Illinois Environmental Protection Agency

Bureau of Land • 1021 North Grand Avenue East • P.O. Box 19276 • Springfield • Illinois • 62794-9276

ILLINOIS EPA RCRA CORRECTIVE ACTION CERTIFICATION

This certification must accompany any document submitted to Illinois EPA in accordance with the corrective action requirements set forth in a facility's RCRA permit. The original and two copies of all documents submitted must be provided.

1.0 Facility Identification

Name: Equilon Enterprises LLC d/b/a/ SOPUS
County: Madison
Street Address: 900 South Central Ave
Site No. (IEPA): 1191150002
City: Roxana
Site No. (USEPA): ILD080 012 305

2.0 Owner Information

Name: Not Applicable
Mail Address:
City:
State: Zip Code:
Contact Name:
Contact Title:
Phone:

3.0 Operator Information

Name: Equilon Enterprises LLC d/b/a/ SOPUS
Mail Address: 128 East Center Street
City: Nazareth
State: PA Zip Code: 18064
Contact Name: Leroy Bealer
Contact Title: Senior Program Manager
Phone: 484-632-7955

4.0 Type of Submission (check applicable item and provide requested information, as applicable)

☐ RFI Phase I Workplan/Report
☐ RFI Phase II Workplan/Report
☐ CMP Report;
☒ Other (describe): Standard Operating Procedures

IEPA Permit Log No. B-43R
Date of Last IEPA Letter on Project: August 22, 2022
Log No. of Last IEPA Letter on Project: B-43R-CA-107

Does this submittal include groundwater information: ☐ Yes ☒ No

Date of Submittal: May 26, 2023

5.0 Description of Submittal: (briefly describe what is being submitted and its purpose)

Revisions to Standard Operating Procedures 5, 16, 25 and 44R based on IEPA comments in their 3/13/23 letter.

6.0 Documents Submitted (identify all documents in submittal, including cover letter; give dates of all documents)

Response to IEPA 3/13/2023 Revised Permit Letter with SOP Updates (SOPs 5, 16, 25, 44R); SOP 5 Utility Clearance Procedures; SOP 16 IDW Handling; SOP 25 Sample Containers, Preservation and Holding Times; SOP 44R Soil Vapor Purging and Sampling; RCRA Corrective Action Certification. Copy of submittal sent electronically directly to Amy Butler, Visal Poornake and Ali Al-Janabi of IEPA.

For: Response to IEPA 3/13/2023 Letter with SOP updates

Date of Submission: May 26, 2023

7.0 Certification Statement

(This statement is part of the overall certification being provided by the owner/operator, professional and laboratory in Items 7.1, 7.2 and 7.3 below). The activities described in the subject submittals have been carried out in accordance with procedures approved by Illinois EPA. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

7.1 Owner/Operator Certification

(Must be completed for all submittals. Certification and signature requirements are set forth in 35 IAC 702.126.) All submittals pertaining to the corrective action requirements set forth in a RCRA Permit must be signed by the person designated below (or by a duly authorized representative of that person):

1. For a Corporation, by a principal executive officer of at least the level of vice president.
2. For a Partnership or Sole Proprietorship, by a general partner or the proprietor, respectively.
3. For a Governmental Entity, by either a principal executive officer or a ranking elected official.

A person is a duly authorized representative only if:

1. the authorization is made in writing by a person described above; and
2. the written authorization is provided with this submittal (a copy of a previously submitted authorization can be used).

Owner Signature: _____ Date: _____

Title: _____

Operator Signature: _____ Date: 5/26/2023

Title: **Senior Program Manager**

7.2 Professional Certification (if necessary)

Work carried out in this submittal or the regulations may also be subject to other laws governing professional services, such as the Illinois Professional Land Surveyor Act of 1989, the Professional Engineering Practice Act of 1989, the Professional Geologist Licensing Act, and the Structural Engineering Licensing Act of 1989. No one is relieved from compliance with these laws and the regulations adopted pursuant to these laws. All work that falls within the scope and definitions of these laws must be performed in compliance with them. The Illinois EPA may refer any discovered violation of these laws to the appropriate regulating authority.

Any person who knowingly makes a false, fictitious, or fraudulent material statement, orally or in writing, to the Illinois EPA commits a Class 4 felony. A second or subsequent offense after conviction is a Class 3 felony. (415 ILCS 5/44 (h))

Professional's Signature: Wendy Pennington Date: 5/26/2023

Professional's Name Wendy Pennington

Address 100 N. Broadway, 20th Floor Professional's Seal:

City St. Louis

State MO Zip Code 63089

Phone 314-452-8929

7.3 Laboratory Certification (if necessary)

The sample collection, handling, preservation, preparation and analysis efforts for which this laboratory was responsible were carried out in accordance with procedures approved by Illinois EPA.

Name of Laboratory *NOT APPLICABLE*

_____ Date: _____

Signature of Laboratory Responsible Officer

Mailing Address of Laboratory

Address _____

City _____

State _____ Zip Code _____

_____

Name and Title of Laboratory Responsible Officer

AECOM
100 North Broadway
20th Floor
St. Louis, MO 63110
USA
aecom.com

May 26, 2023

Ms. Jacqueline Cooperider, PE
Manager, Permit Section
Illinois Environmental Protection Agency
Division of Land Pollution Control
Bureau of Land
1021 North Grand Avenue East
Springfield, Illinois 62794

Response to IEPA 3/13/2023 Revised Permit Letter with SOP Updates (SOPs 5, 16, 25, 44R)
Equilon Enterprises LLC dba Shell Oil Products US
Roxana, Illinois
1191150002 - Madison County (ILD080012305)
Log B-43R-CA-99, -100, -101, -103, -104, -105

Dear Ms. Cooperider:

AECOM Technical Services, Inc. (AECOM) is submitting the enclosed revised Standard Operating Procedures (SOPs) in response to the Illinois Environmental Protection Agency (IEPA) comments in a letter dated March 13, 2023. SOPs were originally submitted, as requested by IEPA, within various reports and work plans related to the Investigation Site in Roxana, Illinois. Below, in accordance with Condition 6 of the IEPA March 13, 2023, letter, is a summary of exact changes made to the SOPs with respect to Conditions 1 through 4 of the same letter.

SOP No	SOP Title	IEPA Comment	Revision Made
5	Utility Clearance Procedures	4	Distance information from power lines added to table in Section 4 for >1,000 kV Nominal System along with statement containing OSHA reference for distance requirement information.
16	Investigation Derived Waste Handling	1	New SOP developed to summarize the safe handling and disposal of investigation derived waste (IDW), including used wash/rinse water.
25	Sample Containers, Preservation & Holding Times	2	Statement regarding holding times for soil vapor samples (30 days for Summa canisters and 48 hours for Tedlar bags) added to Section 5.

SOP No	SOP Title	IEPA Comment	Revision Made
44R	Soil Vapor Purging & Sampling	3	a) Statement regarding no soil vapor sampling within 48 hours of rainfall event of ½-inch or greater and in standing/ponded water added at the start of Section 5 (former Section 6). b) Statements regarding purge rate not exceeding 200 mL/min added throughout (Section 4 Step 5, and Section 5 Step 4). c) Section 5 Vapor Port Sampling – With No Tracer Gas removed as well as Figure 2 (replaced by previous Figure 3). d) Statement regarding soil vapor sampling depths (at least 3 feet below ground/foundation and above capillary fringe) added at the start of Section 5 (formerly Section 6).

