Voluntary Remediation Investigation Plan – Addendum 1

Former Square D Site
252 N. Tippecanoe Street Peru, IN

IDEM VRP #6211202

1 July 2022

Project No.: 0685236

The business of sustainability

ERM

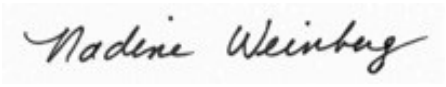
Signature Page

1 July 2022

Voluntary Remediation Investigation Plan – Addendum 1

Former Square D Site
252 N. Tippecanoe Street Peru, IN

IDEM VRP #6211202



Nadine Weinberg
Partner in Charge

Aaron Friedrich, LPG (IN #2254)
Principal Consultant

ERM, INC.

8425 Woodfield Crossing Boulevard, Suite 560-W

Indianapolis, Indiana 46240

CONTENTS

1. INTRODUCTION

On behalf of Schneider Electric Systems USA, Inc. (Schneider Electric), Environmental Resources Management (ERM) has prepared this Voluntary Remediation Investigation Plan – Addendum 1 (hereinafter the "Addendum 1"). The purpose of this Addendum 1 is to describe additional appropriate approaches and methodologies to further characterize Release-Related Chemicals (RRCs) in soil gas and groundwater originating from the former Square D site located at 252 North Tippecanoe Street in Peru, Indiana ("the Site"). This project is being conducted with oversight from the Indiana Department of Environmental Management's (IDEM's) Voluntary Remediation Program (VRP) and has been assigned IDEM reference identification VRP #6211202.

Schneider Electric is undertaking the scope of work presented herein in a voluntary manner consistent with the approved methods outlined in IDEM's Remediation Closure Guide (RCG) dated 2012 and the pending Risk-based Closure Guide (2022). Prior to this submittal, ERM has transmitted two key documents as follows:

- *Voluntary Remediation Investigation Plan (VRIP)* - summarized initial off-Site investigation activities southeast of Plant 1 on the Norfolk Southern Railroad (NSR) property bordering the east side of the Site as well as the 9th and Denver Street Rights of Way. The VRIP was transmitted to the IDEM VRP on April 15, 2022.
- *Site Investigation Report (SIR)* - summarized the on-Site soil, soil gas, and groundwater investigation activities and Conceptual Site Model (CSM) that led to the development of the VRIP. The SIR was transmitted to the IDEM VRP on April 22, 2022.

The VRIP and the SIR can be found on IDEM's Virtual Filing Cabinet (VFC) under documents #83303704 and #83311535, respectively.

The VRIP documented the following:

- Summary of on-Site geology and hydrogeology
- List of RRCs and description of areas where their adequate characterization could not be completed on-Site (serving as the basis for the off-Site-focused VRIP)
- Specific proposed sampling locations
- Health and Safety Plan
- Schedule of Activities
- Description of investigative procedures including:
  - Membrane Interface probe/Hydraulic Profiling Tool (MIHPT) borings
  - Soil boring advancement, soil sampling, and monitoring well installation via rotary sonic drilling in overburden and bedrock
  - Soil gas probe installation via Geoprobe direct push technology or via hand auger
  - Grab and monitoring well groundwater sampling
  - Waterloo Advanced Profiling System (Waterloo^{APS})
  - Sub-Slab Soil Gas Port Installation and Sampling
  - Analytical methods and approaches
  - Other supporting Standard Operating Procedures (SOPs)

The VRIP contemplated that materially different techniques/methodologies might be required and necessitate an addendum. In that context, this Addendum 1 documents the following:

- Off-Site CSM and remaining data gaps
- Path forward including:
  - further off-Site soil gas and groundwater characterization
  - Vapor Intrusion (VI) evaluation
- Data management and quality objectives
- Schedule of Activities
- Standard operating procedures for:
  - Sub-Slab Soil Gas Probe Installation and Sampling
  - Soil Gas Probe Installation and Sampling
  - Indoor Air and Outdoor Ambient Air Sampling
  - Groundwater Sampling
  - Other supporting Standard Operating Procedures (SOPs)

2. PRELIMINARY OFF-SITE POTENTIAL VI CSM

The SIR submitted to IDEM in April 2022 presents the CSM of the on-Site geology and hydrogeology. Following the completion of the initial, off-site investigation, an updated off-Site CSM related to the VI pathway is emerging based on observations as summarized below:

- Consistent with on-Site, the generalized off-Site geology from surface to depth includes anthropogenic fill/surface soils, floodplain clays, glacial outwash, and clay till overburden overlying limestone bedrock. Within the overburden deposits, the generally coarser glacial outwash has the greatest mass flux of RRCs in both soil gas and groundwater. Semi-continuous siltier strata within the glacial outwash are evident and likely impact contaminant transport including potentially limiting upward soil gas migration. Groundwater is generally encountered at a depth of 13 to 15 feet below ground surface (ft bgs) within the glacial outwash.
- Soil gas beyond the southeast side of the Site contains trichloroethene (TCE) concentrations above IDEM's 2022 residential soil gas Screening Levels (SLs). No other RRCs have been detected in off-Site soil gas at concentrations that exceed IDEM's residential soil gas SLs.
    - In shallow soil gas (i.e., less than 5 ft bgs), nine of 10 sample locations were below residential SLs with only one exceedance (950 ug/m^3) on the abutting NSR property (with samples below SLs approximately 15 feet to the north and south supporting the view of a localized bounded source).
    - In intermediate depth soil gas (i.e., generally between 5 to 6 ft bgs), eight of 10 sample locations were below residential SLs with only two exceedances (91 and 1,400 ug/m^3) on the NSR property (with samples below SLs approximately 15 feet to the north and south of both locations supporting the view of localized impacts). All three sample locations on Denver Street and all six locations on E 9th Street were below residential SLs.
    - In the deep interval (i.e., greater than 10 ft bgs), a soil gas plume (perhaps 120 ft wide) exceeding residential SLs (maximum of 2,400 ug/m^3) is evident on the NSR property. Though all three sample locations on Denver Street were below residential SLs in this interval, three of six locations on E 9th Street exceeded residential SLs (maximum of 410 ug/m^3).
    - *Soil gas exceeding residential SLs has not been adequately characterized south of E 9th Street or eastward towards N Water Street.*
- Shallow groundwater (i.e., at or near the water table, which has the potential to generate soil gas plumes far from the original source) beyond the southeast side of the Site contains primarily TCE (maximum of 1,300 ug/l) above IDEM's 2022 Tapwater SLs. Other RRCs that exceed Tapwater SLs in shallow groundwater include single occurrences of cis-1,2-dichloroethene (cDCE) and vinyl chloride (VC)[1]. Evaluation of shallow and deeper groundwater is ongoing; however, initial interpretation of migration pathways for RRCs in groundwater is unclear. Pathways are geologically-controlled and groundwater flow towards the south or east-northeast is possible and requires further evaluation.
    - *Groundwater exceeding residential SLs has not been adequately characterized south of E 9th Street or eastward towards N Water Street.*
- Though the on-Site soil gas plume is more related to the proximity to the original RRC source areas, the off-Site soil gas plume is coincident with the shallow groundwater plume. This is evidenced by the

