalled following sample collection. This ensures that there is no loss of vacuum due to a valve accidentally being opened during packing and unpacking and also prevents dust and other particulate material from fouling the valve.

4.9 Each canister will be equipped with a particulate filter, which prevents particulate from entering the canister during sampling. The filter will always be used during soil vapor sampling.

4.10 During sample collection, all relevant information, including atmospheric conditions (i.e., temperature, barometric pressure, humidity, etc.) will be recorded in a field logbook.

4.11 All canisters will be labeled with a unique sample identification number, the date and time of sample collection, and the parameters to be analyzed.

4.12 Chain-of-custody records will be maintained for all samples.

4.13 Upon completion of sample collection, final vacuum in the canister should be between 2 and 5 inches of Hg. Record the final canister vacuum on the Chain-of-Custody. The vacuum gauge can also be used to monitor the filling of the canister during sample collection.

5.0 REFERENCES

Guidance for Evaluating Soil Vapor Intrusion in the State of New York, New York State Department of Health (NYSDOH), Center for Environmental Health, Bureau of Environmental Exposure Investigation, October 2006.

Standard Operating Procedure Sampling Volatile Organic Compounds Using SUMMA Polished Stainless Steel Canisters, EPA-REG1-ESD/CAN-SAM-SOP, March 1994.