FILE ON EDOC'S _____ YES _____ NO

SITE NAME _____

SITE # _____

COUNTY _____ TOWN _____

FOILABLE _____ YES _____ NO

SC/PSA _____ RI/FS _____

RD _____ RA _____

SM _____ OTHER _____

NAME DESCRIPTION:

Report. HW130004_2007-03-5. SVI_workplan

ARCADIS BBL
Infrastructure, environment, facilities

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ENVIRONMENT

Ms. Alicia Barraza
New York State Department of Environmental Conservation
Division of Solid & Hazardous Materials
Bureau of Solid Waste and Corrective Action
625 Broadway
Albany, New York 12233-7258

Subject:
Bayer MaterialScience LLC
125 New South Road
Hicksville, New York
USEPA ID#: NYD002920312
Site-Wide Soil Vapor Investigation

Date:
March 15, 2007

Contact:
John C. Brussel, PE

Phone:
315.671.9441

Email:
John.Brussel@arcadis-us.com

Our ref:
2253.32305 #5

Dear Ms. Barraza:

On behalf of Bayer MaterialScience LLC (Bayer), this letter presents a work plan for a site-wide soil vapor investigation at the above-referenced site. This work plan has been prepared as requested by the New York State Department of Environmental Conservation (NYSDEC) in a letter dated June 2, 2006. Pursuant to Bayer's response in a June 9, 2006 letter from ARCADIS BBL and as agreed by the NYSDEC on July 7, 2006, preparation of this work plan was deferred until the extent of impacted soils in the former Plant 1 area, which were discovered following removal of the concrete floor slabs in this area, could be more fully delineated and an approach to address the impacted soils was determined.

Volatile organic compound- (VOC-) impacted soils in the Plant 1 area were delineated by sampling activities performed in 2006 (the "Phase I through III" pre-design sampling activities, as discussed below). Polychlorinated biphenyl- (PCB-) impacted soils in the Plant 1 area continue to be delineated (a work plan for Phase VI sampling activities has been submitted for NYSDEC approval). Bayer originally anticipated that the PCB- and VOC-impacted soils would be addressed concurrently via an interim corrective measure (ICM) and that soil vapor sampling would be performed after the impacted soils were addressed. However, based on the need for additional PCB delineation soil sampling and as agreed by the NYSDEC during a January 29, 2007 meeting, the PCB- and VOC-impacted soils will be addressed via final corrective measures to be evaluated in the upcoming Corrective Measures Study (CMS). Soil vapor sampling will be performed in advance of the CMS to provide a preliminary evaluation of soil vapor conditions outside the VOC-impacted

soil area and to provide data for use in evaluating final vapor intrusion mitigation measures as part of the CMS (if necessary).

Relevant background information related to the proposed soil vapor investigation, including a summary of previous VOC soil and soil vapor sampling, is presented below followed by a discussion of the proposed additional soil vapor sampling activities.

I. BACKGROUND

VOC soil vapor sampling activities were previously performed at the site as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation (RI) in 1989. VOC soil sampling was performed most recently, as part of the two-phase Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) in 2004, an ICM in 2005, and Phase I through Phase III pre-design sampling activities in 2006. These sampling activities and results are briefly summarized below.

Summary of Previous VOC Soil Vapor Sampling

Soil vapor samples were collected during the CERCLA RI at 55 locations that provided coverage across the site, except for areas covered by pavement or buildings at the time. Soil vapor field screening was performed using a photoionization detector (PID) and confirmatory soil vapor analysis for site-related VOCs, including trichlorethene (TCE), tetrachloroethene (PCE), trans-1,2-dichloroethylene, and vinyl chloride monomer, was performed using portable gas chromatography. Based on the analytical results, PCE was the only VOC identified in the soil vapor samples. PCE was detected at only two soil vapor sampling locations – one location southeast of Plant 1 and one location northwest of Plant 2. However, the detection limits were higher than those that can be achieved using current analytical methods, and improvements to soil vapor sampling methodologies have been made since 1989.

Details of the previous soil vapor sampling are presented in the *Remedial Investigation Report* (Leggette, Brashears & Graham, Inc., Revised August 1992). Sections of the report related to the previous soil vapor sampling, including applicable tables and a figure, were provided to the NYSDEC in e-mail correspondence from ARCADIS BBL dated July 11, 2006. The soil gas summary was subsequently reviewed by the New York State Department of Health

(NYSDOH), and comments were forwarded to Bayer in a January 22, 2007 letter from the NYSDEC. These comments have been considered in preparing this work plan.

Summary of Previous VOC Soil Sampling

Soil samples from over 150 locations have been analyzed for VOCs since the start of the RFI in February 2004. The VOC soil sampling locations and color-coded analytical results (concentration ranges) are shown on Figure 1. Details of the VOC soil sampling programs are included in the following documents, which have been approved by the NYSDEC:

- *RCRA Facility Investigation Report* (ARCADIS BBL, June 2004).
- Phase II RFI Report contained in a letter from ARCADIS BBL to the NYSDEC dated January 5, 2005.
- *Interim Corrective Measure Certification Report* (ARCADIS BBL, November 2005).
- Phase IV Sampling Plan contained in a letter from ARCADIS BBL to the NYSDEC dated July 6, 2006.