Condition 5 of the IEPA March 13, 2023, letter required submittal of a Class 1* Permit Modification Request to revise Section C.7.5 of the Permit Renewal Application for the current Permit to refer to the most current SOPs. In a previous Permit Modification, dated January 29, 2018 (and approved by IEPA in a letter dated December 20, 2019), Section C.7.5 was revised to contain the following language; therefore, no Class 1* Permit Modification Request to review further is submitted at this time.

> 2. *SOPUS will continue to use the most current version of applicable Standard Operating Procedures (SOPs) related to collecting and handling groundwater samples. Where language differs between SOPs and Section C, the SOP takes precedence.*

As previously requested by IEPA, below is an SOP summary table, which indicates the most recent revision date and IEPA approval date for each SOP for your reference. SOPs in **bold** below are those included within this submittal.

SOP No.	SOP Title	SOP Revision Date	Last Approved by IEPA
3	Calibration & Maintenance of Field Instruments	3/12/2021	3/13/23
4	Decontamination	3/12/2021	3/13/23
5	**Utility Clearance Procedures**	**4/26/2023**	**3/13/23**
8	Field Reporting and Documentation	3/12/2021	3/13/23
10	Well Gauging Measurements	3/12/2021	3/13/23
11	Groundwater Sampling & Well Wizard Operation	3/12/2021	3/13/23
12	Grouting Procedures	12/9/2019	3/13/23
14	Headspace Soil Screening	12/9/2019	3/13/23
16	**Investigative Derived Waste Handling**	**5/22/2023**	**NEW SOP**

AECOM

SOP No.	SOP Title	SOP Revision Date	Last Approved by IEPA
17	Logging	12/9/2019	3/13/23
18	Low Flow Groundwater Purging & Sampling	3/12/2021	3/13/23
20	Well Development	3/12/2021	3/13/23
21	Monitoring Well Installation	7/24/2015	10/10/17
23	Quality Assurance Samples	3/12/2021	3/13/23
24	Soil and Groundwater Sample Identification, Packaging & Shipping	3/12/2021	3/13/23
25	**Sample Containers, Preservation & Holding Times**	**4/26/2023**	**3/13/23**
26	Sample Control & Custody Procedures	3/12/2021	3/13/23
28	Soil Sampling	12/9/2019	3/13/23
29	Soil Probe Operation	12/9/2019	3/13/23
42	Groundwater Profiling	12/9/2019	3/13/23
44R	**Soil Vapor Purging & Sampling**	**5/22/2023**	**3/13/23**
46	Indoor Air Sampling with Canisters	7/23/2015	10/10/17
47	Sub-slab Soil Gas Installation & Sampling with Canisters	4/4/2017	10/10/17
48	SVE Well Data Collection and Sampling	3/12/2021	3/13/23
49	SVE Effectiveness Monitoring at VMPs	3/12/2021	3/13/23
51	Vapor Sample Classification, Packaging & Shipping	3/12/2021	3/13/23
52	Soil Vapor Field Laboratory Screening	3/12/2021	3/13/23
53	Dwyer Digital Manometer	3/12/2021	3/13/23
56	LNAPL Recovery	3/12/2021	3/13/23

If you have any questions, please contact Wendy Pennington at wendy.pennington@aecom.com (314-452-8929). Copies of this submittal are being electronically sent separately directly to Amy Butler (IEPA, Springfield) and Ali Al-Janabi (IEPA, Collinsville).

Sincerely,

Wendy Pennington, PE
Project Manager, AECOM

Samuel Fisher, CHMM
Environmental Scientist, AECOM

encl: Revised SOPs 5, 16, 25, and 44R
RCRA Corrective Action Certification Form

cc: Amy Butler (IEPA - Springfield, IL)
Ali Al-Janabi (IEPA - Collinsville, IL)
Leroy Bealer (Shell)
Tom Morgan (Phillips 66)
Greg Mollett (Greensfelder)
Project File
Repositories (Roxana Public L brary, website)

1. Objective

The purpose of this Standard Operating Procedure (SOP) is to define the standard procedures for subsurface utility clearance that will allow staff to work safely and prevent damage to utility systems. This procedure provides descriptions of equipment and procedures necessary to properly clear utilities prior to beginning subsurface field activities for Shell projects in Hartford and Roxana, Illinois.

This document also defines the procedure for contacting the applicable "one-call" service for locating underground utilities. One-call, Joint Utility Locating Information for Excavators (JULIE), is a public service provided by individual states as a single point of contact for requesting a utility locate from a majority of underground utilities. This service is primarily for locating utilities on public properties and right-of ways.

Utility clearances should be completed prior to the start of any work in the area that could feasibly result in contact with or damage to that utility. Additional information and a checklist can be found in AECOM Procedure No. S3AM-331-PR1 Underground Utilities. Please use S3AM-331-PR1 in conjunction with this SOP.

Utility clearances are supposed to be completed/submitted by the company doing the drilling/excavating but they will likely require information from us. We should also confirm, in the field, that utilities have been marked. We should also get locate ticket number and information from subcontractor once it's available.

2. Other SOPs Referenced in this SOP

- SOP No. 8 – Field Reporting and Documentation

3. Equipment

Equipment typically used during utility clearance procedures:

- Project map
- Known utility map
- Marking paint
- Stakes or flags

- Permanent marker
- Coloring pencils or permanent marker in different colors
- Measuring tape and/or wheel
- Other related field paperwork, as needed.
- Camera
- Surveyors, as needed
- Appropriate PPE (hard hat, safety glasses, steel toe boots, gloves, etc.)

4. Location Marking

Prior to utility clearance, locations to be drilled or excavated should be marked by the task manager, field personnel scheduled to complete the work, or a knowledgeable assigned designee. Per one-call guidelines excavation areas should be marked either a) with stakes or flags with the necessary radius to be cleared marked on the stake or flag or b) with white marking paint (black paint may be substituted when necessary). When using paint, the extent of the area to be cleared should be marked, if possible.

As a note, fluorescent paint should not be used when DyeLIF technology is to be used.

When marking locations, initial adjustments to locations should be made based on visible utilities such as overhead power lines, sewers and other utility corridors. As a rule, drill rig masts and excavating equipment must stay at least 50 horizontal feet away from overhead utilities unless/until the voltage and height of the system has been determined. Depending on the voltage of the overhead lines or site/client requirements, a lesser distance may be used. The table below summarizes the typical minimum distances from overhead power lines. Additional information can be found in AECOM Procedure No. S3AM-302-PR1 Electrical Safety. Please use S3AM-302-PR1 in conjunction with this SOP.

Minimum Distances from Power Lines	
Nominal System (kV)	**Minimum Required Distance (feet)**
0-50	10
51-100	12
101-200	15
201-300	20
301-500	25
501-750	35
751-1,000	45
>1,000	[as established by utility owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution

The distance requirement information presented above is also in accordance with OSHA 1926.1408.