[1] cDCE was detected at only one location in the core of the plume on the NSR property at 100 ug/l. VC was detected at only one location near the corner of E 9th St and N Water St at 3.5 ug/l.

relative lack of off-Site shallow and intermediate depth soil gas detections above SLs as compared to the deep interval near the water table.

- The relative absence of off-Site shallow and intermediate soil gas concentrations in excess of residential SLs (except for a few localized detections on the NSR property) is conspicuous in that it may suggest that soil gas is not migrating towards buildings.
  - *Though confirmation is warranted, a reasonable hypothesis is that a complete pathway for VI into nearby homes does not exist.*

A mitigating factor related to potential soil gas migration is the on-Site operation of Soil Vapor Extraction (SVE). The SVE system along the southeastern on-Site boundary inhibits potential soil gas migration off-Site as confirmed by vacuum measurements collected from soil gas probes during the off-site investigation work. The on-Site SVE system has operated as an interim remedial measure since September 2021.

3. PROPOSED PATH FORWARD

As noted in the prior section, three immediately evident *data gaps* have been identified off-Site along with the actions that will be implemented to address those gaps, as follows:

- *Soil gas exceeding residential SLs has not been adequately characterized south of E 9th Street or eastward towards N Water Street.*
  - Continued vertical profiling of soil gas and shallow groundwater (from which soil gas volatilizes) off-Site until the soil gas plume extent has been adequately characterized.
- *Groundwater exceeding residential SLs has not been adequately characterized south of E 9th Street or eastward towards N Water Street.*
  - Continued groundwater investigations in both overburden and bedrock until the groundwater plume extent has been adequately characterized.
- *Though confirmation is warranted, a reasonable hypothesis is that a complete pathway for VI into nearby homes does not exist.*
  - Complete VI evaluation at a single residence as an exemplar for potential VI in nearby homes.

3.1 Soil Gas Delineation

A Geoprobe direct push rig will be used to install depth-discrete soil gas sampling ports at the intermediate (5 to 6 ft bgs) and deep (>10 ft bgs) intervals. Samples will be collected into tedlar bags for analysis by EPA Method 8260 at a fixed laboratory. The SOPs for these approaches are as described in the VRIP.

The actual sample locations will be determined based on field decisions; however, Figure 1 highlights some preliminary sampling points as well as generalized areas of focus for further off-Site investigations until the soil gas plume is adequately characterized (note: which may require expansion of the investigation beyond those areas designated). The delineation will continue until the soil gas plume is adequately characterized.

3.2 Groundwater Delineation

The groundwater delineation will be completed using a combination of the following approaches:

1. Areal delineation of shallow (i.e., near water table) groundwater conditions using a Geoprobe direct push rig to collect grab samples.
2. Potential use of the Waterloo Advanced Profiling System (Waterloo^{APS}) depending on observed geologic conditions.
3. Soil boring advancement, soil sampling, and monitoring well installation via rotary sonic drilling in overburden and bedrock.

The SOPs for these approaches are as described in the VRIP. The sampling locations will be generally in the same areas as shown in Figure 1 though specific locations will be based on the results of the soil gas/shallow groundwater direct push assessment. The delineation will continue until the groundwater plume extent is adequately characterized.

3.3 VI Evaluation

A residential VI investigation will be conducted at the residence located at 220 East 9th St. Though the current hypothesis is that there is no complete VI pathway, confirmation is warranted. The proposed residence represents a potential worst case scenario in that it lies closest to the former Square D property. The residence is also an exemplar of other residences in the area in that it has both a basement and crawlspace (based on assessor records). The proposed, generalized approach to the off-Site residential VI sampling **(subject in each case to**

authorization by resident) has been prepared in consideration of IDEM's *Procedures for Gaining Access to Third Party Properties by Responsible Parties Performing Remediation (2015)* and is summarized below (additional details are provided in SOPs in the VRIP as well as in Appendix B of this Addendum 1):