A total of 19 individual VOC constituents have been detected in the soil samples collected as part of the 2004 RFI, the 2005 ICM, and the 2006 Phase I through Phase III pre-design soil sampling activities. However, outside the Plant 1 area, no VOCs other than acetone (a common laboratory artifact) were detected in soils at concentrations exceeding the soil guidance values presented in the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) titled "Determination of Soil Cleanup Objectives and Cleanup Levels," HWR-94-4046, dated January 24, 1994 (TAGM 4046). Nine VOCs were identified in the Plant 1 area soils at concentrations exceeding the TAGM 4046 soil guidance values. These VOCs include acetone, 2-butanone, methylene chloride, 4-methyl-2-pentanone, PCE, trans-1,2-DCE, TCE, vinyl chloride, and xylenes. The VOC-impacted soils in the Plant 1 area are currently covered with polyethylene sheeting to minimize infiltration and release of VOCs to ambient air. These soils will be addressed via a final corrective measure to be determined during the CMS.

Based on the identification of VOC-impacted soils beneath the former Plant 1 floor slab and the elevated detection limits for the soil vapor sampling performed during the RI, site-wide soil vapor sampling will be performed, as discussed below.

II. PROPOSED SOIL VAPOR SAMPLING

As part of the proposed soil vapor investigation, soil vapor samples will be collected at 13 sampling locations (locations SG-1 through SG-13, as shown on Figure 1). The proposed sampling locations have been selected to provide coverage across the site, including in areas where building construction is planned during site redevelopment, within/near the footprints of the former plant buildings, and in various paved areas. A proposed soil gas sampling summary, which identifies each soil gas sampling location and sampling rationale, is presented in the table below.

Sample ID	Sampling Location	Sampling Rationale
Locations Within Proposed New Building Footprint		
SG-1	Immediately Northeast of the Former Plant 1 Building	To evaluate potential "worst-case" conditions beneath the planned future onsite building (i.e., near the existing VOC-impacted soil area)
SG-2	Between the Former Plant 1 and Plant 2 Buildings	To evaluate potential soil vapor migration from the VOC-impacted soil area and potential conditions beneath the planned future onsite building
SG-3	West of the Former Plant 2 Building	To evaluate potential conditions beneath the planned future onsite building
SG-4	Within the Footprint of the Former Plant 3 Building	
Locations Outside Proposed New Building Footprint		
SG-5	Along the Southern Property Boundary	To evaluate potential soil vapor migration and conditions along the property boundary
SG-6		
SG-7		
SG-8	Along the Eastern Property Boundary	To evaluate potential soil vapor migration and conditions near the existing and former rainwater runoff sumps/recharge basins at the property boundary
SG-9		
SG-10		
SG-11		

Sample ID	Sampling Location	Sampling Rationale
SG-12	Along the Northern Property Boundary	To evaluate potential conditions along the property boundary
SG-13		

Before the soil vapor sampling begins, an ARCADIS BBL field survey crew will field-identify the proposed sampling locations using coordinates obtained from the sampling locations map. The sampling locations will be adjusted in the field, if needed, for equipment access. Each proposed final sampling location will then be surveyed and marked using a flagged, wooden stake. The methods for collecting soil vapor and ambient air samples are detailed in the Standard Operating Procedures (SOPs) provided in Attachments 1 and 2, respectively. The NYSDOH's October 2006 Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH Guidance Document) was considered in the development of these SOPs. In accordance with the NYSDOH's guidance, samples will be collected at depths greater than 5 feet below the ground surface (bgs) to reduce the likelihood of atmospheric air being introduced into the samples. Sample collection is proposed for the 5 to 5.5 foot interval bgs at each location, which is consistent with the proposed depth of foundation footings during site redevelopment. The sampling interval will be limited to approximately 6-inches to reduce potential sample dilution that could otherwise occur across a larger interval. Vertical profile sampling is not proposed because, as observed during completion of the RFI soil borings, subsurface soil conditions at the site are relatively uniform and potential confining layers are not apparent.

As part of the soil vapor investigation, a direct-push (i.e., Geoprobe® rig) will be used to collect soil samples continuously to a depth of approximately 5.5 feet deep at a distance of approximately 5 feet from each proposed soil vapor sampling point. Soils removed from the boring will be characterized for color, texture, moisture, density, cohesion, plasticity and indication (if any) of staining or obvious odor. The proposed sampling plan may be adjusted, as appropriate (with concurrence from Bayer and the NYSDEC) based on the soil conditions encountered. Digital photos will be taken to document soil conditions and subsequent soil gas probe installation. The soil borings will be backfilled with bentonite grout prior to installation of the adjacent temporary soil vapor sampling probes.

At each proposed soil vapor sampling location, the Geoprobe® rig will be used to advance an assembly consisting of interconnected 4-foot lengths of 1.25"-diameter steel probe rod, affixed with an expendable point holder and expendable point at the

downhole end, to the desired sampling depth (5.5 feet bgs). Bentonite will be used to seal the annular space (if any) between the steel rod and borehole wall to isolate the subsurface interval from the atmospheric air. After the target depth is reached, the expendable point will be disengaged by hydraulically retracting the steel probe rods upwards approximately 0.5-feet to create a void in the subsurface soil for soil vapor collection. A high-density polyethylene (HDPE) or fluoropolymer sample delivery tube (3/16" or 1/4" inside diameter) with an attached Post-Run-Tubing (PRT) threaded adapter will be lowered through the 1.25"-diameter steel rod and threaded into the expendable point holder.