Operations adjacent to overhead power lines are prohibited unless the power has been shut off (such as lockout/tagout), the minimum distance above has been observed, or the power lines have been isolated (such as using insulating blankets) by the owner of the lines.

5. One-Call

The purpose of the one-call system is to alert member utility companies to a planned drilling or excavating project. The one-call system will inform the person making the utility call which member companies will be notified. Additional contacts may be necessary if suspected utility providers in the area of the proposed work are not members of the public one-call system. Illinois has their own one-call number Illinois: 1-800-892-0123. Illinois requires the subcontractor actually performing the drilling or excavating to make the initial call (e.g., Illinois), and each drilling subcontractor needs to have their own locating (in this case JULIE) ticket number.

Once a one-call notification has been placed the utility companies typically have 48-hours (2 business days) to respond. The time does not include weekends or observed holidays. Once a one-call has been placed work should be ready to start within 10 working days. Once work has begun, renewal of utility locates is determined by an individual state's regulations. If the

markings of utility locations are destroyed or removed before excavation/drilling commences or is completed, the one-call ticket must be renewed.

A joint meet may also be requested if the area of the proposed work is large and/or complicated. Member utilities must be given 48-hours prior to the joint meet to schedule a representative to attend. Following the joint meet, an additional 48 hours must be allowed for the utility companies to mark their utilities.

The following information should be provided when making a one-call:

- Identification of who is conducting the work as well as any subcontractor such as a drilling or excavating firm. The contact information for the person responsible along with a phone number where they can be easily reached is a minimum.
- Type of work being conducted (e.g. drilling or excavating).
- Location of work being conducted described as best as possible. Addresses in conjunction with relation to buildings or other property features when possible should be used. Other forms of locating include distances and directions from intersections.
- Whether or not a joint meet is required.
- The time frame expected for work to begin.

The following information should be recorded and kept available after the one-call has been made:

- Ticket serial number
- Utilities one-call will notify
- Time and location of joint meet (if applicable)
- Time and date by which utilities are to be cleared
- Log of utilities which have been cleared, either from markings on ground at the location or locator calling to confirm.
- Re-notification date when activities extend beyond 28 days.

Industrial facilities often are responsible for utility locates on their own property and will not be covered by a one-call. Field personnel should coordinate with their contact at such a facility in order to check for known utilities under control of the facility and for any additional clearance efforts which may be required.

When possible, identify the size of underground utilities being marked. The general rule is that the accuracy of marking, from the center of the utility, is the width of the utility plus 1.5-feet. Certain utility companies may require a greater distance from their lines.

The following are the colors from the uniform color code and marking guidelines:

- White (or Black) – Proposed excavations
- Pink – Temporary survey markings
- Red – Electric power lines, cables, conduit and lighting cables
- Yellow – Gas, oil, steam, petroleum or gaseous materials
- Orange – Communication, alarm or signal lines, cables or conduit
- Blue – Potable water
- Purple – Reclaimed water, irrigation and slurry lines
- Green – Sewers and drain lines

These colors shall be used by both the company requesting the utility locate and the member companies marking underground utilities.

6. Private Utility Clearance

Private utility clearance involves using ground penetrating radar (GPR) and/or electromagnetic (EM) technologies to check for utilities prior to beginning secondary utility clearance and excavation or drilling activities. GPR and EM should be performed by a trained and qualified subcontractor.

7. Secondary Utility Clearance

Secondary utility clearance involves using an air knife, a hand auger, a post-hole digger and/or a shovel to check for utilities prior to beginning the excavation or boring.

Air Knife/Vacuum Excavation

Air Knife/Vacuum Excavation operations involve air/water jetting combined with a high suction vacuum to create a boring or trench of specified dimensions. Single point borings need to have the hole cleared to below the depth of known utilities in the area and to a diameter 3 inches greater than the diameter of the tools penetrating the ground surface (per Shell guidelines). If the

depth of utilities in the area is not known, a minimum depth of 5 to 10 feet can be used, depending on client/property owner requirements.

As an alternative, a "V-trench" or a triangle configuration of air-knife holes can also be used to clear a location. If the air-knife is to be completed in a triangle formation, the air knife holes should be completed in sets of three in as tight a triangle as the boring size will allow, with the center of the boring to be completed at the center of the triangle. Whichever method is selected, the air knife boring(s) must be located so that the absence of underground utilities can be confirmed. Once the location is confirmed as being clear, the air knife hole(s) or trench should be backfilled with air knife spoils or an inert material, such as silica sand or flowable fills, unless drilling is to commence right away. Refer to the scope of work or other project documentation for other backfill options.

Hand Auger

Due to access, availability or other reasons, air knifing/vacuum excavation may not be an option. If this is the case, hand augers may be used to clear a location. Due to the size of the hand auger bucket, multiple hand auger holes may be necessary to clear a location for a single boring. If multiple hand augers are necessary, the best option is to complete hand auger holes in sets of three in as tight a triangle as the boring size will allow, with the center of the boring to be completed at the center of the triangle. The same depth requirement for clearance applies to hand auger holes as it does for air knifing/vacuum excavation. Once the location is confirmed as being clear, the hand auger hole(s) should be backfilled with hand auger spoils or an inert material, as described for air knifing/vacuum excavation holes.

Post-hole digger / Hand Shovel

As a last choice, conventional means such as a post-hole digger or hand shovel may be used to clear a location. This option is generally best only when any known utilities are very shallow, or the surface material is extremely coarse (large gravels and rocks). Hand shovels and post-hole diggers have a higher chance of damaging weaker utilities, so caution should be taken when used. If deeper clearance than a foot or two is necessary, either an air knife or hand auger should be used for utility clearance. Other procedures/protocols mentioned above still apply.

8. Final Boring Placement

To the extent possible, excavation or drilling work should not be performed within 5 feet of a confirmed or suspected utility or other subsurface structure. The minimum distance to perform work from any utility may vary and should be confirmed with the utility company. If drilling

will be performed within 5 feet of a confirmed or suspected utility, contact the utility company/companies to discuss any potential precautions that should be taken. Shell projects require the secondary utility clearance hole be cased if within 10 feet of a gas line. Casing may also be used if the sidewall caves in or water fills in the secondary utility clearance hole. If an unmarked utility is encountered during secondary utility clearance, contact the project/task manager and/or site contact/property owner for further guidance and information.

9. Documentation

Once private utility locating personnel and one-call personnel have marked any utility lines in the vicinity of the work to be performed, document the markings for the project file. Documentation can include, but is not limited to:

- Photographs showing the markings and surrounding area,
- Field sketch of the vicinity including work locations and utility lines marked,
- Updating the area basemap (AutoCAD) with utility information, if necessary/possible,
- Private utility clearance report from the trained and licensed subcontractor,
- One-call ticket printout documenting the utilities contacted, etc.
- Shell Borehole Clearance form
- AECOM Procedure S3AM-331-PR1 Underground Utilities Checklist
- AECOM Procedure S3AM-302-PR1 Electrical Safety Checklist

Refer to SOP No. 8 Field Reporting and Documentation for further guidance. Documentation should be kept with the project file for future reference.

1. Objective

This document defines general standard operating procedure for investigation derived waste (IDW) handling. These procedures, in conjunction with client requirements, and local, state and federal regulations, shall be used to ensure that any residuals generated are managed in a safe and environmentally sound manner.