1. Attempts will be made, coordinating with IDEM, to gain access to the property[2].
    - A letter of introduction will be sent first to schedule a phone call.
    - The phone call will allow for an initial explanation of the situation and answering of questions.
    - A meeting at the residence will be scheduled to explain in detail the proposed activities exterior and interior to the residence, understand any necessary accommodations, and answer any additional questions.
2. Upon finalization of the access agreement (if requested by owner) and mutually scheduling a site visit, an initial property inspection will be conducted to:
    - Complete residential property inspection checklist based on IDEM's template (Appendix A within this Addendum)
    - Obtain home construction layout drawings (if available),
    - Inspect and photograph the interior and exterior of the residential structure (focusing on baseline conditions, household chemical storage, preferential pathways),
    - Document potential indoor air background sources and complete an indoor air background checklist, and
    - Select basement sub-slab, crawlspace, and indoor air sampling locations.
3. VI sampling will occur as follows:
    - Exterior soil gas probes will be installed and sampled. ERM will install depth-discrete soil gas probes on each of the four sides of the residence. The depth intervals will include shallow (i.e., < 5 ft bgs), intermediate (i.e., 5 to 7 ft bgs) and deep (i.e., >10 ft bgs). A total of 12 exterior soil gas probes will be installed. ERM will attempt to install the soil gas probes using a slide hammer, percussion hammer-drill or hand auger. A Geoprobe direct push rig will be avoided but may become necessary if conditions prevent the use of a hammer-drill or hand auger.
    - Sub-slab soil gas probes (Vapor Pins) will be installed and sampled in the basement sub-slab in at least two locations and potentially more if preferential pathways are identified. Crawlspace samples will also be collected in at least two locations. Finally, indoor air samples will be collected in at least two locations (e.g., basement and main living floor).
    - Ambient air samples will be collected from at least two exterior locations contemporaneously with the interior samples.
    - All residential (i.e., interior and exterior) VI sampling will be collected using Summa canisters and analyzed for all RRCs by TO-15 method. QA/QC samples will be collected consistent with the QAPP transmitted with the SIR dated April 22, 2022 and will include leak testing and select duplicate samples.
    - All sampling ports will be left installed to allow for future sampling events (e.g., to confirm initial results if data discrepancies exist, or for confirmation of sub-slab, crawlspace, and interior sampling points during heating season).

[2] For the home located at 220 East 9th Street, this was procedure was circumvented when the owner's son contacted the City of Peru. The City of Peru subsequently referred the son to Schneider Electric personnel. A meeting with the homeowner at 220 East 9th Street occurred on 28 June 2022 with representatives of Schneider Electric.

4. At the conclusion of VI sampling, the grounds will be restored to original condition as best as possible, and an attempt will be made to caulk preferential pathways (e.g., basement floor cracks and utility cut-throughs) out of an abundance of caution. Post-activity photographs will be collected to document the property condition for comparison against the baseline photographs if necessary.

If the results of sampling confirm indoor air impacts, then mitigation measures will be considered (especially if TCE concentrations are greater than 10X the 2022 IDEM screening levels), designed, and implemented as appropriate. Also, sampling at additional nearby residences would be proposed as appropriate (i.e., driven by soil gas and groundwater data).

If the results of sampling confirm no indoor air impacts, then no additional residential sampling is proposed immediately (except perhaps heating season sampling at the original residence when appropriate) pending completion of the off-Site soil gas and groundwater plumes. Once all plumes are adequately characterized, Schneider Electric will discuss with IDEM appropriate next steps with respect to any additional residential sampling.

Based on the results of the exterior depth-discrete soil gas as well as indoor air sampling, a region-specific attenuation factor may be calculated based on actual data (rather than using default assumptions) to support a revised residential screening level for considering additional residential sampling. Though the VI evaluation procedures described above are potentially applicable to any residences (e.g., with various constructions - crawl spaces, basements, slab-on-grade, etc., but likely limiting to single samples for each sample type) where VI evaluation is appropriate, a modified approach may be appropriate after the initial residential sampling starting with exterior soil gas sampling only and applying screening levels adjusted based on site-specific attenuation factors. Interior sampling would only be conducted if the adjusted screening levels are exceeded in exterior soil gas. Such an approach would ensure protectiveness of human health while minimizing unnecessary intrusions into residences. If calculation of region- or site-specific attenuation factors are deemed appropriate, the specific calculation and approach will be documented in a future deliverable.

4. DATA MANAGEMENT AND QUALITY OBJECTIVES

Data generated in the field will be recorded in field logbooks and in ERM's database format through Equis Collect. Analytical data will be provided by the project laboratory in an electronic data deliverables (EDD) package that is compatible with the Equis format consistent with previous project work. The laboratory reports will be provided in a PDF format and will be submitted to IDEM.

Upon receipt of the analytical data, Schneider Electric will perform a standard validation to determine if the laboratory assigned the appropriate qualifiers to the analytical data in the database. The laboratory's QA/QC data package will also be evaluated for completeness.

5. SCHEDULE OF ACTIVITIES

Sampling and reporting activities will proceed on the following schedule and amended, if necessary, if certain homeowners are not amenable to this approach. Schneider Electric recognizes that not every homeowner will accept the approach below, and the schedule of activities can and will be adjusted and subsequently communicated to IDEM.

Task	Schedule
Conduct residential sampling	As soon as access can be obtained (likely July to August 2022 for initial round)
Continue offsite delineation of soil gas and groundwater impacts	Pending all approvals from City agencies (e.g., Streets, Utilities and Building Departments) (likely beginning July to August 2022)

FIGURE 1 PROPOSED INVESTIGATION LOCATION MAP

Legend

- Proposed Soil Gas and Shallow GW Location
- Location From Previous Investigation
- Potential Investigation Work Area
- Site Boundary

Note:
- Proposed boring spacing is approximately 100 feet

N

0 50 100 150 200
US Feet

Figure 1: Proposed Investigation Location Map
Schneider Electric
Peru, IN

The business of sustainability

ERM

APPENDIX A RESIDENTIAL PROPERTY INSPECTION CHECKLIST

Clear Form

Residential Property Inspection Checklist

Preparer's name: Date:

Preparer's affiliation: Phone #:

Site Name: Site #:

Property Address:

Weather Conditions

Temperature (°F): High Low

Wind (Speed/Direction):

Barometric Pressure:

Cloud Cover & Precipitation:

Precipitation 72 hours prior to sampling event (in):

Amount of precipitation during the sampling event (in):

Humidity (%)

Part I - Occupants

Name	Age	Address (Lot/Apt #)	Sex	Occupation

Part II - Building Characteristics

Building Type:

Residential - Single Family		Strip mall	
Multi-family residential		Commercial	
Office		Other (specify):	
Industrial			

Year Constructed:

Describe Building:

Sensitive Population (day care / nursing home / hospital / school / other):

If so, specify:

Windows and doors closed for the 24 hour period prior to and during sampling?

Number of floors at or above grade:

Number of floors below grade:

Specify (full basement / crawl space / slab on grade):

Depth of basement below grade surface (ft): Basement size (ft^2):

Basement floor construction:

☐ Concrete Basement ☐ Dirt Crawlspace ☐ Floating ☐ Stone Other:

Foundation walls: ☐ Poured concrete ☐ Cinder blocks ☐ Stone Other:

Residential Property Inspection Checklist

	Yes	No	Note
Basement sump present?			
Sump pump?			
Water in sump?			
Significant cracks present in basement floor?			
Significant cracks present in basement walls?			
Basement walls or floor sealed with waterproof paint or epoxy coatings?			
Whole house fan?			
Septic system?			
If so, is it used?			
Floor drains present?			
Utility fixtures (e.g. toilets, sinks) all have P-traps?			
If yes, is there water in the p-traps?			
What is the condition of the p-traps?			
Notes:			
Has the homeowner had any plumbing issues lately?			
If so, describe:			
Has the homeowner ever had sewer gas smells in their home?			
Irrigation/private well?			
If so, is it used?			
Sub-slab vapor/moisture barrier in place?			
Type:			

Type of ground cover outside of building:

☐ Grass ☐ Concrete ☐ Asphalt Other:

Type of heating system (check all that apply):

Hot air circulation		Steam radiation	
Heat pump		Electric baseboard	
Hot air radiation		Kerosene heater	
Hot water radiation		Other (specify):	
Wood			
Are any of these systems in use during the time of sampling?		☐ Yes ☐ No	

Type of ventilation system (check all that apply):

Central air conditioning		Bathroom ventilation fans	
Conditioning units		Outside air intake	
Mechanical fans		Other (specify):	
Kitchen range hood fan			
Are any of these systems in use during the time of sampling?		☐ Yes ☐ No	

Type of fuel utilized (check all that apply):

Natual gas		Coal	
Electric		Solar	
Fuel oil		Kerosene	
Wood		Other (specify):	

Residential Property Inspection Checklist

Part III - Outside Contaminant Sources

	Yes	No
Is there a contaminated site within 50ft (BTEX) or 100ft (chlorinated)?		

If yes:

Site Name: Site Number:

Other stationary sources nearby (gas station, emission stacks, etc.):

Heavy vehicular traffic nearby (or other mobile sources):

Part IV - Indoor Contaminant Sources

Identify all potential indoor sources found in the building (including attached garages), the location of the source (floor and room), and whether the item was removed from the building 48 hours prior to indoor air sampling event. Any ventilation implemented after removal of the items should be completed at least 24 hours prior to the commencement of the indoor air sampling event.

Potential Sources	Location	Removed (Y/N/NA)
Gasoline storage cans		
Gas-powered equipment		
Kerosene storage cans		
Paints/thinners/strippers		
Cleaning solvents		
Oven cleaners		
Carpet/upholstery cleaners		
Other house cleaning products		
Moth balls		
Polishes/waxes		
Insecticides		
Furniture/floor polish		
Nail polish/polish remover		
Hairspray		
Cologne/perfume		
Air fresheners		
Fuel tank (inside bldg)		
Wood Stove or fireplace		
New furniture/upholstry		
Hobbies - glues, paints, etc.		
Other		

Residential Property Inspection Checklist

Part V - Miscellaneous

	NA	Yes	No
Do any occupants of the building smoke:			
If yes, how often?			
Last time someone smoked in the building?			
Does the building have an attached garage?			
If so, is a car usually parked in the garage?			
Are gas-powered equipment or cans of gasoline/fuels stored in the garage?			
Do the occupants of the building have their clothes dry cleaned?			
If yes, how often:			
Do any of the occupants use solvents in work?			
If yes, what types of solvents are used?			
If yes, are their clothes washed at work?			
Have any pesticides/herbicides been applied around the building or in the yard?			
If so, when and which chemicals?			
Has there ever been a fire in the building?			
If yes, when?			
Has painting or staining been done in the building lately?			
If yes, when?			
If yes, where?			

Part VI - Sampling Information

Sample Technician:

Phone number:

Sample Source:

Indoor air	
Sub-slab	
Near slab soil gas	
Exterior soil gas	

Analytical Method:

TO-14A	
TO-15	
TO-15SIM	
Other (specify):	

Sample Type:

400 mL-1.0 L Summa Canister	
6.0 L Summa Canister	
Other (specify):	

Residential Property Inspection Checklist

Laboratory:

Total Samples

Sample location - Field Sample ID#

Sample location - Field Sample ID#

Sample location - Field Sample ID#

Sample location - Field Sample ID#

Sample location - Field Sample ID#

Sample location - Field Sample ID#

Sample location - Field Sample ID#

Sample location - Field Sample ID#

Sample location - Field Sample ID#

Sample location - Field Sample ID#

Sample location - Field Sample ID#

Provide Drawing of Building Structure & Sample Location(s) in Building:

Residential Property Inspection Checklist

Part VII - General Observations

Provide any information that may be pertinent to the sampling event and may assist in the data interpretation process:

Part VIII - Further Explanation

If any part of this checklist requires further explanation, please use the section below:

APPENDIX B STANDARD OPERATING PROCEDURES

Standard Operating Procedure #40
Groundwater Sampling (Micro-Purge Method)

This Standard Operating Procedure (SOP) details the procedures to be used to collect groundwater samples via the micro-purge method for laboratory analysis of site-specific compounds.

Sampling Equipment and Supplies

The following is a listing of equipment and supplies that will be used during sampling. Other unspecified equipment, where it is functionally equivalent, may also be used either in addition to or as a replacement for the following list.

- Site map with the locations of the monitoring wells marked and a table with the Geographic Position System (GPS) coordinates of each well.
- A copy of the Health and Safety Plan and a copy of the Quality Assurance Project Plan (QAPP).
- A down-hole bladder or centrifugal pump capable of producing variable flow between approximately 100 milliliters per minute (mL/min) and 2 gallons per minute (gpm).
- Stainless steel pipe or Teflon-lined discharge tubing.
- Teflon or stainless steel bailers (if needed).
- A water level meter.
- An in-line flow cell and water quality monitor capable of measuring dissolved oxygen, oxidation-reduction potential, turbidity, specific conductance, pH, and temperature.
- Containers to store the purged water.
- Disposable gloves.
- Laboratory-supplied containers and shipping coolers.
- Preservatives.
- Ice.
- Indelible-ink markers.
- Labels.
- Chain-of-custody form.
- Field notebook and pens.

Field Documentation

See SOP #110 of the QAPP for field documentation procedures.

Standard Operating Procedure #40
Groundwater Sampling (Micro-Purge Method)

Decontamination

Perform sampling equipment and instrument decontamination as indicated in the HASP.

Sampling Equipment and Instrument Testing and Inspection

Perform sampling equipment and instrument testing and inspection as indicated in SOP #100.

Static Water Level Measurement

- Collect static groundwater levels at the wells no sooner than 48-hours after their initial development to ensure that the final set of measurements is representative of equilibrium conditions (quasi-static water levels).
- Obtain static groundwater levels before sampling any of the monitoring wells. Obtain static groundwater levels from all the monitoring wells at the site in as short a time-span as possible; preferably within one day.
- Unlock the wells and remove the expandable pressure cap.
- Record in the field notebook whether the well was under a positive or negative pressure when the cap was removed, and if any was observed, allow the pressure to equilibrate for approximately 20 minutes before gauging the depth to water.
- Take the water level measurements by slowly lowering the meter tip and tape into the monitoring well until the buzzer and the light signal that liquid has been reached. Establish the water level measurement relative to the measuring point on the monitoring well, which will be the north side of the well or a point previously marked by a surveyor, if present.
- Raise and lower the meter tip and tape until the buzzer and light signal are repeated twice at a given point. If the water level changes (barometric compensation of a confined potentiometric surface), take measurements at intervals until a stable reading is obtained. Record all measurements and time of collection in the field notebook.
- Record the final stabilized depth-to-water measurement and the time when measured in the field notebook and in any other form indicated in SOP #110. This reading indicates the distance between the measuring point at the top of the well casing and the water.

- Measure and record the total depth of each well prior to purging and sampling the well in the field notebook and any other form indicated in SOP #110. This total depth measurement is to be used to judge if the well may have "silted up" or been damaged since the last sampling event; since this SOP details the micro-purge method for groundwater sampling, a minimum purge volume need not be calculated.

- Shut and lock the wells that will not have a water sample collected, if any.

- Record the measurements in the field notebook as indicated in SOP #110.

Well Purging

- Purge each monitoring well by: (1) using the procedures in the Indiana Department of Environmental Management's (IDEM's) *Micro-Purge Sampling for Monitoring Wells* guidance dated January 8, 2003 (Appendix ___ of the QAPP); (2) until the well goes dry; or (3) until three well volumes have been extracted. If procedure #1 cannot be completed to the necessary parameters, use one of the other two procedures.

- If a well goes dry, stop the purging procedure and allow it to recharge for 24 hours or less and then sample it with a clean Teflon bailer.

- Record the type of well purging equipment, any operating settings, purge volumes, and any water quality measurements in the field notebook, as specified in SOP #110.

Sample Collection

- Obtain groundwater samples once purging is complete by disconnecting the flow-through cell and filling the sample containers directly from the discharge tubing or bailer.

- Collect the VOC sample first (if required).

- Be careful when placing the VOC sample into the VOA vials to avoid agitating the sample. Fill the VOA vials until there is a positive meniscus to minimize air filled headspace.

- Collect samples for other analytical fractions by pouring water directly into the container.

- Preserve the groundwater samples as necessary. See Table 3-2 of the QAPP for the appropriate containers, sample volume, and preservatives.

- Follow SOP #120 for the contents of the container label and to package, mark and label, and ship the sample containers. The laboratory to which samples will be submitted is listed in Table 2-2 of the QAPP.

- Secure the well caps and lock the protective casing at each location after sampling has been completed.

Quality Control Samples

See Table 3-3 of the QAPP for the type and rate of quality control samples to be collected for each medium.

- Equipment Rinseate Blank Sample: Equipment rinseate blanks will be collected from both dedicated and non-dedicated sampling equipment that is to be used during the project (e.g., pumps, hand augers, tubing, bailers, etc.). Equipment rinsate samples will be prepared by collecting laboratory-supplied reagent-grade deionized water that has been poured over/through the sampling equipment. In the case of a pump, the pump will be turned on and the deionized water pumped through it.

- Trip Blanks: Trip blanks, which will be provided by the laboratory, are vials containing laboratory-deionized or distilled water and will be taken to the field with the sample containers and will not be opened in the field.

- Field Duplicates: The duplicates will be collected after the investigative sample at the location has been collected using the same procedures and will be analyzed for the same parameters as the investigative samples. The duplicates will not be identified as such to the laboratory.

- Matrix Spike/Matrix Spike Duplicate Samples (MS/MSDs): MS/MSD samples are collected in the same way as field duplicates. Three times the investigative sample volume will be required for groundwater samples designated for MS/MSD analysis. The samples will be identified as MS/MSD samples so that the laboratory can perform the necessary spike evaluation procedures. The sample locations will target areas that field screening indicates as possibly moderately impacted.

Standard Operating Procedure #40
Residential Indoor Air, Crawlspace and Outdoor Ambient Air Sampling using U.S. EPA TO-15 Test Methods

This Standard Operating Procedure (SOP) details the procedures to be used to collect residential indoor air (IA) and outdoor ambient air (AA) samples for analysis of volatile organic compounds (VOCs) using U.S. EPA's TO-15 test method as part of a vapor intrusion (VI) assessment.

Equipment

- Site map with the locations of the sample locations
- A copy of the Health and Safety Plan and a copy of the Quality Assurance Project Plan (QAPP)
- Summa canister
- Stainless steel extension tubes
- Laboratory-supplied nitrogen canister
- Pre-calibrated flow controllers equipped with an in-line particulate filter and vacuum gauge
- Labels/tags
- Shipping packaging provided by the laboratory
- IDEM's Indoor Air Building Survey Checklist or similar
- Chain-of-custody form
- Field notebook

General Procedures

- Sampling personnel will avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- If possible, all windows and doors of the facility will be closed during sampling and for 24 hours prior to sampling.
- Weather information (temperature, barometric pressure, relative humidity, wind speed, and wind direction) and approximate indoor temperature will be recorded at the beginning of the sampling event. Field personnel will record substantial changes to these conditions that may have occurred 24 to 48 hours prior to, and during the course of sampling.

Sampling Procedures

- One sample will be collected per level of the residence including basements and crawlspaces. The sampling locations will be identified on a floor plan completed with the Indoor Air Building Survey Checklist. A floor plan drawing will also be

completed that identifies locations of HVAC equipment, chemical storage areas, garages, doorways, stairways, sumps, drains, utility perforations, north direction, and separate footing sections. For the background AA sample, a location upwind (on the day of sampling) from the building(s) will be sampled.

- An evacuated (Certified) 6 L stainless steel Summa canister will be used to collect each sample. The canisters will be certified clean and provided by the laboratory, along with flow controllers equipped with an in-line particulate filter and vacuum gauge. Each flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection. For the purposes of residential indoor air sampling, the flow controller will be calibrated for a 24-hour sampling period.

- A photoionization detector (PID) measurement will be collected before sampling begins and prior to the completion of the indoor air sampling. The PID measurements will be recorded in the field book.

- Where possible, the summa canister intake will be placed at breathing height (e.g., 3 to 5 feet above ground) via attachment of a stainless steel extension tube to the intake of the canister. It may not be possible to adhere to this height guidance within crawlspaces.

- The protective brass plug will be removed from each canister and the pre-calibrated flow controller (and extension tube) will be attached. The brass fitting will then be attached to the flow controller/extension tube and sealed tightly for a leak test. Once the brass fitting is attached, the setup will be a "closed system" and a leak test can therefore be initiated.

- The leak test will consist of opening the flow gauge and recording the pressure. After five minutes, field personnel will again record the pressure. Since the setup is a "closed system", the pressure should not change. If the pressure decreases, then another IA sampling setup will be used as there may be a leak between the flow gauge and Summa canister.

- The unique identification numbers for each summa canister and flow controller will be recorded, along with the initial canister pressures on the vacuum gauge (check equipment-specific instructions for taking this measurement). Canisters with a significantly different pressure than originally recorded by the testing laboratory will not be used for sampling. These numbers and values will be recorded in the field book and on the chain-of-custody (COC) form for each sample.

- The valve on the summa canister will be completely opened. The time each valve was opened (beginning of sampling) will be recorded in the field book and on the chain of custody.

- The outdoor AA sample will be initiated approximately one hour before the IA or crawlspaces samples are started. The outdoor AA sample will be mounted at a level approximately 3 to 5 ft above ground level. The AA sample will be kept out of sight to limit the potential disturbances.

- An inventory form will be completed for each IA and the AA sample location by the field technician. This form will be completed to document any potential chemicals, paints, varnishes, solvents, etc., that were found in the house prior to commencing the indoor air sampling effort.

- Each canister and the area surrounding each canister will be photographed to document conditions prior to sampling and the presence of any potential background VOC sources. Any potential VOC sources will be noted on the Indoor Air Building Survey Checklist.

- Sample collection will be stopped prior to the pre-determined sample duration. Ideally, a vacuum reading of approximately 2 to 6 inches of mercury (Hg) should remain in the canister. If there is no vacuum remaining the sample will be rejected and should be collected again in a new canister.

- The final vacuum pressure will be recorded, and the canister valve closed. The date and time that sample collection was stopped will be recorded.

- The flow controller will be removed from each canister and replaced with the protective brass plugs.

- Labels/tags (sample name, time/date of sampling, etc.) will be attached to the canisters as directed by the laboratory.

- The canisters and other laboratory-supplied equipment will be placed into the packaging provided by the laboratory.

- The COC form will be completed, making sure to include the identification numbers for each canister and flow controller, the start and end times for each canister's sample collection period, and the initial and final canister pressures from the vacuum gauge.

- The sample canisters will be delivered to the laboratory via commercial delivery service. If the pressure reading of a canister is "zero" when logged in by the laboratory, the sample will not be analyzed and will be recollected.

A typical summa canister sample setup in an indoor air setting is shown in the photo below.

Standard Operating Procedure #60
Sub-Slab Soil Gas Port Installation and Sampling

This Standard Operating Procedure (SOP) details the procedures to be used to install and collect sub-slab soil gas (SGss) samples for analysis of volatile organic compounds (VOCs) as part of a vapor intrusion (VI) assessment.

Equipment Required

- Site map with the sample locations
- A copy of the Health and Safety Plan and a copy of the Quality Assurance Project Plan (QAPP), including Cystalline Silica Awareness (NAM-1347-GUI) and Crystalline Silica SDS
- Hammer drill and bits (5/8" and 1 1/2")
- Wet/dry vacuum
- Bottle brush
- Stainless Steel Vapor Pin™ Sampling Port with Silicon Sleeve
- Threaded Secure Cover
- Hammer
- Summa canisters, or tedlar bags
- Leak test tubing
- Water dam or helium gas leak testing supplies
- Gas-tight syringe (60cc)
- Sample labels/tags
- Pre-calibrated flow controller equipped with an in-line particulate filter and a vacuum gauge, or air pump and vacuum chamber
- Chain-of-custody form
- Field notebook
- Shipping packaging supplied by the laboratory
- Dust masks and dust control for the purpose of mitigating crystalline silica exposure
- Safety glasses with side shields
- Hearing protection

General Procedures

- Sampling personnel will avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).

- If possible, all windows and doors of the facility will be closed during, and for 24 hours prior, to sampling.

- Weather information (temperature, barometric pressure, relative humidity, wind speed, and wind direction) and approximate indoor temperature will be recorded at the beginning of the sampling event. Field personnel will record substantial changes to these conditions that may have occurred 24 to 48 hours prior to, and during the course of sampling. Record on SGss field sampling form.

Installation Procedures

- Follow all appropriate subsurface clearing (SSC) procedures prescribed under ERM's SSC procedures for safe work procedures. A private utility locator will be used to check for buried obstacles (pipes, electrical lines, etc.).

- Set up wet/dry vacuum to collect drill cuttings, using a dust collection attachment and/or wetting mechanism to prevent the release of crystalline silica into the breathing zone.

- Drill a 1.5-inch diameter hole approximately 2 inches into the slab.

- Drill a 5/8-inch diameter hole through the slab and into the underlying soil to form a void.

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

- Place the stainless steel Vapor Pin™ soil gas port with silicone sleeve into the drilled hole using a hammer.

- Secure the threaded flush mount protective cover onto the Vapor Pin™.

Leak Testing and Sampling Procedures

- If possible, the SGss probe will be installed at least 24 hours prior to sample collection.

- An evacuated 6L Summa canister, or 1L tedlar bag will be used to collect the SGss sample. The canister, or tedlar bag, will be certified clean and provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate. These SGss samples will be collected over a period of approximately 5-10 minutes if collected concurrently with indoor air samples.

- The protective brass plug will be removed from the canister intake and the pre-calibrated flow controller attached to the canister intake. The brass plug will then be attached to the top of the flow controller and sealed tightly in preparation for the leak test. Once the brass fitting is attached to the flow controller, the setup will be a "closed system" and the leak test can be initiated.

- The leak test will be performed by opening the flow gauge and recording the initial pressure. After five minutes, the pressure will again be recorded. Since the setup is a "closed system", the pressure should remain the same. If the pressure decreases, then there may be a leak between the flow gauge and Summa canister. Another Summa canister and flow controller will then be employed and the leak test repeated. Record leak test result on field sampling form.

- Additionally, a leak test of the sample train, and sample point will be conducted using <u>either</u> the water dam, or helium gas, leak detection methods as described below

- Water Dam Leak testing procedures

    - The sample port seal will be leak tested using the water dam method. A 2" PVC pipe will be place around the sample port and sealed to the floor using plumbers putty or similar material. A section of 3/8" tubing will be attached to the sample port.

    - Potable water will be poured into the area between the Vapor Pin™ and the PVC pipe. An air pump (Gillian GilAir or similar) will be attached to the 3/8" tubing and will be turned on, initiating a vacuum under the concrete slab.

    - The water dam will be observed for a period of approximately five (5) minutes. If the water level appears to change, or significant bubbling is observed, the leak test will be considered a failure, and the Vapor Pin™ will be reinstalled as per the methods above.

    - If the water level does not change, the leak test will be considered successful, and sample collection will begin.

- Helium Gas Leak testing procedures

    - A weighted plastic shroud will be placed over the sampling port, and sealed to the floor with putty, tape, etc.

    - Helium gas will be pumped into the plastic shroud until the helium gas detector records at least 10% helium concentration within the shroud

    - The helium gas probe will be removed from the shroud, be allowed to equilibrate to atmospheric concentrations (0 ppm), and then be inserted into the purge port of the SGss sample train.

    - If the helium concentration in the sampling train is less than 10% of the shroud concentration, the leak test will be considered successful. If the concentration is greater than 10% of the shroud concentration, the sample train connection points will be tightened, or the Vapor Pin™ will be reinstalled, and the test will be repeated.

- Once both leak tests are complete. The sample tube assembly will be connected to the top of the flow controller and firmly tightened.

- The canister valve will be opened completely, and the time (beginning of sampling) and the initial canister pressure from the vacuum gauge recorded. The identification numbers for the canister and flow controller will also be recorded. A canister with a significantly different pressure than originally recorded by the testing laboratory is not to be used for sampling and will be replaced.

- Sample collection will be stopped after the scheduled duration of sample collected but when the canister still has approximately 2 to 6 inches of mercury (Hg) remaining in the canister.

- The final vacuum pressure and time will be recorded in the field book after the canister valve has been closed.

- Each canister, sample port and the area surrounding the sample port will be photographed before and after sampling to document site conditions.

- If appropriate, the flow controller from the canister will be removed and the protective brass plug replaced onto the canister intake.

- The sample labels/tags (sample name, time/date of sampling, etc.) will be attached to the canister as directed by the laboratory.

- The canister and other laboratory supplied equipment will be placed in the packaging provided by the laboratory.

- The chain-of-custody form will be completed, making sure to include the identification numbers for each canister and flow controller, the start and end times for each canister's sample collection period, and the initial and final canister pressures on the vacuum gauge.

- The sample canisters will be delivered to the laboratory via commercial delivery service. If the pressure reading of a canister is "zero" when logged in by the laboratory, the sample will not be analyzed.

Sample system in the photo above shows a typical summa canister sample connection train leading to a subslab sample port.

Two staged subslab drilling for the installation of the Vapor Pin™

Final subslab installation appears of the Vapor Pin™

Protectant flush mounted cover over the Vapor Pin™

Standard Operating Procedure #70
Soil Gas Port Installation and Sampling

This Standard Operating Procedure (SOP) details the general procedures to be used to install soil gas ports and collect soil gas (SG) samples for analysis of volatile organic compounds as part of a vapor intrusion assessment.

Equipment Required

- Site map with the locations of the sample locations.
- A copy of the Health and Safety Plan and a copy of the Quality Assurance Project Plan (QAPP).
- Hand auger, hammer drill, slide hammer or Geoprobe® drill rig.
- ½" diameter X 6" long stainless steel soil gas screen.
- ¼" Teflon tubing.
- Gas-tight Swagelock fittings.
- Laboratory supplied certified clean Summa canisters.
- Leak test tubing.
- Clean steel rods (such as a pin flag).
- Helium gas.
- Helium meter.
- Clear plastic bags for leak detection shroud.
- Weighted hose for sealing plastic bag to floor.
- Sample labels/tags.
- Pre-calibrated flow controller equipped with an in-line particulate filter and a vacuum gauge
- Chain-of-custody form.
- Field notebook.
- Shipping packaging supplied by the laboratory.

General Procedures

- Sampling personnel will avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- Weather information (temperature, barometric pressure, relative humidity, wind speed, and wind direction) and approximate indoor temperature will be recorded at the beginning of the sampling event. Field personnel will record substantial changes to these conditions that may have occurred 24 to 48 hours prior to, and

during the course of sampling. The information may be measured with onsite equipment or obtained from a reliable source (e.g., a local newspaper).

- See SOP #190 for field documentation procedures.
- See SOP #10 for general soil boring procedures.

Installation/Development Procedures

- Assemble the stainless steel screen and Teflon tubing and the gas tight Swagelock fittings.
- Place the SG port assembly into a drilled hole[1], with the screen placed in the vadose zone; preferably (per IDEM) at least 5 feet below ground surface to minimize low-bias due to ambient air interference. Hang screen in hole by tubing and extend tubing out of the hole with enough extra for connection to Summa canister, or tedlar bag.
- Pour quartz sand, or fine glass beads, down the borehole around the screen and extending at least three to six inches above the top of the screen.
- Install a hydrated bentonite seal to approximately six inches below ground surface.
- Place a minimum 4-inch diameter, locking, steel flush-mount cover over the port tubing and set in concrete. Wind extra tubing into flush-mount cover and close/bolt cover.
- Using a pneumatic pump, (Gillian Gil Air or similar) remove approximately 3 times the volume of the sample tubing, screen, and pore space of the sand pack, record on soil gas sampling field form.

Leak Testing and Sampling Procedures

- Following installation of the SG port and curing of the cement for at least 24 hours, the stainless steel cap will be removed from the stainless steel SG port tube.
- An evacuated 1L Summa canister, or new 1L tedlar bag, will be used to collect the SG sample. The Summa canister will be certified clean and provided by the laboratory, along with a flow controller equipped with an in-line particulate filter

[1] Installation procedures can include either a Geoprobe, slide hammer, and/or hammer drill to advance to appropriate depth based on field conditions.

and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate (0.1 Lpm) for the duration of approximately 10 minutes for sample collection.

- The protective brass plug will be removed from the canister intake and the pre-calibrated flow controller attached to the canister intake. The brass plug will then be attached to the top of the flow controller and sealed tightly in preparation for the leak test. Once the brass fitting is attached to the flow controller, the setup will be a "closed system" and the leak test can be initiated.

- The leak test will be performed by opening the flow gauge and recording the initial pressure. After five minutes, the pressure will again be recorded. Since the setup is a "closed system", the pressure should remain the same. If the pressure decreases, then there may be a leak between the flow gauge and Summa canister. Another Summa canister and flow controller will then be employed and the leak test repeated. Record leak test data on soil gas field sampling form.

- The sample port seal will be leak tested using helium as a tracer gas. Connect the helium canister to flow regulator (if applicable) and tubing.

- Place the helium meter tubing intake and the discharge tubing from the helium canister adjacent to the sub-slab sampling port.

- Place the clear plastic shroud around the sampling port, encompassing the helium meter intake tubing and the canister discharge tubing. The end of the soil gas sample tube should remain outside of the shroud.

- Place the weighted hose around the edges of the shroud to hold it in place and create a seal. The sealed sampling port, helium meter intake tubing and helium gas discharge tubing should be contained inside of the shroud with only the end of the sampling tube extending outside of the shroud. Turn on the helium gas and slowly inflate the shroud to approximately 20% helium gas content (as measured by the helium meter). Record helium gas concentration beneath shroud on the sampling forms.

- Purge the sampling tube using a gas-tight syringe (60cc) or PID. Three tubing/port volumes are to be purged prior to sample collection at a rate of approximately 0.1 Lpm.

- Carefully remove the end of the helium meter tubing from beneath the shroud to avoid losing helium from the shroud. Allow the meter to "zero" and connect to the sampling tube. Allow the meter to run until it reaches a stable reading. The concentration of helium in the sampling train should be a maximum of 10% of the

minimum concentration beneath the shroud. If the concentration is above 10%, remove the shroud, reseal the sampling point with additional concrete or hydrated bentonite clay and repeat the leak test.

- Once both leak tests are complete, the canister valve will be opened completely, and the time (beginning of sampling) and the initial canister pressure from the vacuum gauge recorded. The identification numbers for the canister and flow controller will also be recorded.

- Sample collection will be stopped (valve closed) after the scheduled duration of sample collected (approximately 8 minutes at a flow setting of 1 Lpm) but when the canister still has a minimum amount of vacuum remaining.

- The final vacuum pressure and time will be recorded after the canister valve has been closed.

- Each canister and sample port and the area surrounding will be photographed to document site conditions.

- The flow controller from the canister will be removed and the protective brass plug replaced onto the canister intake.

- The sample labels/tags (sample name, time/date of sampling, etc.) will be attached to the canister as directed by the laboratory.

- The canister and other laboratory supplied equipment will be placed in the packaging provided by the laboratory.

- The chain-of-custody form will be completed, making sure to include the identification numbers for each canister and flow controller, the start and end times for each canister's sample collection period, and the initial and final canister pressures on the vacuum gauge.

- The sample canisters will be delivered to the laboratory via commercial delivery service. If the pressure reading of a canister is "zero" when logged in by the laboratory, the sample will not be analyzed and will be recollected.

ERM has over 160 offices across the following countries and territories worldwide

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Ghana
Guyana
Hong Kong
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Mozambique
The Netherlands
New Zealand
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Senegal
Singapore
South Africa
South Korea
Spain
Switzerland
Taiwan
Tanzania
Thailand
UAE
UK
US
Vietnam

ERM's Indianapolis
8425 Woodfield Crossing Blvd
Suite 560-W
Indianapolis, IN 6240

www.erm.com

The business of sustainability

ERM