An initial gas draw (purging) will be performed prior to sampling to remove atmospheric gas from the system and charge the sampling apparatus with soil vapor in preparation for collection of a representative sample (as discussed below). At the ground surface, the sample delivery tube will be attached to an air sampling pump, and a minimum of one volume will be evacuated from the sampling system. An electronic flow sensor will be used to measure pump flow rate (not to exceed 100 milliliters per minute [mL/min] during purging activities), and the desired volume will be purged based on pumping duration. After one full purge volume (equivalent to 1½ times the volume inside the sampling line) has been expelled from the sampling system, the pump will be disconnected and a PID equipped with a 10.6 electron volt lamp will be attached to the tubing to measure approximate total organic vapor levels. A swagelock valve will be closed prior to disconnecting the pump and connecting the PID to prevent atmospheric air from entering the tubing.

Sample collection and analysis will be conducted in accordance with USEPA Compendium Method TO-15, titled "Determination of VOCs In Air Collected In Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)." At each sampling location, a pre-cleaned stainless-steel canister (a 6-liter SUMMA® canister) with an attached flow regulator will be connected to the sample tubing and slowly opened to collect the soil vapor sample. Batch-certified-clean canisters will be provided by the laboratory with an initial vacuum of at least 26 inches of mercury (in. of Hg). Flow regulators will be pre-set to draw soil vapor at a flow rate of 200 mL/min. Each soil vapor sample will be collected over an approximately 30 minute period. When the canister vacuum reaches approximately 2 in. of Hg, the valve on the canister will be closed, leaving a vacuum in the canister as a means for the laboratory to verify the canister does not leak while in transit. Four sets of vacuum readings will be obtained in connection with sampling and analysis: (1) following canister cleaning for shipping to the field; (2) prior to

sampling, with all the connections and leak checks completed; (3) at the end of sampling; and (4) prior to analysis in the laboratory.

A tracer gas (helium) will be used in connection with the soil vapor sampling to provide a means to evaluate whether the soil vapor samples are diluted by surface air. A 5-gallon plastic pail will be placed over the soil vapor sampling location, and hydrated bentonite will be used to create a seal between the pail and the ground surface and penetration for the downhole tooling (at the top of the pail). Prior to sampling, helium will be introduced into the pail through a fitting on the side of the pail. The helium levels in the purge gas and in the pail (prior to and immediately after sampling) will be measured using a gas detector.

An upwind ambient air sample will be collected each day of soil vapor sampling. Consistent with the soil vapor sampling approach, the proposed air sampling will also involve use of a pre-cleaned 6-liter SUMMA® canister with an attached flow regulator. However, the regulator for the soil vapor sampling will be adjusted by the laboratory to provide uniform sample collection over an approximate 8-hour sampling period.

Prior to moving to the next sampling location, all down-hole equipment (i.e., steel rods, expendable point holder) will be decontaminated. Following completion of the sampling activities, the boreholes will be backfilled with bentonite grout. Soil sample liners, recovered soil samples, and used soil vapor sample tubing will be placed in steel 55-gallon drums for offsite transportation and disposal.

The air sample and soil vapor samples will be submitted to Severn Trent Laboratories, Inc. (STL) located in Burlington, Vermont for laboratory analysis for selected VOCs in accordance with USEPA Compendium Method TO-15. Based on the extensive VOC soil sampling implemented during the 2004 RFI, 2005 ICM, and subsequent 2006 Phase I through Phase III sampling activities, the VOC analyte list will consist of the 19 individual VOCs detected in onsite soil samples. These constituents and associated detection limits are identified in Table 1. The soil vapor samples will also be analyzed for helium using American Society for Testing and Materials (ASTM) Method D1946. STL is certified in the State of New York to perform air sample analyses. Laboratory analysis will be performed on a standard turnaround for reporting of analytical results (i.e., three to four weeks following sample collection).

III. REPORTING

A summary letter report will be prepared following receipt of the soil vapor laboratory analytical results. The letter report will include:

- A summary of work activities performed and analytical results obtained for the soil vapor investigation.
- An evaluation of the soil vapor results, including comparisons to guidance values presented in the NYSDOH *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006).
- Data tables presenting laboratory analytical results.
- Figures showing the surveyed air and soil vapor sampling locations and corresponding laboratory analytical results.
- Copies of the laboratory Form 1 analytical results.
- A CD containing the full laboratory analytical data reports.

We have assumed that validation of the soil vapor analytical results will not be needed. The summary letter report will be submitted to the NYSDEC/NYSDOH approximately one month after receipt of the final analytical data from the laboratory.

IV. ANTICIPATED SCHEDULE

ARCADIS BBL is prepared to implement the proposed soil vapor sampling activities shortly following NYSDEC/NYSDOH approval of this sampling plan. The proposed field activities will take approximately one week to complete. Preliminary laboratory analytical results for the soil vapor sampling activities will be available approximately three to four weeks following sampling. As indicated above, a summary letter report will be submitted to the NYSDEC/NYSDOH approximately one month after receipt of the final laboratory analytical data.

We await NYSDEC/NYSDOH approval of the proposed soil vapor sampling activities. Please do not hesitate to contact Joel Robinson of Bayer at 412.777.4871 or the undersigned at 315.671.9441 if you have any questions or require additional information.

Sincerely,

ARCADIS of New York, Inc.