A variety of IDW related activities may require unearthing, moving, lifting, over packing, or sampling drums. Such activities are inherently hazardous and require special health and safety precautions.

2. Other SOPs Referenced in this SOP

- None

3. Equipment

Equipment used during field reporting/documentation and containerizing:

- Labels for IDW Container;
- Disposable latex or nitrile gloves;
- Assorted tools (knife, screwdriver, crescent wrench, (15/16") socket and drive, non-sparking bung wrench, etc.)
- Drum funnel
- Plastic sheeting (if applicable)

4. General Information

Prior to beginning work that will generate IDW, identify the proper containers and staging area for IDW. Also coordinate with the Site IDW Coordinator to ensure proper characterization of the IDW generated.

Potential IDW Materials include, but are not limited to, the following:

- Purged groundwater from sampling activities (purgewater)
- System water
- Soil cuttings (from drilling, vacuum excavation, trenching, etc.)

- Recovered LNAPL
- Absorbent materials
- Spent carbon
- Decontamination liquids (wash/rinse water)
- Residual solids from system cleaning/maintenance

IDW containers should be:

- Compatible with the waste to be contained
- Labeled appropriately
- In good condition and managed to prevent rupture
- Closed unless actively adding/removing material

Staging Areas where IDW may be stored are:

A. Central Accumulation Area

- Secure storage area
- No limit to the volume staged
- Aisle space
- 90-day storage time limit
- Weekly inspections required

B. Satellite Accumulation Area

- Located at or near the point of generation and under the control of the operator
- Volume less than or equal to 55-gallons

Labels

- Select proper label for the containerized material (hazardous, non-hazardous, waste material [characterization pending analytical], universal waste, flammable material, etc.)
- Date of Accumulation
- Waste Codes (if applicable)
- Container ID

- Generator information
- Material Description or Proper Shipping Name

Characterization

There are two methods in which IDW may be characterized:

- Generator Knowledge
    - The same residual has been generated by the same process before and nothing has changed in the process or the residual.
- Laboratory Analysis
    - A sample is collected and sent to a laboratory to evaluate proper characterization or to confirm prior characterization of a generated residual.

5. IDW Handling

Note that expendable materials (e.g., disposable sampling equipment such as gloves and tubing) can be decontaminated, if necessary, collected in trash bags, and disposed as municipal waste. Decontamination of expendables materials may be necessary if it came into contact with hazardous waste.

A. Always wear proper nitrile, or other specific to chemical of concern, gloves while collecting and containerizing IDW.

B. Use a funnel when transferring liquid IDW into a closed-top drum.

C. Use plastic sheeting when transferring IDW into a container by dumping/pouring.

D. Ensure a spill kit is readily available near IDW containers.

E. Containers holding liquids shall have secondary containment.

F. When filling drums, leave open space at the top in order to accommodate expansion if freezing occurs. Leave at least 4 inches of open space.

G. Ensure containers are closed at all times, unless actively adding or removing waste.

H. Once a new container is started and labeled, take a photo of the label and send to the Site IDW Coordinator.

I. When a container is full and/or the task generating the IDW is completed, notify the Site IDW Coordinator so that proper transportation/disposal can be arranged.

a. Transportation and disposal of IDW is performed by properly trained/licensed/permitted companies/facilities.

J. Be familiar with the Site Contingency Plan for emergencies related to IDW, and with the Site/Task Health and Safety Plan.

Refer to the client requirements, and local/state/federal regulations for additional information (Title 35 Ill. Adm. Code, Parts 700-739).

1. Objective

The purpose of this Standard Operating Procedure (SOP) is to define the standard protocols for sample containers, preservation and hold times for Shell projects in Hartford and Roxana, Illinois. This SOP serves as a supplement to information which might be in a project Work Plan or scope of work and is intended to be used together with other SOPs.

2. Other SOPs referenced in this SOP

- SOP No. 24 Sample Classification, Packaging and Shipping

3. Equipment

The following equipment is typically required for this SOP:

- Waterproof coolers (hard plastic or metal)
- Custody seals
- Field forms such as Chain of Custody (COC) or sample collection sheet
- Field notebook
- Ice
- Bubble wrap, and/or protective foam pack
- Clear packing tape
- Re-sealable storage bags
- Sample containers and labels
- Waterproof pen
- Permanent marker
- Nitrile gloves, or similar
- Trash bags, or laboratory provided cooler lining bags

4. Sample Containers

Certified commercially clean sample containers will be obtained from the contract analytical laboratory. The lab will indicate the type of sample to be collected in each bottle type, and the preservative (if applicable) of each bottle. The work plan may list the appropriate sample containers for the specific analyses required for each project.

5. Sample Preservation

Samples will be preserved prior to, or at the time of the sample collection, if applicable. Chemical preservatives, if necessary, are typically added to the sample containers by the laboratory prior to shipment to the field. In some cases, preservatives may be added to the sample containers in the field by sampling personnel.

After sample collection, each container will be labeled and stored on ice at ≤6°C in an insulated cooler until packed for shipment to the laboratory. The ice or samples will be bagged per laboratory specific requirements. Freezing samples will not be permitted. Any breakable sample bottles need to be wrapped in protective packing material (e.g., bubble wrap, protective foam pack) to prevent breakage during shipping. Refer to SOP No. 24 Sample Classification, Packaging and Shipping for additional information.

6. Sample Hold Times

Samples will be hand delivered or shipped via overnight express carrier for delivery to the analytical laboratory. All samples must be shipped for laboratory receipt and analyses as soon as possible and within specific holding times. This may require daily shipment of samples with short holding times. The hold time varies for each type of analysis, and therefore, it will be necessary to check with the lab to verify the hold times to determine how frequently samples need to be sent to the lab. Typical soil and groundwater sample hold times are provided in **Table 1**. Holding times for soil vapor samples will be no more than 30 days for Summa canisters and no more than 48 hours for Tedlar bags.

Table 1 Typical Sample Holding Times & Preservation

Analysis	Holding Time	Preservation
Alkalinity	14 days	Cool to ≤6°C
Ammonia NH3	28 days	Cool to ≤6°C - H2SO4 to pH<2
Asbestos	1 year	None
BOD 5	48 hours	Cool to ≤6°C
BOD 5 Inhibited	48 hours	Cool to ≤6°C
BTEX	14 days	Cool to≤6°C; HCl
Chloride	28 days	Cool to ≤6°C
Chlorophyll	24 hrs to filtration - 28 days after filtration	Freeze filters in 90% acetone
Chromium VI (Hexavalent) in water	24 hours	Cool to ≤6°C
COD	28 days	Cool to ≤6°C - H2SO4 to pH<2
Conductivity	28 days	Cool to ≤6°C
Cyanide in Soil	14 days	Cool to ≤6°C

Table 1 Typical Sample Holding Times & Preservation

Analysis	Holding Time	Preservation
Cyanide in Water	14 days	Cool to ≤6°C NaOH to pH>12; 0.6 g ascorbic acid
EDB/DBCP	14 days	Cool to≤6°C; pH<2 (zero headspace)
Fluoride in Soil	28 days	Cool to ≤6°C
Fluoride in Water	28 days	Cool to ≤6°C
Grain Size Sediment	6 months	None required
Guaiacols/Catechols/Phenols	30 days	Cool to≤6°C; H2SO4 to pH<2
Halogenated Hydrocarbons HH	7 days water/14 days soil	Cool to ≤6°C
Hardness	6 months	HNO3 to pH<2
Herbicides	7 days water/14 days soil	Cool to ≤6°C
Hydrocarbon chlorinated	7 days water/14 days soil	Cool to ≤6°C Ascorbic acid
Ignitability	None	Cool to ≤6°C
Iron and sulfur bacteria	6 hours	Cool to≤6°C; 0.008% Sodium Thiosulfate
Mercury in Water	28 days	Cool to≤6°C; HNO3 to pH<2
Metals -- Except Cr(6) and Hg	180 days	HNO3 to pH <2
Metals, dissolved	6 months	Filter - then add HNO3 to pH<2
Nitrate NO3-	48 hours	Cool to ≤6°C
Nitrate-Nitrite	28 days	Cool to≤6°C; H2SO4 to pH<2
Nitrite NO2-	48 hours	Cool to ≤6°C
Nitrogen Pesticides	7 days water/14 days soil	Cool to ≤6°C
TPH DRO/ORO	7 days water/14 days soil	Cool to ≤6°C
TPH GRO	14/14 days	Cool to ≤6°C pH<2 (zero headspace)
Oil & Grease in Water	28 days	Cool to≤6°C; HCl to pH<2
Oil and Grease in Soil	28 days	Cool to ≤6°C
PAH Hazardous Waste Designation w/o HPLC	7 days water/14 days soil	Cool to ≤6°C
PAH Polynuclear Aromatic Hydrocarbons	7 days water/14 days soil	Cool to ≤6°C
PCBs only	7 days water/14 days soil	Cool to ≤6°C
Percent Solids Soil/Tissue	7 days	Cool to ≤6°C
Personal Monitors	None	None
Pesticides/PCBs	7 days water/14 days soil	Cool to ≤6°C
pH	24 hours	Cool to ≤6°C
Phenolics in Soil (4AAP)	28 days	Cool to ≤6°C
Phenolics in Water (4AAP)	28 days	Cool to≤6°C; H3PO4; FeSO4 and CuSO4

Table 1 Typical Sample Holding Times & Preservation

Analysis	Holding Time	Preservation
Phosphorus, Total and Dissolved	28 days	Cool to≤6°C; H2SO4 to pH<2
PM10	1 year	Cool to ≤6°C
PM2.5	30 days	Cool to ≤6°C
Semivolatile Organics /SVOCs	7 days water/14 days soil	Cool to ≤6°C
Settleable Solids (SS)	48 hours	Cool to ≤6°C
Specific conductance	28 days	Cool to ≤6°C
Sulfate	28 days	Cool to ≤6°C
Sulfide	7 days	Zinc acetate; NaOH to pH>9
TOC in Soil	28 days	Cool to ≤6°C
TOC in Water	28 days	Cool to≤6°C; H2SO4 to pH<2
Total Dissolved Solids (TDS)	7 days	Cool to ≤6°C
Total Kjeldahl Nitrogen (TKN)	28 days	Cool to≤6°C; H2SO4 to pH<2
Total Non-Volatile Solids (TNVS)	7 days	Cool to ≤6°C
Total Non-Volatile Suspended Solids (TNVSS)	7 days	Cool to ≤6°C
Total Persulfate Nitrogen (TPN)	28 days	Cool to≤6°C; H2SO4 to pH<2
Total Solids (TS)	7 days	Cool to ≤6°C
Total Suspended (TSS)	7 days	Cool to ≤6°C
Total Volatile Solids (TVS)	7 days	Cool to ≤6°C
Tributyl tin	7 days water/14 days soil	Cool to ≤6°C
Turbidity	48 hours	Cool to ≤6°C
Volatile Organics/VOCs	7 days water/14 days soil	Cool to≤6°C; HCl to pH<2 (zero headspace)

1. Objective

The purpose of this Standard Operating Procedures (SOP) is to define the standard procedure SOP and necessary equipment for collection of soil vapor samples from vapor monitoring points / sampling ports using stainless steel canisters for Shell projects in Hartford and Roxana, Illinois. This SOP serves as a supplement to information which might be in a project Work Plan and is intended to be used together with other SOPs.

2. Other SOPs referenced in this SOP:

- SOP No. 4 Decontamination
- SOP No. 26 Sample Control and Custody Procedures
- SOP No. 51 Vapor Sampling Classification, Packaging and Shipping
- SOP No. 52 Soil Vapor Field Lab Screening

3. Equipment

The following equipment is typically needed:

- Logbook
- Disposable nitrile gloves
- Cut resistant gloves
- Ultra-fine permanent marker
- Paper towels
- Decontamination equipment
- Soil vapor sampling field sheets and/or field computer
- Small brush or broom
- Charcoal filter
- 15 mL hand pump
- 60 mL syringe or equivalent
- Peristaltic pump with battery
- Rotameter or equivalent
- Photoionization Detector (PID) (e.g., RAE Instruments MultiRAE or equivalent)

- Flame Ionization Detector (FID) (e.g., Thermo Scientific TVA-2020 or equivalent)
- Lower Explosive Limit (LEL) meter (e.g., RAE Instruments MultiRAE or equivalent)
- Landfill gas detector (e.g., Landtec GEM-2000 or equivalent)
- Stainless steel canisters with flow controllers (supplied by the laboratory)
- 1-Liter Tedlar® bags (new or decontaminated as outlined in SOP No. 4 Decontamination) – 2 per sample
- Black trash bag for storing Tedlar® bag samples
- Bentonite grout
- Foam padding for shroud-ground seal
- Sample train assembly (configuration and parts shown on **Figure 1**)
- Vacuum gauge (0 – 30 inches Hg)
- Teflon® tubing (laboratory-grade) – 1/8" ID – ¼" OD
- Tygon® tubing (laboratory-grade) – 3/16" ID – 3/8" OD
- Tracer gas (e.g., Grade 5 helium)
- Tracer gas shroud (e.g., plastic tote)
- Tracer gas meter (e.g., Dielectric Technologies MGD-2002 or equivalent)
- Watch or timer
- Fully stocked toolbox
  - Ratchet set (**$^{1}/_{2}$, $^{9}/_{16}$, $^{5}/_{8}$, $^{3}/_{4}$, $^{7}/_{8}$, $^{15}/_{16}$**)
    - Safety cutting tools
    - Rubber mallet
    - Wire brush
    - Pry bar
    - Wrenches (7/16, ½, 9/16, 5/8)
- Bilge pump for removing water from vaults
- Shipping supplies (e.g., UN boxes, shipping labels, hazard labels, packing tape)

4. Vapor Port Development Purging

If the port has been newly installed, the port must be developed by purging 3 volumes of the sampling assembly including 3 volumes of the sand pack. If development is not required, proceed to **Section 4** or **Section 5** below for the appropriate sampling procedures

1. Open vapor point vault to check integrity of individual soil vapor monitoring port(s) (VMP). Each port shall have a hose barb connected to a 3-way polycarbonate stopcock (3-way) using silicone tubing. The 3-way shall be in the "off" position.
2. Connect peristaltic pump and Tygon tubing connected to the 3-way.
3. Connect charcoal filter exhaust to the discharge end of the tubing assembly.
4. Calculate Purge volume:
    - Vapor Port tubing (1/8-in diameter): 2.41 mL/foot (single volume)
    - Sample train assembly / Tygon® tubing (1/4-in diameter): 9.65 mL/foot (single volume)
    - Sand Pack: 18,765 mL (4.95 gallons – single volume – assuming 18-inch-thick sand pack)
5. Open 3-way and begin purging port at a rate no greater than 200 mL/min. Document time started.
6. Once 3 volumes are reached, stop pump and close 3-way. Document time stopped.
7. Move to next depth or replace vault cover and clean up at location.

5. Vapor Port Sampling – With Tracer Gas Shroud

1. When conducting soil vapor purging and sampling, no soil vapor sampling should take place within 48 hrs after a rainfall event of ½ inch or greater and in standing or ponded water areas. Additionally, soil vapor samples should be collected from a depth of at least 3 ft below the ground surface or building foundation, but above the capillary fringe soil layer located 14.75 in (37.5 cm) above the top of groundwater, when conducting soil vapor purging and sampling.Set up at VMP. Turn off vehicle. If vehicle will be left running per health and safety procedures, prevent sample and sample media from being exposed to vehicle exhaust.
2. Open vapor point vault to check integrity of individual VMP(s). Each port shall have a hose barb fitting connected to a 3-way valve using silicone tubing. The 3-way shall be in the "off" position.
3. Perform stainless steel canister vacuum check, per the steps listed in **Section 6** of this SOP.

4. Remove hose barb fitting from port and set up the sample assembly using the configuration shown in **Figure 3**. The flow controller (one for each stainless-steel canister provided by the laboratory) shall be connected to the stainless-steel canister inlet. Do not re-use flow controllers between samples. Flow controllers can be set to different rates as specified by the project work plan, depending on size of container to be filled. For a 1-Liter stainless steel canister, approximately 5 minutes is a standard collection time (~167 ml/min). Flow rate should not exceed 200 mL/min.
5. Perform sample train leak check, per the steps listed in **Section 6** of this SOP.
6. Calculate Purge volume:
    - Vapor Port tubing (1/8-in diameter): 2.41 mL/foot (single volume)
    - Sample train assembly (1/4-in diameter): 9.65 mL/foot (single volume)
7. Purge the three volumes from the vapor monitoring port purge using the 60 mL syringe. If pullback is observed on the 60 mL syringe and the purge cannot be completed, the VMP screen may be saturated with water and will not yield a representative sample. If this happens, do not sample the VMP. Similarly, if water or LNAPL is observed in the syringe during the purge, do not sample the VMP. Record purge results in field computer and on sample sheets.
8. Remove the 3-way and connect the sample train to the VMP using Swagelok® fittings.
9. Open Port Valve and Valve #1. Use 60 mL syringe to purge 30 mL (approximately three times the volume of the sample train assembly).
10. Close Valve #1.
11. Place an enclosure shroud over the VMP and assembled sample train as shown in **Figure 3**. The shroud shall have openings for:
    - Introduction of tracer gas;
    - Pressure relief to the atmosphere and access of a tracer gas monitoring device;
    - Tygon tubing to connect to the peristaltic pump for Valve #1

    The shroud shall have sufficient glove access to open or close all valves within. As shown in **Figure 3**, the shroud must also be sealed to the ground with hydrated bentonite (or equivalent) or foam padding.
12. Introduce tracer gas into the shroud at a known rate until the atmosphere within the shroud contains a sufficient quantity (typically 20% to 50%) of tracer gas.

13. Connect peristaltic pump to Valve #1 using Tygon tubing, open Valve #1, and collect sample bag #1. The sample bag shall be filled at a rate no greater than 200 mL/min.
14. Close Valve #1.
15. From the soil vapor in Tedlar® sample bag #1, obtain readings for tracer gas with tracer gas detector. If tracer gas readings are elevated, analyze sample bag #1 using a landfill gas detector to obtain a direct methane reading. See **Section 6** for acceptance criteria.
16. Open stainless-steel canister valve completely and record the time in field computer or on sample sheets.
17. Allow the canister to fill until the vacuum gauge reads between -5 and -10 inches Hg; however, an ideal sample shall have approximately -5 inches Hg remaining after sampling is complete. When ambient temperatures are below freezing, close canister valve when the vacuum gauge reading is -8 inches Hg[1]. For a 1-Liter canister, filling shall take approximately 5 minutes but may require more or less time depending on formation materials.[2] If the vacuum gauge reading drops below -5 inches Hg before approximately 5 minutes, close the stainless-steel canister valve completely. Record the time in the field computer and on sample sheets. Record the concentration of tracer gas within the shroud after closing the canister valve.
18. Connect peristaltic pump to tubing connected to Valve #1 and open Valve #1 to collect sample bag #2. The sample bag shall be filled at a rate no greater than 200 mL/min.
19. Break seal on the shroud and disconnect flow controller, stainless steel canister, and used tubing from sample assembly.
20. From the soil vapor in sample bag #2 obtain readings for total volatile organics with a PID, for CO_2, CH_4, LEL, and oxygen (O_2) with a landfill gas detector, and for tracer gas concentration with the tracer gas detector. See **Section 6** for acceptance criteria. Record readings in field computer or on field sheets. If FID or PID is not on-site, label and retain Tedlar® sample bag #2 for reading at field trailer. Tedlar® sample screening shall be performed in accordance with SOP No. 52 Soil Vapor Field Lab Screening.

[1]Sample will undergo thermal expansion (some loss of vacuum) when moved from a cold outdoor setting to a warmer indoor setting. By closing the canister valve at -8 inches Hg, the sample will be able to undergo thermal expansion without reaching 0 inches Hg. The larger the difference between outdoor and indoor temperatures, the greater the loss of vacuum.

[2]Other sized canisters will take different amounts of time to sufficiently fill.

21. Perform stainless steel canister vacuum check, per the steps listed in **Section 6** of this SOP.
22. Disconnect the sample train from the VMP and reconnect the 3-way.
23. Move to next depth or replace vault cover and clean up at location.
24. Decontaminate any non-designated equipment (e.g., sample assembly) following procedures listed in **Section 7**.

6. Quality Control

Quality control procedures have been developed to verify equipment integrity, sample quality, and sample repeatability.

In addition to the procedures listed below, the following items are also of concern:

- Care shall be taken to keep all sampling equipment, especially the stainless-steel canisters, safe from damage.
- No samples are to be collected in an area where vehicle or other equipment exhaust is being discharged. Do not place samples or sample media directly on asphalt, gravel, or other ground surfaces.

Field Duplicates

A field duplicate shall be collected for 10% of the samples collected.

Field duplicates are collected by using a sample assembly with an additional 3-way union. A stainless-steel canister with a flow controller is attached to each of the 3-way unions on the assembly. For sampling, both stainless steel canister valves shall be opened and closed simultaneously. Use the appropriate procedure described above to collect samples.

Stainless Steel Canister Vacuum Check

The stainless-steel canister vacuum check shall be performed for 100% of the stainless-steel canisters.

Prior to Sampling

1. Remove brass cap from stainless steel canister. Brass cap will not be present if canister is configured with quick connect fitting.
2. Attach the pressure gauge provided by the laboratory to the stainless-steel canister inlet.
3. Open valve one-half turn, then close valve.
4. Record reading on the canister tag. If the canister does not show a vacuum or shows a vacuum of less than -26 inches Hg, then:

- Label the canister tag with "Insufficient vacuum – No Sample";
- Set canister aside for return to the laboratory;
- Record canister ID number to share with task manager and lab coordinator; and
- Contact task manager and lab coordinator if number of canister failures affect field work.

5. Make sure valve is closed tight, but not overtight.
6. Remove the pressure gauge.
7. If not immediately using the stainless-steel canister for sample, place and tighten brass cap on stainless steel canister (not applicable if canister is configured with quick connect fitting).

After Sampling

1. Attach the pressure gauge provided by the laboratory to the stainless-steel canister inlet.
2. Open valve one-half turn, then close valve.
3. Record reading. There shall still be a vacuum in the stainless-steel canister. The final vacuum on the canister shall be between -10 inches of Hg to -2 inches of Hg. If the final vacuum does not fall within this range, contact the task manager immediately to determine the value of using another stainless-steel canister to recollect the sample.
4. Make sure valve is closed tight, but not overtight.
5. Remove the pressure gauge.
6. Place and tighten brass cap on stainless steel canister (not applicable if canister is configured with quick connect fitting).

Sample Train Vacuum Leak Check

The sample train leak check shall be performed for 100% of the samples collected.

1. Assemble the sampling apparatus as shown in **Figure 1**.
2. Keep the stainless-steel canister closed, and Valve #1 in the "open" position.
3. Attach the 15 mL hand pump to sample train at Valve #1.
4. Withdraw air from the sampling apparatus until a vacuum between 20 and 25 inches Hg is achieved. Close Valve #1. Use flow controller's built-in vacuum gauge to observe the induced vacuum for at least five minutes. If the flow controller's vacuum gauge does not function properly, notify the task manager.

5. If the change in vacuum over five minutes is equal to or less than 0.5 inches Hg, the system leak rate is acceptable.
6. If the change in vacuum over five minutes is greater than 0.5 inches Hg, check, tighten or replace the fittings and connections and repeat the leak check.

Tracer Gas Check

Soil vapor samples shall be collected using a tracer gas, as per the project work plan or activity plan.

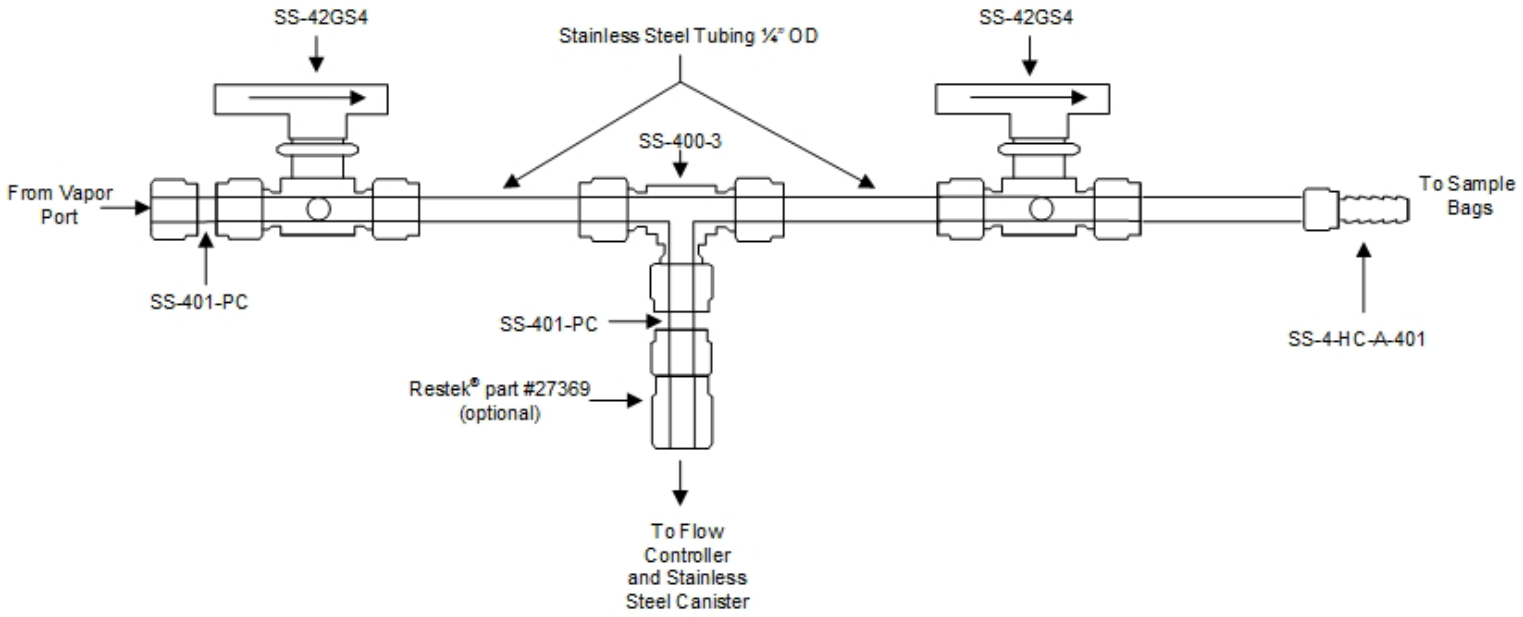
1. Tracer gas shall be introduced near the VMP to test the integrity of the probe seal and the above ground connections.
2. Collect the soil vapor sample per procedures in **Section 5**.
3. If the concentration of the tracer gas in a sample is ≤10% of the concentration of the tracer gas in the shroud:
    - Prior to stainless steel canister sampling: continue with sample collection.
    - Following stainless steel canister sampling: the sample is acceptable.
4. If the concentration of the tracer gas in the sample is >10% of the concentration of the tracer gas in the shroud:
    - Prior to stainless steel canister sampling: check methane levels.
        - If methane reading ≥2%, continue with sample collection.
        - If methane reading ≤2%, stop sample collection. Check fittings and valves before restarting sample collection.
    - Following stainless steel canister sampling: check methane levels.
        - If methane reading ≥2%, the results may be biased high by methane. Call task manager to discuss.
        - If methane reading <2%, sample likely compromised; do not use sample. Call task manager to inform of need for re-sample.
    - If a sample is found to be compromised, 2 additional attempts (3 attempts total) shall be made to collect a sample.
        - With each additional attempt, check stainless-steel tubing and fittings for holes and loose connections, and place an additional layer of bentonite seal in the interior of the well vault.
        - After 3 attempts, if a successful sample has not been collected, the VMP shall not be sampled for that quarter.

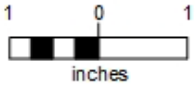
7. Decontamination

- Non-designated stainless-steel assemblies shall be thoroughly decontaminated by purging with at least half a liter of air (e.g., with hand pump or peristaltic pump).
- If a stainless-steel assembly comes into contact with groundwater, it shall be decontaminated using a Liquinox® detergent wash followed by a distilled water rinse. Discuss with task manager before re-using the assembly.
- If a stainless-steel assembly comes into contact with LNAPL, immediately call task manager and segregate the contaminated components from other sample media.
- Multiple stainless-steel assemblies shall be available to sample crews to allow for equipment to be cleaned and dried sufficiently before being reused.
- Tedlar® bags may be decontaminated if it meets the criteria listed in SOP No. 4 Decontamination.

8. Shipping

- Sample information shall be recorded on a chain of custody for the laboratory following procedures outlined in SOP No. 26 Sample Control and Custody Procedures.
- Samples shall be shipped to the laboratory following DOT regulations. If there is the possibility that samples may be classified as hazardous, samples must be shipped as such. For procedures, see SOP No. 51 Vapor Sampling Classification, Packaging and Shipping, and check with one of the office hazardous shipping personnel.

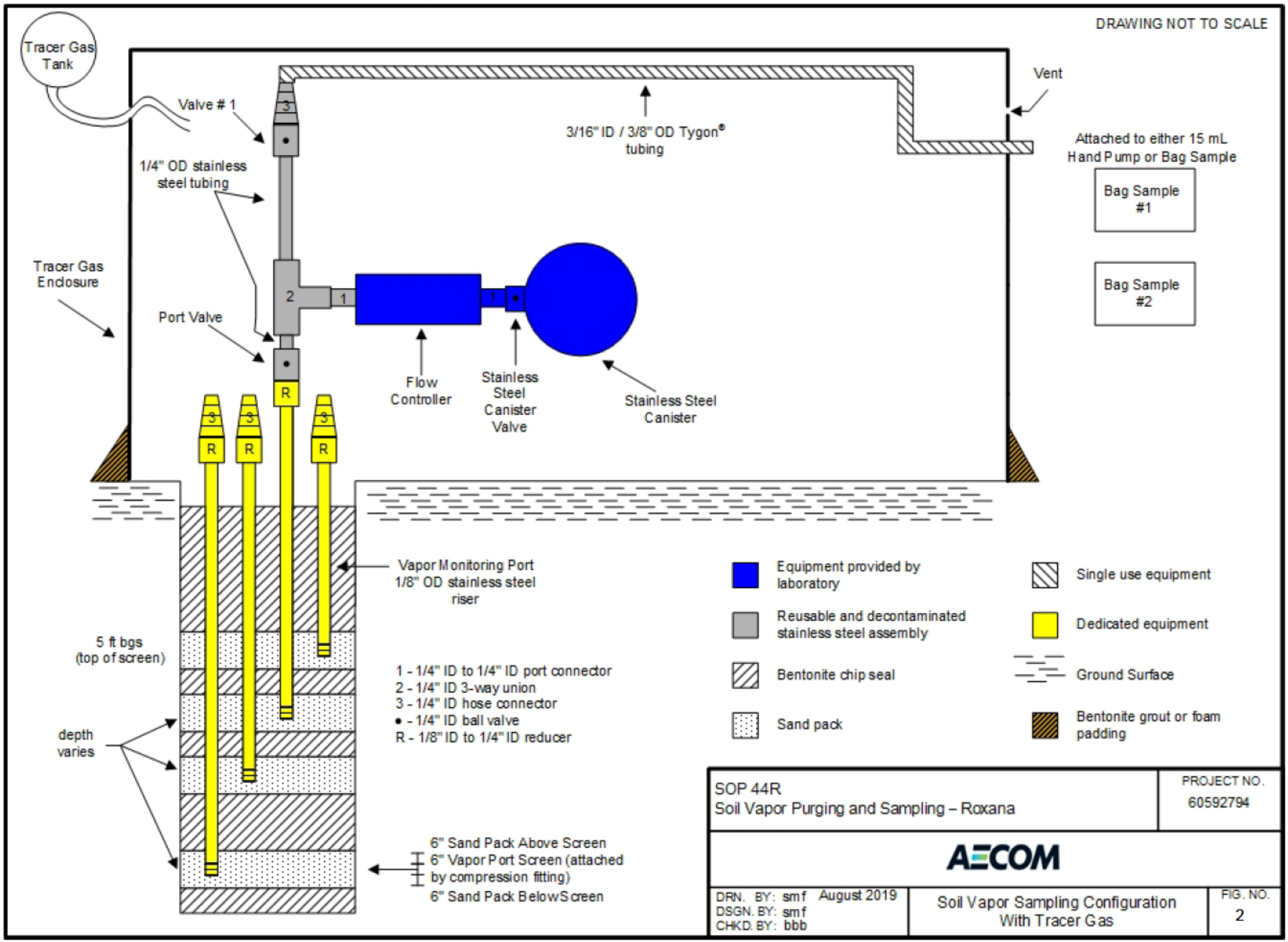




Notes:
1) All components listed with Swagelok® part numbers (if applicable).
2) All components made by Swagelok® unless otherwise noted.
3) Assembly shown for standard sample.
4) Duplicate assembly includes an additional 3-way union between the two shown.
5) All fittings shown are compression fittings with SS-400-Set ferules and SS-402-1 nuts.
6) Restek® part #27369 is a female quick connect fitting that may be used to connect sampling assembly to flow controller when flow controller is outfitted with accompanying Restek® part #27373 (male quick connect fitting).

Source: https://swagelok.com/products.aspx; Accessed June 13, 2019.
Source: https://www.restek.com/catalog/view/53581; Accessed June 13, 2019.

SOP 44R Soil Vapor Purging and Sampling – Roxana		PROJECT NO. 60592794
AECOM		
DRN. BY: smf August 2019 DSGN. BY: smf CHKD. BY: bbb	Soil Vapor Sampling Assembly	FIG. NO. 1


DRAWING NOT TO SCALE
Tracer Gas Tank
Valve # 1
1/4" OD stainless steel tubing
3/16" ID / 3/8" OD Tygon® tubing
Vent
Attached to either 15 mL Hand Pump or Bag Sample
Bag Sample #1
Bag Sample #2
Tracer Gas Enclosure
Port Valve
Flow Controller
Stainless Steel Canister Valve
Stainless Steel Canister
Vapor Monitoring Port 1/8" OD stainless steel riser
5 ft bgs (top of screen)
depth varies
1 - 1/4" ID to 1/4" ID port connector
2 - 1/4" ID 3-way union
3 - 1/4" ID hose connector
• - 1/4" ID ball valve
R - 1/8" ID to 1/4" ID reducer
6" Sand Pack Above Screen
6" Vapor Port Screen (attached by compression fitting)
6" Sand Pack Below Screen
Equipment provided by laboratory
Reusable and decontaminated stainless steel assembly
Bentonite chip seal
Sand pack
Single use equipment
Dedicated equipment
Ground Surface
Bentonite grout or foam padding
SOP 44R
Soil Vapor Purging and Sampling – Roxana
PROJECT NO.
60592794
AECOM
DRN. BY: smf August 2019
DSGN. BY: smf
CHKD. BY: bbb
Soil Vapor Sampling Configuration With Tracer Gas
FIG. NO.
2