John C. Brussel

John C. Brussel, PE
Senior Engineer II

Copies:
Mr. Paul Olivo, United States Environmental Protection Agency
Ms. Katy Murphy, New York State Department of Environmental Conservation
Mr. Joel E. Robinson, Bayer MaterialScience LLC
Mr. Joseph Molina III, PE, ARCADIS BBL

Table

TABLE 1
PROPOSED ANALYTE LIST AND REPORTING LIMITS

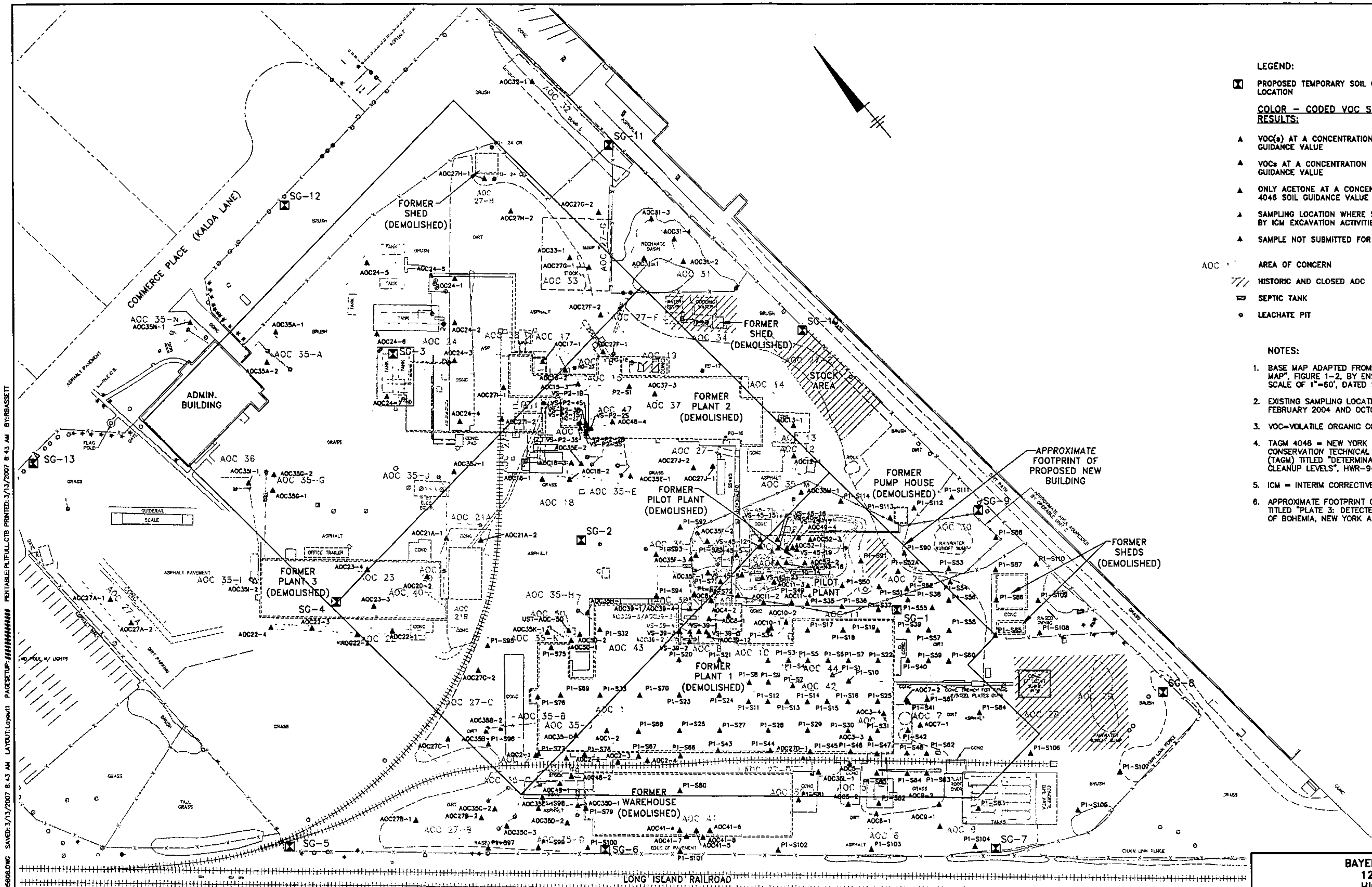
SOIL VAPOR INVESTIGATION WORK PLAN
BAYER MATERIALSCIENCE LLC
125 NEW SOUTH ROAD
HICKSVILLE, NEW YORK

Compound	CAS Number	Reporting Limit (ppb v/v)	Reporting Limit ($\mu g/m^3$)
Acetone (2-propanone)	67-64-1	5.0	12
Benzene	71-43-2	0.20	0.64
Bromomethane (Methyl bromide)	74-83-9	0.20	0.78
2-Butanone (Methyl ethyl ketone)	78-93-3	0.50	1.5
Carbon disulfide	75-15-0	0.50	1.6
Chlorobenzene	108-90-7	0.20	0.92
Chloroform	67-66-3	0.20	0.98
1,2-Dichloroethene (cis)	156-59-2	0.20	0.79
1,2-Dichloroethene (trans)	156-60-5	0.20	0.79
Ethylbenzene	100-41-4	0.20	0.87
Methylene chloride	75-09-2	0.50	1.7
4-Methyl-2-pentanone (MIBK)	108-10-1	0.50	2.05
Styrene	100-42-5	0.20	0.85
Tetrachloroethene (PCE)	127-18-4	0.20	1.4
Toluene	108-88-3	0.20	0.75
Trichloroethene (TCE)	79-01-6	0.20	1.07
Vinyl chloride	75-01-4	0.20	0.51
Xylenes (m&p)	1330-20-7	0.50	2.17
Xylenes (o)	95-47-6	0.20	0.87
Methyl Butyl Ketone	591-78-6	0.50	2.05

Notes:

1. Analyses to be performed by Severn Trent Laboratories, Inc. (STL) of Burlington, Vermont using the following methods:
   - United States Environmental Protection Agency (USEPA) Method TO-15 for volatile organic compounds (VOCs); and
   - American Society for Testing and Materials (ASTM) Method D1946 for helium.
2. CAS = Chemical Abstract Service.
3. ppb (v/v) = parts per billion volumetric basis.
4. ug/m^3 = micrograms per cubic meter.

Figure



LEGEND:

- PROPOSED TEMPORARY SOIL GAS SAMPLING LOCATION

COLOR – CODED VOC SOIL ANALYTICAL RESULTS:

- VOC(s) AT A CONCENTRATION >TAGM 4046 SOIL GUIDANCE VALUE
- VOCs AT A CONCENTRATION <TAGM 4046 SOIL GUIDANCE VALUE
- ONLY ACETONE AT A CONCENTRATION >TAGM 4046 SOIL GUIDANCE VALUE
- SAMPLING LOCATION WHERE SOIL WAS REMOVED BY ICM EXCAVATION ACTIVITIES
- SAMPLE NOT SUBMITTED FOR VOC ANALYSIS

AOC — AREA OF CONCERN

HISTORIC AND CLOSED AOC

SEPTIC TANK

LEACHATE PIT

NOTES:

1. BASE MAP ADAPTED FROM A DRAWING ENTITLED "AREA OF CONCERN MAP", FIGURE 1-2, BY ENSR CORPORATION. PISCATAWAY, NJ, AT A SCALE OF 1"=60', DATED 2/14/03.
2. EXISTING SAMPLING LOCATIONS WERE SURVEYED BY BBL, INC. BETWEEN FEBRUARY 2004 AND OCTOBER 2006.
3. VOC=VOLATILE ORGANIC COMPOUND
4. TAGM 4046 = NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM (TAGM) TITLED "DETERMINATION OF SOIL CLEANUP OBJECTIVES AND CLEANUP LEVELS", HWR-94-4046 DATED 1994.
5. ICM = INTERIM CORRECTIVE MEASURE.
6. APPROXIMATE FOOTPRINT OF PROPOSED BUILDING IS FROM A DRAWING TITLED "PLATE 3: DETECTED PCE IN SOIL", BY IMPACT ENVIRONMENTAL OF BOHEMIA, NEW YORK AT A SCALE OF 1" = 133', DATED 10/19/06.

BAYER MATERIALSCIENCE LLC
125 NEW SOUTH ROAD
HICKSVILLE, NEW YORK
SOIL GAS INVESTIGATION WORK PLAN

PROPOSED SOIL GAS SAMPLING LOCATIONS

ARCADIS BBL
infrastructure, environment, facilities

FIGURE
1

ARCADIS BBL

Attachment 1

Standard Operating Procedure:
Soil Vapor Sampling and Analysis
Using USEPA Method TO-15

Standard Operating Procedure: Soil Vapor Sampling and Analysis Using USEPA Method TO-15

I. Scope and Application

This document describes the procedures to install a temporary soil vapor sampling point and collect soil vapor samples for the analysis of volatile organic compounds (VOCs) by United States Environmental Protection Agency (USEPA) Method TO-15 (TO-15). The TO-15 method uses a passivated stainless steel canister to collect a whole-air sample that is then analyzed for VOCs using a quadrupole or ion-trap gas chromatograph/mass spectrometer (GS/MS).

The following sections list the necessary equipment and detailed instructions for installing temporary soil vapor sampling points and collecting samples for VOC analysis.

II. Personnel Qualifications

ARCADIS BBL field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, site-specific training, first-aid, and cardiopulmonary resuscitation (CPR), as needed. ARCADIS BBL field sampling personnel will be well versed in the relevant standard operating procedures (SOPs) and possess the required skills and experience necessary to successfully complete the desired field work. ARCADIS BBL personnel responsible for leading soil vapor sample collection activities must have previous soil vapor sampling experience.

III. Equipment List

The equipment required to install a temporary soil vapor point is presented below:

- Direct-push rig (e.g., PowerProbe™ or Geoprobe®) equipped with interconnecting 4-foot lengths of 1.25 inch-diameter steel rods;
- Expendable points (one per sample);
- Expendable point holder, and appropriate twist-to-lock connector;
- Photoionization detector (PID);
- High-density polyethylene (HDPE) tubing;
- Non-coated bentonite;
- Appropriate PPE (as required by the Health and Safety Plan); and

- Digital camera.

The equipment required for vapor sample collection is presented below:

- Stainless steel SUMMA® canisters (order at least one extra, if feasible);
- Flow controllers with in-line particulate filters and vacuum gauges; flow controllers are pre-calibrated to specified sample duration (e.g., 30 minutes, 8 hours, 24 hours) or flow rate (e.g., 200 milliliters per minute [mL/min]); confirm with the laboratory that the flow controller comes with an in-line particulate filter and pressure gauge (order at least one extra, if feasible);
- 1/4-inch or 3/16-inch ID tubing (Teflon®, HDPE, fluoropolymer, or similar);
- Twist-to-lock fittings;
- Stainless steel "T" fitting (if collecting duplicate [i.e., split] samples);
- Portable vacuum pump capable of producing very low flow rates (e.g., 100 to 200 mL/min);
- Rotameter or an electric flow sensor if vacuum pump does not have a flow gauge;
- Tracer gas source (e.g., helium);
- PID;
- Appropriate-sized open-end wrench (typically 9/16-inch);
- Chain-of-custody (COC) form;
- Sample collection log (a sample is attached); and
- Field notebook.

IV. Cautions

Sampling personnel should not handle hazardous substances (such as gasoline), permanent marking pens, wear/apply fragrances, or smoke cigarettes/cigars before and/or during the sampling event.

Care should also be taken to ensure that the flow controller is pre-calibrated to the proper sample collection time (confirm with laboratory). Sample integrity is maintained if the sampling event is shorter than the target duration, but sample integrity can be compromised if the event is extended to the time that the canister reaches atmospheric pressure.

Care must be taken to properly seal around the steel rods and tubing at the ground surface to prevent leakage of atmosphere into the soil vapor point during purging and sampling. Temporary points are to be sealed at the surface using hydrated bentonite.

V. Health and Safety Considerations

Field sampling equipment must be carefully handled to minimize the potential for injury and the spread of hazardous substances. For soil vapor sampling point installation, the direct-push rig should be operated only by personnel with prior experience using such a piece of equipment.

VI. Procedures

Temporary Soil Vapor Point Installation

Temporary soil vapor points are installed using a direct push rig to advance an assembly of interconnected 4-foot lengths of 1.25"-diameter steel probe rod, affixed with an expendable point holder and expendable point at the downhole end, to the desired sampling depth. Bentonite is used to seal the annular space (if any) between the steel rod and borehole wall to isolate the subsurface interval from the atmospheric air. After the target depth is reached, the expendable point is disengaged by hydraulically retracting the steel probe rods upwards approximately 0.5-feet to create a void in the subsurface soil for soil gas collection. An HDPE or fluoropolymer sample delivery tube (3/16" or 1/4" inside diameter) with an attached Post-Run-Tubing (PRT) threaded adapter is lowered through the 1.25"-diameter steel rod and threaded into the expendable point holder. The tubing will be purged with a portable sampling pump prior to collecting the vapor sample.

1. Advance an assembly consisting of interconnected lengths of decontaminated 1.25-inch-diameter steel drive rods, affixed with an expendable point holder and expendable point at the downhole end, to the bottom of the desired sampling interval.

2. Cut a length of sample collection tubing slightly longer (e.g., 2 to 3 feet) than the collection depth. Attach a twist-to-lock connector to one end of the sample collection tubing and lower the twist-to-lock connector and attached tubing through the drive rods. Thread the twist-to-lock connector into the expendable point holder, by twisting counterclockwise.

3. Hydraulically retract the sampling assembly approximately 6 inches or more if needed, allowing the expendable point to fall off, and creating a void in the subsurface for soil gas sample collection.

4. Fill annular space between the steel drive rod and the borehole wall (if any) with bentonite. Typically, only a bentonite surface seal is needed since there is no annular space between the steel drive rods and the borehole wall.

5. Proceed to vapor sample collection.

6. When soil vapor sampling is complete, backfill the borehole with bentonite grout.

Soil Vapor Sample Collection

Preparation of Stainless Steel Canister and Collection of Sample

1. Record the following information in the field notebook/sample collection logs, if appropriate (contact the local airport or other suitable information source [e.g., site-specific measurements, weatherunderground.com] to obtain the information):

   a. wind speed and direction;
   b. ambient temperature;
   c. barometric pressure; and
   d. relative humidity.

2. Remove the brass plug (dust cap) from the sampling canister and connect the flow controller with in-line particulate filter and vacuum gauge to the canister. Do not open the valve on the canister. Record in the field notebook/sample collection log and on the COC form the flow controller number with the appropriate canister number.

3. Connect the flow controller, sample collection tubing, and purge pump to a T-connection equipped with a valve. Be sure the purge pump is connected to the valved opening of the T-connection. Open the valve on the T-connection and purge 1 to 2 (target 1.5) volumes of air from the sampling line using the purge pump [purge volume = 1.5 Pi r^2h] at a rate of approximately 100 mL/min. Close the valve on the T-connection following purging.

4. Open the valve on the sampling canister. Record the initial canister vacuum pressure in the field notebook/sample collection log and COC form. If the initial vacuum pressure does not register less than -28 inches of Hg, then the canister is not appropriate for use and another canister should be used (if this occurs, return to Step 2).

5. Record in the field notebook/sample collection log the time sampling began and take a photograph of the canister and surrounding area.

Termination of Sample Collection

1. Arrive at the canister location at least 10 to 15 minutes prior to the end of the required sampling interval.

2. Stop collecting the sample by closing the canister valve. Record the final vacuum pressure. The canister should have a minimum amount of vacuum (approximately 2 inches of Hg or slightly greater).

3. Record the date and local time (24-hour basis) of valve closing in the field notebook/sample collection log and COC form.

4. Remove the particulate filter and flow controller from the canister, re-install the brass plug on the canister fitting, and tighten with the appropriate wrench.

5. Package the canister and flow controller in the shipping container supplied by the laboratory for return shipment to the laboratory. The canister does not require preservation with ice or refrigeration during shipment.

6. Complete the appropriate forms and sample labels as directed by the laboratory (e.g., affix card with a string).

7. Complete the COC form and place the requisite copies in a shipping container. If shipping by courier service (e.g. FedEx) close the shipping container and affix a custody seal to the container closure. Ship the container to the laboratory via overnight carrier for analysis. If transporting directly to laboratory or for laboratory sample pick up, follow standard Chain of Custody procedures.

Soil Vapor Monitoring Point Abandonment

Once the soil vapor samples have been collected, the soil vapor monitoring points will be abandoned by removing the drive rods and filling the resulting hole with bentonite.

VII. Waste Management

Field personnel will collect and containerize all investigation-derived waste materials (including disposable equipment) for proper disposal.

VIII. Data Recording and Management

Measurements will be recorded on field sample collection logs or in the field notebook at the time of measurement with notations of the project name, sample date, sample start and finish time, sample location (e.g., GPS coordinates, distance from permanent structure, canister serial number, flow controller serial number, initial vacuum reading, and final pressure reading. Field sampling logs and COC records will be transmitted to the Project Manager.

IX. Quality Assurance

Vapor sample analysis will be performed using USEPA TO-15 methodology. This method uses a quadrupole or ion-trap GC/MS with a capillary column to provide optimum detection limits. The GC/MS system requires a 1-liter gas sample (which can easily be recovered from a 6-liter canister) to provide a 0.5-ppbv detection limit. The 6-liter canister also provides several additional 1-liter samples in case subsequent re-analyses or dilutions are required. This system also offers the advantage of the GC/MS detector, which confirms the identity of detected compounds by evaluating their mass spectra in either the SCAN or SIM mode.

X. References

New York State Department of Health (NYSDOH). 2006. "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" October 2006.

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Soil Gas Sample Collection Log

(Page 1 of 2)

Sample ID:

Client:		**Date/Day:**	
Project:		**Weather:**	
Location:		**Temperature:**	
Project #:		**Wind Speed/Direction:**	
Samplers:		**Subcontractor:**	
Logged By:		**Equipment:**	
Coordinates:		**Moisture Content of Sampling Zone (circle one):**	Dry / Moist
Sampling Depth:			
Probe (circle one):	Permanent / Temporary	**Approximate Purge Volume:**	
Time of Collection:	Start: Finish:	**Background PID Ambient Air Reading:**	

Nearby Groundwater Monitoring Wells/Water Levels:

Well ID	Depth to Groundwater (feet)

SUMMA Canister Information

Size (circle one): 1 L 6 L

Canister ID: _____

Flow Controller ID: _____

Tracer Gas Information (if applicable)

Tracer Gas: _____

Canister Pressure (inches Hg):		
Reported By Laboratory	**Measured Prior to Sample Collection**	**Measured Following Sample Collection**

Tracer Gas Concentration (if applicable):		
Measured in Purge Effluent	**Measured in 'Concentrated' Area Prior to Sample Collection**	**Measured in 'Concentrated' Area Following Sample Collection**

Weather Conditions	Start of Sample Collection	End of Sample Collection
Temperature		
Humidity		
Wind Velocity		
PID		

Approximating One-Well Volume (for purging):
When using 1¼-inch "Dummy Point" and a 6-inch sampling interval, the sampling space will have a volume of approximately 150 mL.
Each foot of ¼-inch tubing will have a volume of approximately 10 mL.

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Soil Gas Sample Collection Log

Sample ID:

General Observations/Notes:

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Attachment 2

Standard Operating Procedure:
Ambient Air Sampling and
Analysis Using USEPA Method
TO-15

Standard Operating Procedure: Ambient Air Sampling and Analysis Using USEPA Method TO-15

I. Scope and Application

This standard operating procedure (SOP) describes the procedures to collect ambient air samples for the analysis of volatile organic compounds (VOCs) using United States Environmental Protection Agency (USEPA) Method TO-15 (TO-15). The TO-15 method uses a passivated stainless steel canister to collect a whole-air sample that is then analyzed for VOCs using a quadrupole or ion-trap gas chromatograph/mass spectrometer (GS/MS).

The following sections list the necessary equipment and provide detailed instructions for placing the sampling device and collecting ambient air samples for VOC analysis.

II. Personnel Qualifications

ARCADIS BBL field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, site-specific training, first aid, and cardiopulmonary resuscitation (CPR), as needed. ARCADIS BBL field sampling personnel will be well versed in the relevant SOPs and possess the required skills and experience necessary to successfully complete the desired field work. ARCADIS BBL personnel responsible for leading ambient air sample collection activities must have previous ambient air sampling experience.

III. Equipment List

The equipment required for ambient air sample collection is presented below:

- 6-liter, stainless steel SUMMA® canisters (order at least one extra, if feasible);
- Flow controllers with in-line particulate filters and vacuum gauges (flow controllers are pre-calibrated by the laboratory to a specified sample duration [e.g., 8-hour, 24-hour]). Confirm with lab that flow controller comes with in-line particulate filter and pressure gauge (order an extra set for each extra SUMMA® canister, if feasible);
- Appropriate-sized open-end wrench (typically 9/16-inch);
- Chain-of-custody (COC) form;
- Sample collection log;
- Field notebook;

- Sample collection logs (a sample is attached);
- Digital camera;
- Lock and chain; and
- Ladder or similar to hold canister above the ground surface (optional).

IV. Cautions

Care must be taken to minimize the potential for introducing interferences during the sampling event. As such, care must be taken to keep the canister away from heavy pedestrian traffic areas (e.g., main entranceways, walkways). If the canister is not to be overseen for the entire sample duration, precautions should be taken to maintain the security of the sample (e.g., do not place in areas regularly accessed by the public, fasten the sampling device to a secure object using lock and chain, label the canister to indicate it is part of a scientific project, place the canister in secure *housing that does not disrupt the integrity/validity of the sampling event). Sampling* personnel should not handle hazardous substances (such as gasoline), permanent marking pens, wear/apply fragrances, or smoke cigarettes before and/or during the sampling event.

Care should also be taken to ensure that the flow controller is pre-calibrated to the proper sample collection time (confirm with laboratory). Sample integrity is maintained if the sampling event is shorter than the target duration, but sample integrity can be compromised if the event is extended to the point that the canister reaches atmospheric pressure.

V. Health and Safety Considerations

Field sampling equipment must be carefully handled to minimize the potential for injury and the spread of hazardous substances.

VI. Procedures

Preparation of Stainless Steel Canister and Collection of Sample

1. Record the following information in the field notebook/sample collection log (contact the local airport or other suitable information source [e.g., site-specific measurements, weatherunderground.com] to obtain the following information):

    a. wind speed and direction;

b. ambient temperature;
c. barometric pressure; and
d. relative humidity.

2. Choose the sample location in accordance with the sampling plan. If a breathing zone sample is required, place the canister on a ladder, tripod, or other similar stand to locate the canister orifice 3 to 5 feet above ground or floor surface. If the canister will not be overseen for the entire sampling period, secure the canister as appropriate (e.g., lock and chain).

3. Record canister serial number and flow controller number in the field notebook/sample collection log and COC form. Assign sample identification on canister ID tag, and record in the field notebook/sample collection log and COC form.

4. Remove the brass plug (dust cap) from the canister. Attach the flow controller with in-line particulate filter and vacuum gauge (leave swage-lock cap on the vacuum gauge during this procedure) to the canister with the appropriate-sized wrench. Tighten with fingers first, then gently with the wrench.

5. Open the canister valve to initiate sample collection. Record the date and local time (24-hour basis) of valve opening in the field notebook/sample collection log and COC form.

6. Record the initial canister vacuum pressure in the field notebook/sample collection log and COC form. If the initial vacuum pressure does not register less than -28 inches of Hg, then the canister is not appropriate for use and another canister should be used.

7. Take a photograph of the canister and surrounding area.

Termination of Sample Collection

1. Arrive at the canister location at least 10 to 15 minutes prior to the end of the sampling interval (e.g., 8-hour).

2. Stop collecting the sample when the canister vacuum reaches approximately 2 inches of Hg (leaving some vacuum in the canister provides a way to verify if the canister leaks before it reaches the laboratory) or when the desired sample time has elapsed.

3. Record the final vacuum pressure. Stop collecting the sample by closing the canister valve. Record the date, local time (24-hour basis) of valve closing in the field notebook/sample collection log and COC form.

4. Remove the particulate filter and flow controller from the canister, re-install brass plug on canister fitting, and tighten with wrench.

5. Package the canister and flow controller in the shipping container supplied by the laboratory for return shipment to the laboratory. The canister does not require preservation with ice or refrigeration during shipment.

6. Complete the appropriate forms and sample labels as directed by the laboratory (e.g., affix card with string).

7. Complete COC form and place requisite copies in shipping container. Close shipping container and affix custody seal to container closure. Ship to laboratory via overnight carrier (e.g., Federal Express) for analysis.

VII. Waste Management

No specific waste management procedures are required.

VIII. Data Recording and Management

Measurements will be recorded on field sample collection logs or in the field notebook at the time of measurement, with notations of project name, sample date, sample start and finish times, sample location (e.g., description and GPS coordinates if available), canister serial number, flow controller number, initial vacuum reading, and final vacuum reading. Field notebooks/sample collection logs and COC records will be transmitted to the Project Manager.

IX. Quality Assurance

Ambient air sample analysis will be performed using USEPA Method TO-15. This method uses a quadrupole or ion-trap GC/MS with a capillary column to provide optimum detection limits. The GC/MS system requires a 1-liter gas sample (which can easily be recovered from a 6-liter canister) to provide a 0.5 ppbv detection limit. The 6-liter canister also provides several additional 1-liter samples in case

subsequent re-analyses or dilutions are required. This system also offers the advantage of the GC/MS detector, which confirms the identity of detected compounds by evaluating their mass spectra in either the SCAN or SIM mode.

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Indoor/Ambient Air Sample Collection Log

Sample ID:

Client:		**Date/Day:**	
Project:		**Sample Intake Height:**	
Location:		**Subcontractor:**	
Project #:		**Miscellaneous Equipment:**	
Samplers:			
Coordinates:		**Time Start:**	
Outdoor/Indoor:		**Time Stop:**	

Instrument Readings:

Time	Canister Pressure (inches Hg)	Temperature (F or C)	Relative Humidity (%)	Air Speed (ft/min)	Barometric Pressure	PID (ppm or ppb)

SUMMA Canister Information

Size (circle one): 1 L 6 L

Canister ID: _____

Flow Controller ID: _____

General Observations/Notes:
