W O R K P L A N

VAPOR INTRUSION INVESTIGATION

ROXANA, ILLINOIS

Prepared for

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Shell Oil Products US (SOPUS) has been conducting a subsurface investigation in the Village of Roxana in the area generally bounded by Illinois Route 111 and the west property boundary (aka west fenceline) of the WRB Refining LLC Wood River Refinery (WRR) (**Figure 1**). This scope of work was identified in a workplan dated January 21, 2009 and approved by Illinois Environmental Protection Agency (IEPA) on May 12, 2009. The investigative results of this work were documented in the *Dissolved Phase Groundwater Investigation and P-60 Free Phase Product Delineation Report*, dated February 18, 2010. Based on recommendations contained in this report, additional sampling activities were conducted in the Spring/Summer 2010, and the results were documented in the *Addendum to February 2010 Report – Supplemental Investigation Activities,* dated September 20, 2010.

The IEPA provided comments to the February 18, 2010 report in a letter to SOPUS dated August 5, 2010. In particular, comment number 4 required submittal of a workplan to evaluate possible vapor intrusion into residences and other structures in the Village of Roxana. The workplan was submitted to IEPA on September 20, 2010. IEPA approved the workplan subject to certain comments and modifications in a November 15, 2010 letter.

Scoping meetings were held with representatives of IEPA, Illinois Department of Public Health (IDPH), Village of Roxana, SOPUS and URS Corporation (URS) on January 6, 2011 and January 25, 2011. In addition, there has been various email correspondence associated with scoping for the project. Relevant information from these letters, correspondence and communications has been incorporated into this revised workplan.

Subsequent sections of this plan include:

- Conceptual Site Model (CSM) – This section summarizes the subsurface conditions and forms the technical basis for the sampling approach. The IEPA's August 5th letter draws parallels between issues in Hartford and Roxana. While there are certain efficiencies that can be gained by making use of established procedures, etc., it is important to recognize there are significant differences between the CSMs for these two sites. These differences form the basis for different investigation approaches.

- Vapor Intrusion Program – This section describes the planned approach to screening and sampling residences and other structures in the Village of Roxana. This section also identifies the procedures for conducting the initial screening, and collecting indoor air and sub-slab soil vapor samples.

- Data Review, Screening, and Reporting – This section describes the planned data review, evaluation and reporting procedures for this work.

- Schedule – This section describes when the initial screening and sampling will be conducted.

Supporting information includes tables, figures and standard operating procedures (SOPs).

The conceptual site model (CSM) for this site has been developed based on the current understanding of the geology, groundwater flow, interaction with the Mississippi River/WRR pumping centers, and release history.

The Village of Roxana is located approximately 1.5 miles east of the Mississippi River within the American Bottoms floodplain. The surface topography across the floodplain generally slopes downward to the west-southwest, with a total drop in elevation of approximately 15 feet across the area. The floodplain deposits regionally consist of recent alluvial (i.e., river) deposits overlying Pleistocene (i.e., Ice Age) glacial outwash. The recent alluvial deposits consist of a complex, heterogeneous sequence of sands, silts, and clays. The underlying glacial outwash deposits consist of more uniform sands and gravels that extend to bedrock. The depth to bedrock in the area typically exceeds 100 feet.

More specific to the site area, the subsurface conditions underlying the site generally consist of two primary strata, a layer of silty clay that is up to nine feet thick across the site underlain by sands. There are occasional interbedded silt or clay layers within the sand, but these do not appear to be laterally (or vertically) extensive.

The glacial outwash deposits (i.e., sands) underlying the area are the primary source for large volume water production (e.g., industrial and municipal supply) and this water bearing zone is known as the American Bottoms Aquifer. The water table for the aquifer generally begins at a depth of approximately 25 to 40 feet below ground surface (bgs) (approximately elevation 403 to 406). Therefore, there is generally a 15 to 30 foot thick vadose (unsaturated) zone in the sand. Groundwater is hydraulically connected with water in the Mississippi River, however, given the large distance from the river and nearby high-volume groundwater pumping (e.g., WRR, BP, etc), the observed water level fluctuations due to river rise take longer to occur and the magnitude of the fluctuations are muted in comparison to observations made at locations further west.

Prior to development in the area, the natural movement of groundwater through the glacial outwash material was toward the west (toward the Mississippi River). Since development in the area, groundwater pumping has altered the regional groundwater flow in the area such that it now flows to the east toward the nearby pumping centers at the WRR.

Another critical aspect of the CSM is the location of the source material relative to the Village of Roxana. There are two main sources/areas that have distinct portions of the village that they may potentially affect:

1. The WRR refinery immediately east of the Village, and
2. The 1986 benzene release in the southern portion of the Village,

Historical releases of petroleum products at the WRR have resulted in a dissolved phase groundwater plume beneath the refinery and along the west fenceline and extending beneath the eastern edge of the Village of Roxana. In addition, the edge of a Light Non-Aqueous Phase Liquid (LNAPL) plume has been observed in certain areas within the confines of the WRR refinery. The primary LNAPL plume is located further east in the refinery. The effects of groundwater pumping at the WRR, as required by the RCRA Part B Permit, act to contain (and eventually capture and recover) LNAPL and dissolved phase impacts.

The 1986 benzene release occurred from a pipeline in the extreme southwestern portion of the Village of Roxana in a commercial/industrial area just west of the intersection of Rand and Highway 111. The groundwater flow direction as a result of pumping the existing groundwater extraction wells, as required by the RCRA Part B Permit, has caused the groundwater benzene impact to migrate toward the WRR pumping centers and is primarily located near the Roxana Public Works yard.

Petroleum vapors in the eastern portion of the Village of Roxana are primarily associated with the LNAPL beneath the WRR, and to a lesser extent, the dissolved phase impact beneath the eastern edge of the Village. The vapors in the southern edge of the Village of Roxana are associated with the benzene release. **Figure 2** presents a schematic diagram of this CSM.

The CSM discussed above, differs from the CSM for the nearby Village of Hartford in the following significant ways:

Village of Roxana	Village of Hartford
No odor complaints or vapor intrusion incidents have been reported.	There have been numerous odor complaints vapor intrusion incidents reported.
Alluvial deposits consist of clay that extends to up to 9 feet bgs and then alluvial sands that grade into the glacial outwash.	Alluvial deposits consist of interbedded silt/sand layers within the clay to approximately 25-30 feet bgs.
Even at high groundwater elevations, there is at least 30 feet of open vadose zone in the sand that allows for biological degradation prior to the vapor reaching the shallow soil zone and will also allow for more continuous operation of an SVE system.	At high groundwater elevations, the aquifer becomes confined; therefore, there is no vadose zone in the sand.
LNAPL is present beneath the refinery but does not underlie the Village.	There are multiple LNAPL areas underlying the Village of Hartford.
The groundwater elevation fluctuations are muted due to the distance from the river, localized pumping and the lack of confining conditions which reduces the potential for vertical movement of vapors from the deeper soils.	The groundwater elevation fluctuations are more dramatic due to the proximity to the river and the fact that confined conditions are present at times.
Groundwater impacts are limited to the main sand unit.	Groundwater impacts are present in four units.
The primary affected media are located at depths of approximately 25-40 feet below bgs.	The primary affected media are as shallow as 15 feet bgs.

Based on the depth of the impacted groundwater and the ongoing natural attenuation, the vapor concentrations exceeding IEPA's guidance concentrations generally are found at deeper depths and not in the shallow soils adjacent to building foundations. In addition, there is a lack of a pneumatic driver to push the vapors vertically due to the muted groundwater elevation fluctuations. Therefore, the potential for vapor intrusion with the Village of Roxana is believed to be dramatically lower compared to that in Village of Hartford.

SOPUS proposes the following overall approach to evaluate and address possible vapor intrusion in the Village of Roxana. The approach includes evaluating via screening/sampling in structures and the installation and operation of a soil vapor extraction (SVE) system inside the WRR and the Public Works yard to control the primary vapor sources[1]. This approach is designed to determine the presence, if any, of vapor intrusion issues within the Village of Roxana as well as reducing source vapor concentrations. This approach will utilize some of the methods and strategies used on the Village of Hartford project where appropriate. **Section 6 (References)** lists several Hartford Working Group documents that were reviewed.

The IEPA's August 5, 2010 letter contained comments from a May 28, 2010 Illinois Department of Public Health (IDPH) letter referring to addressing residences near vapor monitoring points (VMPs) 1, 2, 4, 5, 6 and 11, and the Public Works yard. Initially, indoor air will be evaluated at a total of fourteen residences and one commercial facility. These locations are in closest proximity to the VMP locations identified in the IDPH letter referenced above. The locations are listed in **Table 1** and summarized below:

VMP Location	Initial Locations (address)
VMP-1	[redacted] East 2nd Street
	[redacted] East 2nd Street
VMP-2	[redacted] East 2nd Street (also used to evaluate VMP-1)
	[redacted] East 3rd Street
VMP-3	[redacted] East 3rd Street, [redacted] [redacted] East 4th Street
VMP-4	[redacted] East 4th Street
	[redacted] East 5th Street
VMP-5	[redacted] East 5th Street
	[redacted] East 6th Street
VMP-6	[redacted] East 6th Street
	[redacted] East 7th Street
VMP-11	[redacted] East 8th Street
	[redacted] East 8th Street
	[redacted] East 8th Street
	Roxana Public Works Buildings
VMP-13	Roxana Public Works Buildings (also used to evaluate VMP-11)

* street addresses concealed for homeowners privacy

[1] The SVE system is not the subject of this workplan, and will be described separately.

Each evaluation will include the following steps which are described in Sections 3.1, 3.2, 3.3, and 3.4**.**

3.1 ACCESS AGREEMENTS

3.1.1 Initial Property Visit

A notification letter was sent to residences identified in Section 2 of this plan on February, 3, 2011. URS Corporation, IEPA, IDPH, and Village of Roxana representatives are coordinating visits with each resident to explain: the overall situation regarding the impact beneath and around the Village of Roxana; the reason why the sampling is necessary; the importance of participation; a general discussion of the sampling efforts which will take place; how the results will be shared; the types of materials which should be removed from the residence at least 48 hours before sampling; the need for an access agreement; and the fact that an access agreement is in both the resident's and SOPUS' best interests.

3.1.2 Obtaining Access Agreements

Prior to beginning screening and sampling at any property, the access agreement that was provided in the initial notification letter dated February 3, 2001 must be signed by the property owner (an example letter and access agreement are provided in **Appendix A**). If an access agreement is not signed by the property owner, screening and sampling will not be performed. Copies of this workplan (when approved by IEPA) will be distributed to those residents who consented to the sampling.

3.2 INITIAL PROPERTY EVALUATION AND SCREENING

3.2.1 Indoor Air Screening

Prior to beginning indoor air screening, calibration and maintenance of instruments will follow procedures performed per SOP 03 – *Calibration and Maintenance of Field Instruments* (provided in **Appendix C**). The initial evaluation and screening process will start with screening indoor air for potentially combustible vapors with a flame ionization detector (FID), a photoionization detector (PID), a lower explosive limit (LEL) meter, and methane detector. Indoor air screening will include measurements collected from the first floor, basement (if present), and crawl space (if present). Screening measurements will be collected at breathing zone height in centrally located living and working areas on the first floor. Where applicable, screening measurements will be collected in basements within two inches above floor drains, where there are visible cracks in floor and walls, and at wall and floor penetrations that indicate signs of damage.

Where applicable, screening measurements will be collected at the access entrance to any crawl space areas. No personnel will physically enter crawl space areas or confined spaces. Residential screening locations and measurements will be recorded. The measured values that will trigger various actions are:

If the combustible gas level is greater than or equal to **1%** of the LEL or if an FID concentration is greater than **200** parts per million (ppm) then the following actions will be taken:

- Immediately confirm the reading with a LEL meter capable of real-time readings and will immediately confirm this reading with another LEL meter.
- The resident will be offered alternative housing until combustible gas levels have been mitigated.
- IEPA and IDPH will be notified immediately to develop a path forward which may include proposing and implementing mitigation measures, sampling procedures, etc.
- Secure access for residences at the step out locations associated with this residence (refer to **Table 1**). A summary of the initial locations and potential step out locations is provided in **Table 1** and shown on **Figure 3**.

If the combustible gas level is above **20%** of the LEL then the following immediate actions will be taken:

- Evacuate the building.
- Notify the local fire department.
- The resident will be offered alternative housing until combustible gas levels have been mitigated.
- IEPA and IDPH will be notified immediately to develop a path forward which may include proposing and implementing mitigation measures, sampling procedures, etc.
- Secure access for residences at the step out locations associated with this residence (refer to **Table 1**). A summary of the initial locations and potential step out locations is provided in **Table 1** and shown on **Figure 3**.

If the field screening results conducted in the residence exceed any one of the baseline criteria listed below, then:

- The sample canisters associated with the residence will be analyzed on an expedited basis.
- The IEPA and IDPH will be notified within one hour after the results are obtained and a path forward will be developed which may include proposing and implementing mitigation measures, sampling procedures, etc.

The baseline criteria that would initiate this accelerated process are as follows:

- An indoor air FID reading from the first floor or basement/crawl space greater than 20 ppm; or
- An indoor air LEL reading from the first floor or basement/crawl space greater than non-detect.

3.2.2 Walk Through Assessment Survey

After the screening for combustible vapors, the next step will be to conduct a visual inspection of the property and interview the occupant/property owner. Any potential indoor emission sources identified will be documented. The building owner/occupant should have removed any items that may complicate the interpretation of the indoor air measurements. It is requested that these items be removed at least 48 hours prior to the testing. This will be communicated to the residents when the sampling visits are scheduled. Suitable secured storage will be provided for these items. The last component of the visual inspection is the development of a sketch of the basement, if present (including but not limited to the location of drains, cracks, and utility entrances). If there is no basement, the sketch should depict the general layout of the first floor of the building. The results of the visual inspection and interview will be documented via photograph and on the *Walk Through Assessment Survey Form* presented in **Appendix B**.

If such discussions have not previously taken place, discussions will be held at this time with the resident regarding sampling procedures, procedures for installing the sub-slab sampling ports, and any actions which will be taken in response to the results of the evaluation.

3.3 INDOOR AIR SAMPLING

The indoor air sampling will be conducted in accordance with SOP 46 - *Indoor Air Sampling with Canisters* (provided in **Appendix C**). Indoor air samples will be collected via evacuated, stainless-steel canisters over a 24-hour period. The samples will be collected at the: 1) location where initial screening identified the highest FID screening measurement in the basement; and 2) the central living area (e.g., living room) or work area of the first floor. If FID screening measurements are consistent, the sample will be collected from a central location of the living or work area of the first floor and basement at breathing zone height (i.e., approximately three to five feet above floor level where possible).

Additional samples may be collected from:

- If a crawl space is present the sample will be collected at the access entrance of the crawl space.
- Samples may also be collected from attached garages, if present.
- Whenever indoor air samples are collected, a corresponding upwind, outdoor air (background) sample also will be collected.

The indoor air sampling field reporting will be conducted in accordance with SOP 08 – *Field Reporting and Documentation* (provide in **Appendix C**).

Indoor air samples will be collected using evacuated, 6-Liter stainless-steel canisters over 24 hours, and will be sent to the laboratory for analysis at least every two or three days. Canisters will be analyzed on a standard turnaround timeframe unless screening values trigger requirements for expedited analysis (see **Section 3.2.1**). The canisters will be analyzed for the petroleum hydrocarbons listed in **Table 2**. Indoor air sample control and custody procedures will be performed per SOP 26 – *Sample Control and Custody Procedures* (provided in **Appendix C**). Sample chain-of-custody (COC) form(s) will be completed to accompany each sample sent to the laboratory. The laboratory will send an electronic sample receipt confirmation, listing all samples received (sample IDs), dates sampled, analyses requested, and the vacuum reading measured by the laboratory. A copy of the COC will also be included with the electronic sample receipt confirmation. This information will be checked against the COC to confirm that the laboratory has entered all information correctly into their laboratory information management system (LIMS) system. Any discrepancies between the COC and sample receipt confirmation will be identified and resolved with the laboratory. Canister classification, packaging and shipping will be performed under SOP 51 – *Vapor Sample Classification, Packaging and Shipping* (provided in **Appendix C**).

3.4 SUB-SLAB VAPOR SAMPLING

Sub-slab vapor sample probe installation and vapor sampling procedures will be performed per SOP 47 – *Sub-Slab Soil-Gas Sampling with Canisters* (provided in **Appendix C**). The probes will be installed at up to three locations in basements. The slab will be mentally divided into three rectangles of roughly equal size and select sample locations near the center of each rectangle. The locations will be adjusted as needed to account for logistical factors. Areas will be selected where visible damage to the floor can be minimized. Samples will be collected from the probes in 1-Liter canisters for a period of approximately 2 hours. Additional field screening will be conducted (via direct reading or Tedlar bags, whatever is appropriate) with a FID, a PID, a LEL meter, and methane detector.

If the Sub-Slab Monitoring Points (SSMP) FID result exceeds 500 ppm, or an LEL result exceeds 1%, the sample canisters will be analyzed on an expedited basis and IEPA and IDPH will be notified within one hour, as described in **Section 3.2.1**. If the SSMP FID results exceed 550 ppm, then access will be requested at the step out locations associated with this residence (refer to **Table 1**). A summary of the initial locations and potential step out locations is provided in **Table 1** and shown on **Figure 3**.

Vacuum leak checks will be performed for each sampling location. As an additional quality control check, tracer gas leak checks using helium will be performed at 100% of the sub-slab soil-gas sampling locations, as described in SOP 47. The helium check will be performed within the first 30 minutes of sample collection. The Sub-Slab vapor sampling field reporting will be conducted in accordance with SOP 08 – *Field Reporting and Documentation* (provide in **Appendix C**).

Sub-Slab vapor samples will be collected using evacuated, 1-Liter stainless-steel canisters over 2 hours, and will be sent to the laboratory for analysis at least every two or three days. Canisters will be analyzed on a standard turnaround timeframe unless screening values trigger requirements for expedited analysis (see **Section 3.2.1**). The canisters will be analyzed for the petroleum hydrocarbons listed in **Table 2**. Indoor air sample control and custody procedures will be performed per SOP 26 – *Sample Control and Custody Procedures* (provided in **Appendix C**). Sample chain-of-custody (COC) form(s) will be completed to accompany each sample sent to the laboratory. The laboratory will send an electronic sample receipt confirmation, listing all samples received (sample IDs), dates sampled, analyses requested, and the vacuum reading measured by the laboratory. A copy of the COC will also be included with the electronic sample receipt confirmation. This information will be checked against the COC to confirm that the laboratory has entered all information correctly into their laboratory information management system (LIMS) system. Any discrepancies between the COC and sample receipt confirmation will be identified and resolved with the laboratory. Canister classification, packaging and shipping will be performed under SOP 51 – *Vapor Sample Classification, Packaging and Shipping* (provided in **Appendix C**).

4.1 DATA REVIEW AND EVALUATION

Field data and documentation will become a part of the project file. URS will be the custodian of the file and maintain the contents of files for the site, including all relevant records, logs, field logbooks, pictures, subcontractor reports, data reviews, and the database management system.

The following documentation will supplement the chain-of-custody records:

- Field logbooks and data
- Field screening and sample collection sheets
- Photographs and drawings
- Questionnaires
- Contractor and subcontractor reports
- Correspondence.

Analytical data will be provided in hard copy and electronic formats. Electronic data will be loaded into a database to facilitate data evaluation and reporting. The data presented in the report will include the data flags provided by the laboratories as well as the qualifiers assigned by the data reviewer.

Stainless-steel canisters will be analyzed for the following:

- *Indoor air samples* - will be analyzed via Modified USEPA Method TO-15 (low level) and Modified ASTM D-1946 methane only.
- *Ambient (outdoor and attached garage) air samples* - will be analyzed via Modified USEPA Method TO-15 (low level)
- *Sub-slab samples* - will be analyzed via Modified USEPA Method TO-15 (standard) and modified ASTM D-1946 plus helium.

The analyte list in Table 2 was specified by IEPA in their November 15, 2010 letter.

The analytical laboratory is capable of attaining the reporting limits to meet the project objectives listed in **Table 2** and may be able to achieve lower analytical sensitivity. The presence of any compounds at relatively high concentrations in the samples, however, may limit the achievable reporting limits due to the need to dilute the sample to get any analytes exceeding calibration range into range. Analytical data from the sampling will be independently reviewed and qualified by URS. A Level III validation will be performed on 100% of the data and a Level IV validation will be performed on 10% of the data, overall.

4.2 DATA SCREENING

Project-specific screening levels are listed in **Tables 3a and 3b** for residential and commercial properties, respectively. For soil gas, the screening levels are taken directly from IEPA proposed regulations (i.e., Tiered Approach to Corrective Action Objectives [TACO]). Two sets of values are shown. Per the proposed IEPA rules, one set of values applies "when soil or groundwater contamination is within 5 feet, vertically or horizontally, of an existing or potential building." The other set of values apply "when soil and groundwater contamination are more than 5 feet, vertically and horizontally from an existing or potential building." The value to be used for a specific sampling location will be determined based on the definitions given above or in consultation with IEPA and IDPH.

Project-specific screening values for indoor air were developed as follows. For benzene, a value of 10 $\mu g/m^3$ for chronic exposure and a value of 29 $\mu g/m^3$ for acute exposure were selected based on input from IDPH and IEPA. These values will be applied at both residential and non-residential buildings. For other compounds of interest, screening levels for chronic exposure were selected based on USEPA risk-based toxicological information. The most thorough and up-to-date compilation of risk-based screening values is the US EPA Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (US EPA, 2010). The RSLs pull together and update regional screening levels formerly issued by EPA Regions III, VI, and IX. Values are given for approximately 700 chemicals and include screening levels for both residential and industrial air. Database values for carcinogens are based on a 1E-06 risk and for non-carcinogens are based on a hazard quotient of 1. The values for industrial air take into account the differences in the assumed exposure scenario versus that for residential air. The RSL values are similar to values that could be calculated using the equations in TACO.

Based on the extensive site characterization work previously performed to address groundwater and soil gas at the site, nine compounds were identified (i.e., the first nine compounds listed in Table 2). Additional compounds were added to the list at the request of the IEPA.

The compounds of interest include three suspected carcinogens (i.e., benzene, ethylbenzene, and 1,4-dioxane) and a number of non-carcinogenic analytes. In addition, gas-phase total petroleum hydrocarbons (TPH-g) are included as a target analyte. The TPH-g will serve to ensure that any significant potential hydrocarbon exposures are identified, even if the specific compounds are not addressed by the analyses. Given that TPH-g may include a wide variety of different compounds, the analysis will be for information purposes only and no screening levels will be applied to the TPH-g data.

The screening levels for indoor air are taken directly from the EPA RSL tables for the non-carcinogenic compounds (i.e., HQ=1 values were used). For the two carcinogens other than benzene (i.e., ethylbenzene and 1,4-dioxane), project-specific screening levels for indoor air have yet to be developed. Values based on a 1E-05 risk level would be consistent with US EPA recommendations.

In addition to the screening values given in **Table 3a and 3b**, measured indoor air concentrations also may be compared with reported typical concentrations in buildings without vapor intrusion (Hodgson and Levin, 2003) (USEPA, 2008).

4.3 REPORTING

Weekly Field Report

A tracking spreadsheet was developed and issued to IEPA on February 17, 2011 for review. If acceptable, this spreadsheet would be kept up to date as information becomes available, and transmitted to the agencies on a weekly basis. The spreadsheet summarizes the investigation work completed and the work planned to be conducted the following week. In addition, this report will contain a running summary of the evaluation/investigation efforts completed to date. For each residence, the summary will include:

- Date initial contact is scheduled
- Date of initial contact
- Access agreement status
- Date investigation work at location is scheduled to begin
- Date investigation work begins
- Results of all field screenings
- Date last SSMP was installed
- Date investigation work is completed
- Date last canister sent to lab for analysis
- Date last set of canister analytical results received from lab
- Additional comments

Residence Evaluation Report

In addition to the weekly field reports, a separate report for each residence will be generated which documents the results of the evaluation. Individual residence evaluation reports will be submitted to IEPA and IDPH within fourteen days of receipt of TO-15 analytical results. Each report will include:

- A general introduction to the overall project and the purpose of the evaluation
- A general description of the efforts carried out in completing the evaluation
- A copy of the Walk-Through Assessment Form and a discussion of the information on the form
- A description of the procedures used to carry out the required indoor air sampling/analysis effort and a discussion of the results
- A description of the procedures used to install the SSMPs
- A description of the procedures used to conduct the required SSMP sampling/analysis and a discussion of the results. (Results may not have been validated.)

The initial access notification letters for vapor intrusion investigation were sent out February 3, 2011. The initial home visits began on February 2, 2011 and are continuing. Sampling will begin once this plan is approved, with a tentative start time to begin in March.

AECOM, Inc. Hartford Hydrocarbon Plume Site Event-Based Monitoring Plan – Draft. March 2009.

ENSR Corporation. Collection of Indoor/Outdoor Whole Air Samples Using Summa™ Sampling Media. January 2, 2009.

ENSR Corporation. Effectiveness Monitoring Plan. July 12, 2007.

ENSR Corporation and Bureau Veritas. Effectiveness Monitoring Plan - Draft. December 9, 2005.

Hodgson, A.T. and H. Levin, April 21, 2003. Volatile Organic Compounds in Indoor Air: A Review of Concentrations Measured in North America Since 1990. Lawrence Berkeley National Laboratory, Berkeley, CA. LBNL-51715.

McHugh, T.E., P.C. DeBlanc, and R.J. Pokuda, 2006. Indoor Air as a Source of VOC Contamination in Shallow Soils Below Buildings. *Soil & Sediment Contamination*, 15, pp103-122.

U.S. Environmental Protection Agency (USEPA), 2008. U.S. EPA's Vapor Intrusion Database: Preliminary Evaluation of Attenuation Factors – Draft. EPA/OSW, Washington, DC. March 4, 2008.

U.S. Environmental Protection Agency (USEPA), 2010. Regional Screening Table. Available at:http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm
Accessed on September 8, 2010.

TABLE 1
SUMMARY OF SAMPLING LOCATIONS

VMP Location	Initial Screening (address)	Potential Step Out (address)
VMP-1	[redacted] East 2nd Street	[redacted] East 2nd Street
		[redacted] East 1st Street
	[redacted] East 2nd Street*	[redacted] East 2nd Street**
VMP-2	[redacted] East 2nd Street*	[redacted] East 2nd Street**
	[redacted] East 3rd Street	[redacted] East 3rd Street
		[redacted] East 3rd Street
		[redacted] East 3rd Street
		[redacted]
VMP-4	147 East 4th Street	[redacted] East 4th Street [redacted]
		[redacted] East 4th Street
		[redacted] East 4th Street
	[redacted] East 5th Street	[redacted] East 5th Street
VMP-5	[redacted] East 5th Street	[redacted] East 5th Street
	[redacted] East 6th Street	[redacted] East 5th Street
VMP-6	[redacted] East 6th Street	[redacted] East 6th Street
	[redacted] East 7th Street	[redacted] East 7th Street
		[redacted] East 7th Street
VMP-11	[redacted] East 8th Street	[redacted] East 8th Street
		[redacted] East 7th Street
		[redacted] East 7th Street
		[redacted] East 7th Street
		[redacted] East 7th Street
	[redacted] East 8th Street	[redacted] East 7th Street
		[redacted] East 7th Street
	Roxana Public Works	none

* [redacted] East 2nd Street is associated with both VMP-1 a VMP-2, therefore it is listed with both locations.

** [redacted] East 2nd Street is the step out for [redacted] East 2nd Street and is listed as such each time [redacted] East 2nd Street is listed.

*street addresses concealed for homeowners privacy.

TABLE 2
TARGET COMPOUNDS AND REPORTING LIMITS

Analyte	CAS Number	Target Analytical Reporting Limit (µg/m^3)	
		Indoor Air	Soil Gas
TO-15 Analytes			
Benzene	71-43-2	5	50
Toluene	100-88-3	150	1,500
Ethylbenzene	100-41-4	10	100
m-/p-Xylene	108-38-3 106-42-3	100	1,000
o-Xylene	95-47-6	100	1,000
1,2,4-Trimethylbenzene	95-63-6	3	30
1,3,5-Trimethylbenzene (mesitylene)	108-67-8	3	30
n-Hexane	110-54-3	350	3,500
n-Propylbenzene (isocumene)	103-65-1	500	5,000
Isopentane	78-78-4	50	500
n-Butane	106-97-8	50	500
Cycloheaxane	110-82-7	50	500
2,2,4-Trimethylpentane	540-84-1	50	500
1,4-Dioxane	123-91-1	50	500
TPH-g	n/a	100	1,000
Additional compounds by ASTM D-1946 analysis			
Methane	74-82-8	0.005% (50 ppmv)	0.05% (500 ppmv)

Notes:
1. TPH-g = Total Petroleum Hydrocarbons (gas phase)
2. Total xylenes are defined as the sum of m-/p- and o- isomers
3. Total trimethylbenzenes are defined as the sum of 1,2,4- and 1,3,5- isomers

TABLE 3a - Residential
PROJECT-SPECIFIC SCREENING LEVELS

Analyte	Screening Level (µg/m³)		
	Indoor Air	**Soil Gas[a]**	**Soil Gas[b]**
Benzene	10 29 (acute)	370	41,000
Toluene	5,200	6,200,000	140,000,000
Ethylbenzene	TBD	1,400,000	59,000,000
m-/p-Xylene	730	130,000	16,000,000
o-Xylene	730	120,000	14,000,000
1,2,4-Trimethylbenzene	7.3	None	None
1,3,5-Trimethylbenzene	None	None	None
n-Hexane	730	None	None
n-Propylbenzene	1,000	None	None
Isopentane	None	None	None
n-Butane	None	None	None
Cycloheaxane	6,300	None	None
2,2,4-Trimethylpentane	None	None	None
1,4-Dioxane	TBD	220	15,000
TPH-g	None	None	None
Methane	None	None	None

a – Applicable if soil or groundwater contamination is within 5 feet, vertically or horizontally, of an existing or potential building.
b – Applicable if soil and groundwater contamination are more than 5 feet, vertically and horizontally, from an existing or potential building.

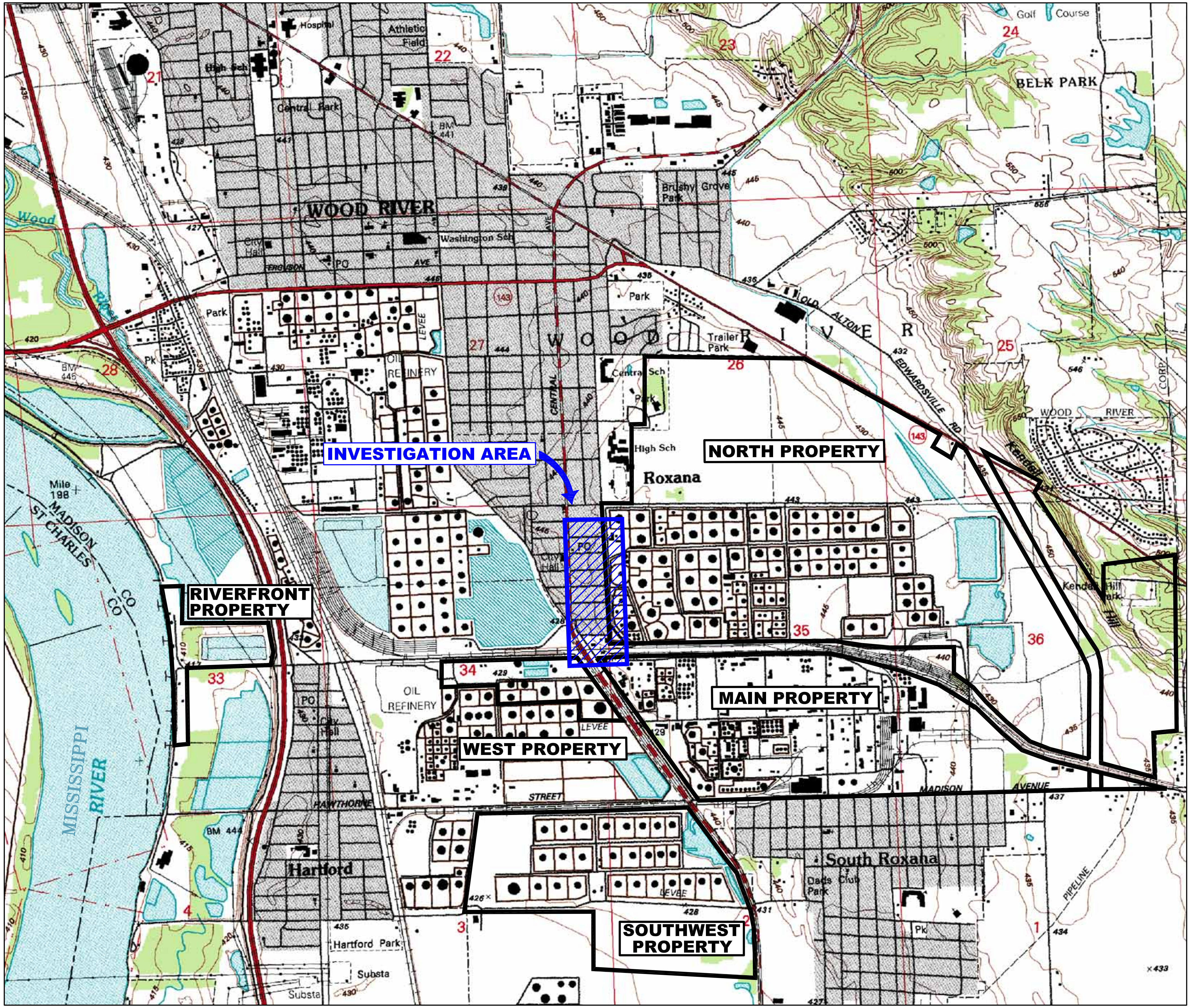
TBD = To be determined

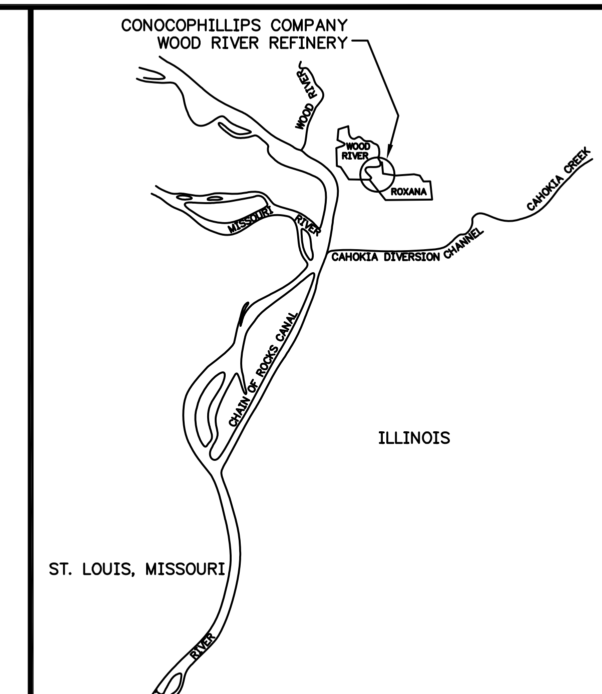
TABLE 3b – Commercial / Industrial
PROJECT-SPECIFIC SCREENING LEVELS

Analyte	Screening Level (µg/m³)		
	Indoor Air	**Soil Gas[a]**	**Soil Gas[b]**
Benzene	10 29 (acute)	2,800	300,000
Toluene	22,000	40,000,000	140,000,000
Ethylbenzene	TBD	8,300,000	59,000,000
m-/p-Xylene	3,100	820,000	52,000,000
o-Xylene	3,100	790,000	41,000,000
1,2,4-Trimethylbenzene	31	None	None
1,3,5-Trimethylbenzene	None	None	None
n-Hexane	3,100	None	None
n-Propylbenzene	4,400	None	None
Isopentane	None	None	None
n-Butane	None	None	None
Cycloheaxane	26,000	None	None
2,2,4-Trimethylpentane	None	None	None
1,4-Dioxane	TBD	2,300	110,000
TPH-g	None	None	None
Methane	None	None	None

a – Applicable if soil or groundwater contamination is within 5 feet, vertically or horizontally, of an existing or potential building.
b – Applicable if soil and groundwater contamination are more than 5 feet, vertically and horizontally, from an existing or potential building.

TBD = To be determined





SITE VICINITY MAP

SCALE: 1IN = 8 MILES

LEGEND

WOOD RIVER REFINERY PROPERTY BOUNDARY

INVESTIGATION AREA

SOURCE: MAP TAKEN FROM ELECTRONIC USGS DIGITAL RASTER GRAPHIC 7.5 MINUTE TOPOGRAPHIC MAP OF WOOD RIVER, ILL-MO REVISED 1994.

CONTOUR INTERVAL = 5 FT

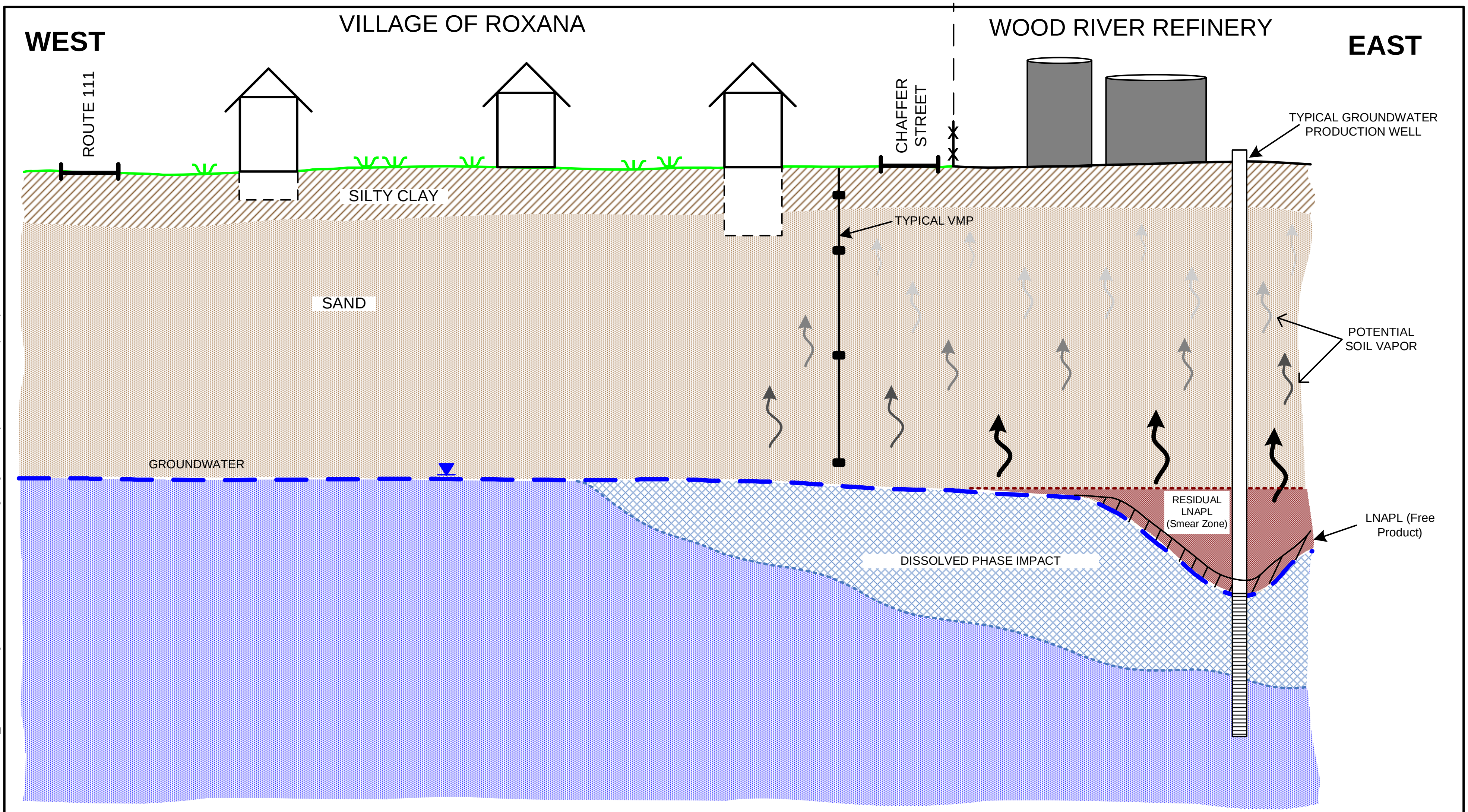
0 2000

SCALE FEET

N

SHELL OIL PRODUCTS US ROXANA, ILLINOIS	PROJECT NO. 21562291
URS	
DRN. BY: djd 2/16/10 DSGN. BY: djd CHKD. BY: wmp	Site Location Map / FIG. NO. 1

File: P:\ENVIRONMENTAL\SHELL OIL PRODUCT US\B-ROXANA-ROUTE 111\2156XXXX_ROXANA INVESTIGATION & ASSESSMENT\DRAWINGS\FIG 1 SITE LOCATION MAP.DWG Last edited: 09/10/10 @ 12:41 p.m. @ WCC-ST.LOUIS



NOTES:

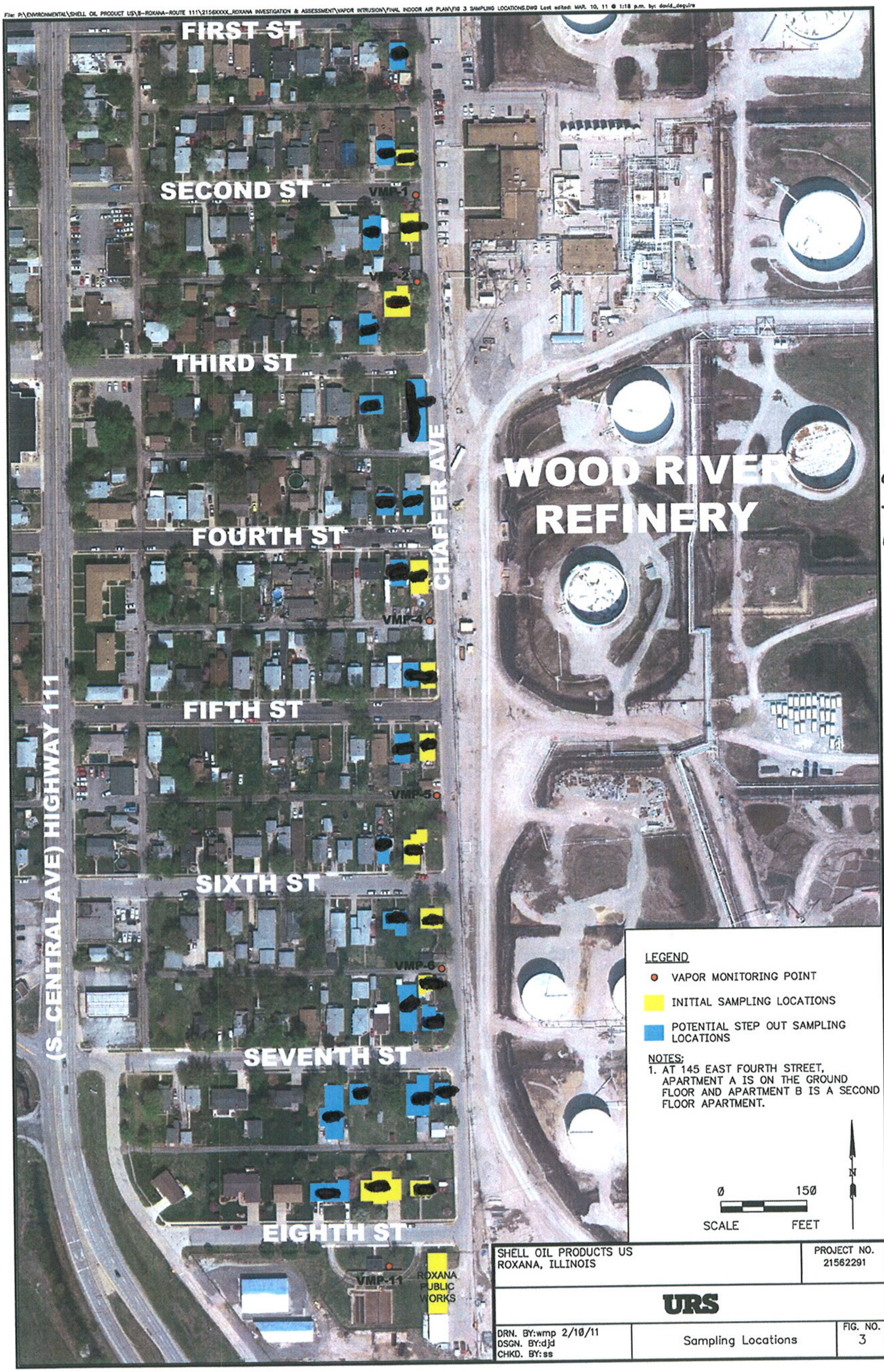
NOT TO SCALE

SHELL OIL PRODUCTS US ROXANA, ILLINOIS		PROJECT NO. 21562291
URS		
DRN. BY: wmp 9/10/10 DSGN. BY: b3 CHKD. BY: b3	Conceptual Site Model	FIG. NO. 2

P:\Environmental\Shell Oil Product US\B-Roxana-Route 111\21562XXXX_Roxana Investigation & Assessment\Drawings\Fig 2 Conceptual Site Model (rev 3).vsd

Last edit: 9/20/2010 11:04:53 AM

File: P:\ENVIRONMENTAL\SHELL OIL PRODUCT US\B-ROXANA-ROUTE 111\2156XXXX_ROXANA INVESTIGATION & ASSESSMENT\VAPOR INTRUSION\FINAL INDOOR AIR PLAN\FIG 3 SAMPLING LOCATIONS.DWG Last edited: MAR. 10, 11 @ 1:18 p.m. by: david_dequire



*Street addresses concealed for home-owners privacy.

URS

February 3, 2011

Resident
[address]
[address]
Roxana, Illinois 62084

Re: **Request for Access**
Village of Roxana

Dear __________:

URS Corporation (URS), on behalf of Shell Oil Products US (Shell), is conducting an environmental assessment in the proximity of the western property boundary of the Main Plant area of the Wood River Refinery located at 900 South Central Avenue, Roxana, Illinois (Shell previously operated this oil refinery from 1918 to 2000). As part of this assessment, URS respectfully requests permission to enter your property and perform certain Work outlined below to assess the possible migration of petroleum-related vapors from the subsurface into your home.

The Work requested to be performed in this letter is not related in any way to the work being undertaken by the Hartford Working Group in Hartford, Illinois. Information about this overall assessment can be found at the following internet site — http://roxanainvestigation.urs-stl.net; a repository has also been established at the Roxana Village Hall. Please note that this Work : (1) is being carried out in accordance with plans approved by Illinois Environmental Protection Agency (IEPA); and (2) will be reviewed and overseen by IEPA. The Illinois Department of Public Health (IDPH) is also involved in this project.

The proposed scope of work to be conducted at your property includes, but is not limited to: inspections/assessments of your home; indoor and outdoor air and soil vapor sampling; installation/operation/ maintenance of vapor mitigation equipment, if necessary; and other vapor mitigation activities, if necessary (the “Work”). Please note that all activities carried out on your property will be subject to your approval.

It is anticipated that this Work will be completed over the next several weeks. Initially, Shell would like to conduct an inspection/assessment of the home and collect indoor, outdoor and subsurface air samples. Additional measurements and/or sampling events and possible remedial activities may be needed in the future. A report documenting the results of our initial efforts will be provided to you soon after they are completed. Additional plans/reports regarding our efforts as they may affect your property will be provided to you as they are developed.

The Work described in this letter will be performed by URS Corporation and their subcontractors, under contract with Shell, and they will comply with the IEPA approved work plan and the Health and Safety Plan developed for this project.

The Work activities described in this letter may result in minor disruptions of the normal use of your property. We will work with you to minimize these disruptions. Shell agrees to indemnify you, the property owner and/or occupant of the property, from any and all claims by third parties which arise directly out of the Work performed by Shell under this agreement.

Shell respectfully requests that you contact URS Corporation within the next 2 weeks (by February 18, 2011) to schedule a convenient time to meet with representatives of URS, IEPA, IDPH and the Village. These representatives anticipate meeting for approximately ½ hour to discuss the planned work, and answer any questions or concerns. We will also provide you with written materials concerning the planned work.

Please contact Wendy Pennington of URS, by phone or email, to schedule the visit:

Wendy Pennington
Phone: 618-225-7613
Email: wendy_pennington@urscorp.com

We have also included an access agreement for this work. We respectfully request that you sign and return the attached agreement if you choose to grant access to your property (or choose not to grant access).

Thank you for your consideration in this matter. URS and Shell look forward to working with you to assess your home, and address issues, if necessary. Should you have any questions or require additional information, please contact me at 314/743-4108 or bob_billman@urscorp.com, or contact Jim Moore, P.E. of IEPA at 217/524-3295.

Sincerely,

Robert B. Billman
Senior Project Manager

cc.: Marty Reynolds – Village of Roxana
Mara McGinnis – IEPA
Chris Cahnovsky – IEPA

Access Agreement for URS on behalf of Shell to Perform Certain Work on Property

Property Address ___________________
Name of Property Owner _____________

____ Yes, I have reviewed Shell Oil Products' February 3, 2011 request and I hereby consent to the entry of Shell, its employees, authorized agents and contractors, upon my property for the purpose of performing the Work described in the subject letter. I understand that I may not be able to use a portion of my property during the Work and I agree to the minor disruption of the normal use of my premises as described.

I further represent and warrant that I am the owner of the subject property and have full authority to provide the consent being given for this property in the Village of Roxana.

____ No, I have reviewed Shell Oil Products' February 3, 2011 request and do not grant access to Shell to my property in the Village of Roxana.

Property Owner Signature ____________________________ Date ___________________

Please return a signed copy of this form to Wendy Pennington of URS Corporation (a pre-addressed stamped envelope is enclosed for your convenience). Shell respectfully requests that you respond to this letter within seven days of its receipt, so that the proposed work can begin as soon as possible.

URS

WALK THROUGH ASSESSMENT SURVEY

ASSESSORS *(initials)*

(Please include NA for not applicable where necessary)

Date: ____________________

Time: *(survey time)* ____________________

Address: ____________________

Residential Contact: ____________________

Phone: (Home) ____________________ **(Cell)** ____________________

Choose one:
Own ☐ **Rent** ☐ **Other** ☐

If Renting/Other:

Landlord Name: ____________________

Landlord Address: ____________________

Landlord Phone Number: ____________________

Has there been an odor complaint(s) reported? **Yes** ☐ **No** ☐

Date of Complaint(s): ____________________

Type of Odor: ____________________

Was there an odor complaint at time of assessment? **Yes** ☐ **No** ☐

Type of Odor: ____________________

Have indoor air samples been collected from the residence: **Yes** ☐ **No** ☐

If so, can URS be provided the results? **Yes** ☐ **No** ☐

Comments:

____

URS

BUILDING CONSTRUCTION

Type of Structure: Single Family ☐ Duplex ☐ Condominium ☐
Townhouse ☐ Other ☐

Structure Description: ______________________________

Number of Floors: ______________________________

Age of Structure: ______________________________

	Yes	**No**
Slab on grade? *(If yes, see slab section for additional description)*	☐	☐
Basement? *(If yes, see basement section for additional description)*	☐	☐
Finished ☐ Unfinished ☐		
Crawlspace? *(If yes, see crawlspace section for additional description)*	☐	☐
Under what % of structure: _____		

Approximate square footage of the structure: _______

General aboveground construction material (check all that apply):
Wood ☐ Brick ☐ Concrete ☐ Cement block ☐
Other ________

Foundation construction (check all that apply):
Concrete slab ☐ Fieldstone ☐ Concrete block ☐ Elevated aboveground/grade ☐
Other ________

Integrity of structure (check all that apply):
Good ☐ Fair ☐ Poor ☐
Other ________

Has the structure been weatherized with any of the following (check all that apply):
Insulation ☐ Storm windows ☐ Energy-efficient windows ☐
Other ________

SLAB SECTION

Are there any drains in the slab? Yes ☐ No ☐

If yes, how many? ______________________________

If yes, are there sewer trap(s)? Yes ☐ No ☐

Are there any exposed slab cracks? Yes ☐ No ☐

Describe any other features about the slab structure:

____

BASEMENT SECTION

Does anyone reside in the basement? Yes ☐ No ☐

If so, how many and who? ______________________________

Basement description (Provide field drawing)

Basement Dimensions: ______________________________

Has the basement flooded previously? Yes ☐ No ☐

If so, how often? ______________________________

When was the last time it flooded? ______________________________

Was there a sheen on the water? Yes ☐ No ☐

Describe: ______________________________

Does the basement have moisture problems? Yes ☐ No ☐ Unknown ☐
Explain: ______________

Basement Floor

Basement Floor is (check all that apply):
Concrete ☐ Dirt ☐ Tile ☐
Other ________

Integrity of Basement Floor:
Good ☐ Fair ☐ Poor ☐

Are there cracks in the basement floor? Yes ☐ No ☐
Describe: ______________________________

Is there exposed soil in the basement walls? Yes ☐ No ☐
If yes, explain: ______________________________

Is the basement easily accessible? Yes ☐ No ☐
Explain: ______________________________

Basement Drains, Sumps, and Openings

Are there sumps in the basement? Yes ☐ No ☐
How many? ______________________________

Are there drains in the basement? Yes ☐ No ☐
How many? ______________________________
How many floor drains have sewer traps? ______________
Other comments/descriptions: ______________________________

Are there any other types of holes or openings in the basement? Yes ☐ No ☐
Explain: ______________________________

URS

Are any of the following used or stored in the basement?

	Yes	No
Paint	☐	☐
Paint stripper/remover	☐	☐
Gasoline	☐	☐
Diesel fuel	☐	☐
Gasoline or Diesel powered equipment	☐	☐
Solvents	☐	☐
Glue	☐	☐
Metal degreaser/cleaner	☐	☐
Drain cleaners	☐	☐
Pesticides	☐	☐
Laundry spot removers	☐	☐
OTHER:	☐	☐

CRAWLSPACE SECTION

Crawlspace Dimensions: ______________________________

Crawlspace floor type: Concrete ☐ Dirt ☐ Gravel ☐ Other: __________

Crawlspace construction type:
Wood ☐ Brick ☐ Concrete ☐ Cement Block ☐

Accessibility: Indoors ☐ Outdoors ☐
Describe entry points: ______________________________

UTILITY SECTION

	Yes	No
Private water well on the property:	☐	☐
Septic system on the property:	☐	☐

Electrical Service Amperage: 60A ☐ 100A ☐ 200A ☐
Other: ______________________________

Type of heating (check all that apply):
Natural gas ☐ Fuel oil ☐ Electric ☐ Wood ☐ Coal ☐
Other: ______________________________

Heat conveyance system:
Forced hot air ☐ Forced hot water ☐ Steam ☐ Radiant floor heat ☐
Wood stove ☐ Coal furnace ☐ Fireplace ☐ Other: ________________

Where is the furnace located? *(show on drawing)* ____________________________

Is there air conditioning? Yes ☐ No ☐

Air conditioning type (check all that apply):
Central air conditioning ☐ Window air conditioning unit(s) ☐
Other: ____

Water heater type:
Gas ☐ Electric ☐ Furnace ☐
Other: ____

Water heater location: *(show on drawing)* _________________________________

Outside utility outlet present? Yes ☐ No ☐
If yes, where: ____

Where do utilities enter the structure? *(show on drawing)*
North side: ____
East side: ____
South side: ____
West side: ____

NATURAL GAS SECTION

Is there a notable natural gas odor in the indoor ambient air of structure? Yes ☐ No ☐
If yes, where? ____

If not, using air monitoring equipment, has there been a detection of natural gas near any joints, valves, thermostats or lines connected to the furnace, boiler or water heater? Yes ☐ No ☐
Comment: ____
If yes, has resident been notified of the natural gas odor and detection? Yes ☐ No ☐

Will an additional walk through assessment need to be conducted once the natural gas line has been fixed? Yes ☐ No ☐

EXTERIOR DESCRIPTION *(Provide Field Drawing)*

Is there a garage? Yes ☐ No ☐
Attached ☐ Detached ☐

Is there a storage shed or other building unit on property? Yes ☐ No ☐
Attached ☐ Detached ☐

Describe: ____

URS

HOUSEHOLD ITEMS
Sources of Chemical Contaminants

Potential VOC Source	**Item Present In Structure? (Yes/No)**	**Source Location**	**Removed 48 hours prior to sampling (Yes/No/NA)**
Paints or paint thinners			
Gas-powered equipment			
Gasoline storage cans			
Cleaning solvents			
Air fresheners			
Oven cleaners			
Carpet/upholstery cleaners			
Hairspray			
Nail polish/remover			
Bathroom cleaner			
Appliance cleaner			
Furniture/floor polish			
Moth balls			
Fuel tank			
Wood stove			
Fireplace			
Perfume/cologne			
Hobby supplies (e.g., solvents, paints, lacquers, glues, photographic dark room chemicals)			
Scented trees, wreaths, potpourri, etc			
Other			

	Yes	**No**
Do one or more smokers occupy this structure on a regular basis?	☐	☐
Do the occupants frequently have their clothes dry-cleaned?	☐	☐
Have you recently remodeled or painted?	☐	☐
Are there any pressed wood products in the structure (e.g., hardwood, plywood wall paneling, particleboard, fibreboard)?	☐	☐
Are there any new upholstery, drapes, shower curtains, or other textiles in the structure?	☐	☐
Has the structure been treated with any insecticides/pesticides?	☐	☐

If yes, what chemicals are used/how often are they applied? ______________________

(cont.) | Yes | No

Are pesticides/herbicides utilized in the yard or garden? ☐ ☐
If yes, what chemicals are used/how often are they applied? ______________________

Is there any stationary emission source in the vicinity of the structure ☐ ☐
If yes, describe: ____

Are there any mobile emission sources (e.g., highway, bus stop, high-traffic area) in the vicinity of the structure? ☐ ☐
If yes, describe: ____

RESIDENT INFORMATION

Resident Contact: ____

When contact may be reached: **Day** ☐ **Evening** ☐

List of Occupants:

Name	Occupation	Under 18?	Sex	Length of time at residence

PHOTO LOG

Photo Documentation:
(Identify, measure, and photograph cracks)

Description and Photo ID or number:
(*Reminder*: **Interior –** electrical panel, floor drains, floor cracks, wall cracks, sumps, all sides of basement; utility entry points, potential basement access issues)

(*Reminder*: **Exterior –** North, East, South, and West sides; utility entry points; landscape within 5 feet of structure; potential site access issues)

INDOOR AIR SCREENING TABLE

Floor	Location	FID/PID	LEL % (where applicable)

Walk-Through Inspection Worksheet

Walk-Through Date: ____________________

Residence Information:

Name: ________________________________

Address: ______________________________

Personnel: ___________________________

Needs Assessor: ______________________

Construction Manager: ________________

Agency Oversight Rep.: _______________

Subcontractor: _______________________

N

Draw in Arrow

Legend

HW Hot Water Heater

Furnace

AC Air Conditioner

Floor Drain

Stairs

Crawl Space

Window

Foundation Crack

Door

S Sump Pump

Column

Wall Partition

Heating/Cooling Register

E Electrical Load Center/Fuse Box

Electrical Outlet

—W— Water

—G— Gas

—E— Electric

—S— Sewer

—T— Telephone

Floor Condition:

All Concrete? Yes _____ No _____

(If No, Note Areas of Concrete or Soil)

Basement Wall Construction Type: _________

Interior Finished? Yes _____ No _____

If Yes, Type of Finished Wall: ____________

Drawn By: ___________________________

BASEMENT FLOOR PLAN

Scale: ¼” = 2'

1. Objective

This document defines the standard operating procedure for calibration and maintenance of field instruments frequently used during environmental field activities. This Standard Operating Procedure (SOP) gives descriptions of the most common used of these instruments and field procedures necessary to calibrate and maintain these field instruments. Other related SOPs are listed below:

- SOP No. 4 – Decontamination
- SOP No. 8 – Field Reporting and Documentation.

2. Equipment

The following equipment is required during field instrument calibration and maintenance activities.

- Latex/Nitrile gloves
- Site logbook
- Field data sheets
- Equipment Calibration Record forms
- Distilled/deionized water
- Decontamination equipment
- Health and Safety Equipment
- Field Instrument Operations Manual
- Calibration gases for Air Monitoring Equipment
- Calibration solutions for Water Monitoring Equipment.

3. Type of Field Instruments Commonly used during Environmental Investigations

The following are some of the more commonly used instruments during environmental investigations.

- Photoionization Detector (PID)
- Multi-gas Meter (usually includes Explosimeter, Hydrogen Sulfide detector, Oxygen sensor, and Carbon Monoxide meter)
- RAM

- Groundwater Level Indicator
- Petroleum/Groundwater Interface Probe
- Groundwater pH, Temperature, Conductivity Meter.

4. Maintenance

Maintenance of field instruments should be performed on all field instruments on a regular basis to ensure instruments are in proper working order at all times and to prolong the instruments life. General maintenance such as regular cleaning of the instrument, battery checks and replacement, and ensuring the instrument is handled and stored properly can easily be performed by URS employees. Other maintenance items such as sensor repair, annual calibrations and repair of a malfunctioning piece of equipment should be performed by the instrument manufacturer or licensed dealer and should not be performed by URS employees. Contact the manufacturer to determine where the instrument should be submitted for these maintenance tasks. The vast range of instruments available for use by the environmental professional have an equally vast maintenance regime and therefore maintenance guidelines specified in manual for each piece of equipment should be referred to and followed at all times.

5. Calibration

Due to the vast number of field instruments available, various parameters potentially monitored, and the wide range of functions potentially performed by each instrument, a description of the calibration of every type of instrument available is not feasible. However, a generalized SOP for general types of field equipment calibration is presented and should be followed while performing calibrations of field instruments.

Air Monitoring Instruments (PID, Multigas Meters, Hydrogen Sulfide Detectors, etc.)

- Turn the instrument on. The on/off switch may be a toggle switch, knob, or button to be depressed depending on the type and brand of instrument being used.
- Allow the instrument to "warm up" and progress through the startup diagnostic routine.
- Apply the calibration gas (isobutylene, methane, multi-gas mixtures, etc.) to the instrument to get an initial instrument reading.
- Record the initial reading on the proper equipment calibration field form and in the site logbook. Also record the calibration standard and concentration of that standard on the field form and in the logbook.

- If the initial reading is greater than +/-5% of the calibration standard proceed with instrument calibration as specified in the equipment operator's manual. If the initial reading is within this +/- 5% window of the calibration gas standard, the instrument should be considered calibrated and additional calibration is not required at this time. At periodic intervals throughout the day the calibration of the instrument should be check and re-evaluated.
- Apply the calibration gas and proceed as directed in the operator's manual.
- After calibration is complete, record the final calibrated reading on the field equipment calibration forms and in the field logbook. At periodic intervals throughout the day the calibration of the instrument should be check and re-evaluated.

Groundwater Parameter Instruments (pH, Temperature, Electrical Conductivity, Turbidity, etc.)

Frequently one instrument will have multiple sensors for measuring various parameters in water. Sensors for temperature, electrical conductivity and turbidity require scheduled calibrations by the equipment manufacturer or authorized service center and should not be performed in the field. The sensor for pH analysis should be calibrated daily in the field prior to use.

- Turn the instrument on. The on/off switch may be a toggle switch, knob, or button to be depressed depending on the type and brand of instrument being used.
- Allow the instrument to "warm up" and progress through the startup diagnostic routine.
- Apply pH 7 and pH 4 buffers solutions as instructed by the instrument prompts or the operator's manual.
- Adjust the reading of the instrument to correlate to the corresponding buffer solution being applied.
- Record reading in the field logbook and on proper field calibration forms.
- Dispose of used buffer solution and reseal buffer solution containers for future use.

Water Level Indicator and Petroleum/Water Interface Probe

Field calibration of this instrument is not required. Rather a series of field checks to ensure the instrument is in proper working order will be described.

- Turn the instrument on. The on/off switch is usually a knob located on the side of the reel in which the measuring tape is rolled onto.

- Push the "test" button to ensure that the batteries are in working order. If the batteries are working, an audible tone will be heard and a visible light located on the side of the real will illuminate.
- Immerse the sensor probe in potable water to ensure the audible tone is heard and visible light illuminates when the electrical circuit is completed when the probe enters the water. Make an observation of where the water level is at on the probe when the circuit is completed. Repeat this step several times to familiarize yourself with this contact point. By performing this step, the chance of submersing the probe to a greater depth than necessary is reduced. Over submersion of the probe will result in a greater amount of the probe and measuring tape to be cleaned and decontaminated prior to collection of another groundwater measurement.
- After collection of every water level measurement, decontaminate all portions of the water level meter or petroleum/water interface probe that came in contact with the groundwater as outlined in SOP No. 4 – Decontamination.

6. Decontamination

Small instruments and equipment will be cleaned according to SOP No. 4 – Decontamination and the generalized procedures stated below:

a. Rinse with potable water to remove the gross contamination

b. Scrub with brush using Alconox soap (or equivalent) and distilled water solution

c. Rinse with distilled water.

Decontaminated equipment should be wrapped in aluminum foil or placed in plastic bags between uses and during storage.

This document defines the standard procedure for field reporting and documentation. This procedure provides descriptions of equipment and field procedures necessary to properly document field activities.

1. Equipment

Equipment used during field reporting and documentation:

- Calculator
- Bound field logbook
- Waterproof pen and permanent marker
- Well completion information form (if necessary)
- Groundwater sampling form (if necessary)
- Boring log (if necessary)
- Other related field paperwork, as needed.

2. Field Reporting and Documentation

Documentation of observations and data acquired in the field will provide information on the acquisition of samples and also provide a permanent record of field activities. The observations and data will be recorded using pens with permanent waterproof ink in a permanently bound weatherproof field logbook.

Field investigation situations vary widely. No set of general rules can anticipate all information that must be entered in a logbook for a particular site. A site-specific logging procedure will be developed to include sufficient information so that the sampling activity can be reconstructed without relying on the memory of field personnel. The logbooks will be kept in the field team member's possession or in a secure place during the investigation.

Each project should have a dedicated logbook. The project leader's name, the sample team leader's name (if appropriate), the project name and location, and the project number should be entered on the inside of the front cover of the logbook. It is recommended that each page in the logbook shall be numbered and dated. The entries should be legible and contain accurate and inclusive documentation of an individual's project activities. At the end of the all entries for each day, or at the end of a particular event, if appropriate, the investigator shall draw a diagonal line and initial and date indicating the conclusion of the entry. Since field records are the basis for later written reports, language should be objective, factual, and free of personal feelings or other terminology which might prove inappropriate. Once completed, these field logbooks become accountable documents and must be maintained as part of the official project files. All aspects of sample collection and handling, as well as visual observations, shall be documented in the logbooks.

The information in the field book will include the following as a minimum.

- Personnel present
- Level of PPE used during sampling
- Weather conditions
- Names and responsibilities of field crew members
- Names and title of any site visitors
- Field analytical equipment, and equipment utilized to make physical measurements shall be identified
- Sample collection equipment (where appropriate)
- Calibration results of field equipment
- Location of Sample
- Description of samples (matrix sampled)
- Results of any field measurements, such as depth to water, pH, temperature, and conductivity
- Sample depth (if applicable)
- Date and time of sample collection
- Sample identification code including QC and QA identification
- Number and volume of samples
- Sampling methods or reference to the appropriate SOP
- Sample handling, including filtration and preservation, as appropriate for separate sample aliquots
- Analytes of interest
- Information concerning sampling changes, scheduling modifications, and change orders
- Field observations

- Summary of daily tasks
- Signature and date by personnel responsible for observations
- Problems identified with equipment or aspects of the project.

Changes or deletions in the field book should be lined out with a single strike mark, initialed, and remain legible. Sufficient information should be recorded to allow the sampling event to be reconstructed without relying on the sampler's memory.

Each page in the field books will be signed by the person making the entry at the end of the day, as well as on the bottom of each page. Anyone making entries in another person's field book will sign and date those entries.

3. Document Control

Document control refers to the maintenance of inspection and investigation project files. All information below shall be kept in project files. Investigators may keep copies of reports in their personal files, however, all official and original documents relating to inspections and investigations shall be placed in the official project files. The following documents shall be placed in the project file, if applicable:

- Chain-of-Custody Records and bound field logbooks
- Records obtained during the investigation
- Complete copy of the analytical data and memorandums transmitting analytical data
- Official correspondence received or transmitted, including records of telephone calls
- Photographs and negatives associated with the project
- One copy of the final report and transmittal memorandum
- Relevant documents related to the original investigation/inspection or follow-up activities related to the investigation/inspection.

Inappropriate personal observations and irrelevant information should not be placed in the official project files. At the conclusion of the project, the project leader shall review the file to ensure that it is complete.

1. Objective

This document defines the standard procedure for the control and custody of environmental samples. This SOP is intended to be used together with several other SOPs. Applicable SOPs are listed below:

- SOP No. 8 - Field Reporting and Documentation
- SOP No. 11 - Groundwater Sampling
- SOP No. 24 - Sample Classification, Packaging, and Shipping
- SOP No. 25 - Sample Containers, Preservation, and Holding Times
- SOP No. 28 - Soil Sampling
- SOP No. 31 - Surface Water Sampling
- SOP No. 32 - Sediment Sampling.

2. Equipment

The following equipment will be needed for sample control and custody procedures:

- Waterproof coolers (hard plastic or metal)
- Custody Seals
- Field forms such as a Chain of Custody (COC) or sample collection sheet
- Field Notebook
- Ice
- Sample Log-in Book
- Clear Tape
- Duct Tape
- Zip-Loc Bags
- Waterproof pens
- Permanent Markers.

3. Sample Control and Custody Procedures

Once the samples are collected, they must remain in the custody of the sampler or another worker from the site. The samples can also remain unattended in a locked vehicle or jobsite trailer so tampering with the samples will not be possible. Right before shipment, a custody seal should be placed over the opening of the cooler and then the cooler should be taped all the way around with clear packing tape to prevent tampering with the samples. Samples will be hand delivered or shipped via overnight express carrier for delivery to the analytical laboratory (see SOP No. 24). All samples must be shipped for laboratory receipt and analyses within specific holding times. This may require daily shipment of samples with short holding times. Each cooler will contain a chain of custody (COC) form.

During field sampling activities, traceability of the samples must be maintained from the time the samples are collected until the laboratory data is issued. Initial information concerning the collection of the samples will be recorded in the field log book as outlined in SOP No. 8 – Field Reporting and Documentation. Information on the custody, transfer, handling, and shipping of samples will be recorded on a COC form. If the COC is not three-part (minimum) carbon-copy form, then photocopy the COC after signatures have been obtained, before the samples and original copy leave the site. An example COC form is attached to this procedure.

The sampler will be responsible for initiating and filling out the COC form. The COC will be signed by the sampler or the field person responsible for sample handling when the sampler relinquishes the samples to anyone else. One COC form will be completed for each cooler of samples collected daily and if samples are not hand delivered, the COC will be placed in a Zip-Loc bag and shipped inside the cooler. COC forms will be used to document the transport and receipt of samples from the field to the lab. Information required on a COC includes the following:

- Samplers signature and affiliation
- Project Number
- Date and time of collection
- Sample identification number
- Sample Type
- Analyses requested.
- The total number of containers being sent to the lab for each sample
- The appropriate preservative used
- If any samples are to be placed on hold at the laboratory, this should be clearly indicated on the COC in the comments section

- Signature of person(s) relinquishing custody, dates, and times
- Signature of person(s) accepting custody, dates, and times
- Method of shipment
- Shipping air bill number (if appropriate).

The person responsible for delivery of the samples to the laboratory will sign the COC form, retain the last copy of the three-part COC form, document the method of shipment, and send the original and the second copy of the COC form with the samples. Upon receipt at the laboratory, the person receiving the samples will sign the COC form. The original COC will remain with the samples until final disposition of the samples by the laboratory. The laboratory will dispose of the samples in an appropriate manner 60 to 90 days after data reporting.

Shell Oil Products Chain Of Custody Record

URS

Air Toxics LTD.

Project Name: Roxana Dissolved Phase

Project #

Lab Vendor #

Please Check Appropriate Box:

- ☑ ENV. SERVICES
- ☐ MOTIVA RETAIL
- ☐ SHELL RETAIL
- ☐ MOTIVA SD&CM
- ☐ CONSULTANT
- ☐ LUBES
- ☐ SHELL PIPELINE
- ☐ OTHER ________

Print Bill To Contact Name: Thomas Adams

PO #

INCIDENT # (ENV SERVICES): 9 7 2 1 6 6 4 0

☐ CHECK IF NO INCIDENT # APPLIES

SAP #: 3 4 0 0 6 1

DATE: 12/6/2010

PAGE: ______ of ______

SAMPLING COMPANY: URS CORPORATION

LOG CODE:

SITE ADDRESS: Street and City: 900 SOUTH CENTRAL AVE – ROXANA

State: IL

GLOBAL ID NO.:

ADDRESS: 1001 HIGHLANDS PLAZA DRIVE WEST - SUITE 300; ST. LOUIS, MO 63110

EDF DELIVERABLE TO (Name, Company, Office Location): Elizabeth Kunkel, URS, St. Louis

PHONE NO.: 314-743-4179

E-MAIL: Elizabeth_Kunkel@URSCorp.com

CONSULTANT PROJECT NAME #: Roxana Dissolved Phase

Laboratory Address: Air Toxics, LTD 180 Blue Ravine Road, Suite B, Folsom, CA 95630-4719

SAMPLER NAME(S) (Print):

TELEPHONE: 314-7429-0100

FAX: 314-429-0462

Bill To Contact E-MAIL: Thomas_Adams@URSCorp.com

TURNAROUND TIME (CALENDAR DAYS):

- ☑ STANDARD (14 DAY)
- ☐ 5 DAYS
- ☐ 3 DAYS
- ☐ 2 DAYS
- ☐ 24 HOURS
- ☐ RESULTS NEEDED ON WEEKEND

- ☐ LA - RWQCB REPORT FORMAT
- ☑ UST AGENCY:

DELIVERABLES:

- ☐ LEVEL 1
- ☐ LEVEL 2
- ☐ LEVEL 3
- ☑ LEVEL 4
- ☑ OTHER (SPECIFY) ________

- ☑ SHELL CONTRACT RATE APPLIES
- ☐ STATE REIMBURSEMENT RATE APPLIES
- ☐ EDD NOT NEEDED
- ☑ RECEIPT VERIFICATION REQUESTED

REQUESTED ANALYSIS

LAB USE ONLY	Field Sample Identification	SAMPLING DATE	SAMPLING START TIME	SAMPLING STOP TIME	Canister Number	Canister Pressure/Vacuum Initial ("Hg)	Canister Pressure/Vacuum Final ("Hg)	Canister Pressure/Vacuum Receipt	Canister Pressure/Vacuum Final (psi)	Method TO-15 (Standard)	ASTM D-1946 + Helium	ASTM D-1946 (Methane Only)					

Turn Around Time:

- ☑ Normal
- ☐ Rush
- ________ Specify

Lab Use Only

Pressurized by:

Date:

Pressurization Gas: N_2 He

ADDITIONAL NOTES:

- 14 day hold time
- Report results between MDL and RL
- Level IV ECVP

Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Received by: (Signature)	Date:	Time:

05/2/06 Revision

1. Objective

This document defines the standard operating procedure (SOP) and necessary equipment for collection of indoor air samples using canisters.

Work involving location access must be conducted by a team of at least two personnel. One member of the team will be designated as the field lead. The field lead will be responsible for interaction with site occupants.

SOPs providing additional related guidance are listed below:

- SOP No. 3 – Calibration and Maintenance of Field Instruments
- SOP No. 8 – Field Reporting and Documentation.
- SOP No. 26 – Sample Control and Custody Procedures.
- SOP No. 51 – Vapor Sample Classification Packaging and Shipping

2. Equipment

Personnel implementing this guideline must ensure that the following are in place:

- Field book
- Leather gloves
- Ultra-fine permanent marker
- Paper towels or Kimwipes
- Sampling logs
- Vacuum pressure gauge (-30 to 0 inches Hg)
- Photoionization Detector (PID)
- Flame Ionization Detector (FID) (e.g., Photovac MicroFID)
- 4-gas meter (e.g., QRAE)
- Methane detector (e.g., Landtec)
- Calibration gas
- Canisters with flow controllers (project specific appropriate size, supplied by the laboratory) or equivalent
- Swagelok® connectors and compression fittings

- Watch or timer
- Safety equipment (e.g. first aid kit, eye wash, 20lb fire extinguisher, etc.)
- Standard field tools (e.g., ratchet set, safety cutting tools, wrenches, zip-ties, etc.)
- Shipping supplies (e.g., UN boxes, shipping labels, hazard labels, packing tape)

3. Ambient Air Sampling

Prior to mobilizing to perform indoor air sampling, ensure the following:

- Access has been granted for the building in question for the period necessary for installation;
- Perform daily safety meeting, reviewing weather, procedures, and location concerns (access, animals, etc.)
- Verify that the occupant is present and is at least 18 years old. If no occupant is at least 18 years of age, installation will be rescheduled.
- Mobilize equipment into the location, minimizing re-entries.
- Verify that screening instruments are operating properly. Instruments indicating negative concentrations shall be re-zeroed.
- Assess air quality, using a four gas meter, methane detector, FID and PID, in the room where work is to be performed. If necessary locate any sources for potential elevated readings.
  - If VOC or LEL readings are above the levels stated in the site Health and Safety Plan (HASP) work will cease until ambient air conditions have resumed safe levels.
  - If oxygen levels drop below 19.6% vacate the residence.
- Perform walk through assessment survey. See **Appendix B** of the vapor intrusion investigation work plan for more information on the walk through assessment survey.
- Perform canister vacuum check, per the steps listed in **Section 4** of this SOP.
- Assemble a canister with the appropriate flow controller.
- Choose sampling locations related to the purpose of the work plan. Ensure that each location for the sample media and equipment is available so as to reduce potential harm to the sample or personal injury to building occupants or field personnel.

- Record Sample identification, canister number and initial vacuum on the sample data sheet and the canister sample tag.
- Remove the brass cap from the inlet of the flow controller.
- Place the canister in the appropriate sample location and open the canister valve one turn and record the sample start time on the sampling data sheet and the canister sample tag. For a 6-Liter canister set at -28 inches mercury (Hg) over a 24-hour period the flow rate is set by the analytical laboratory at 3.5 ml/min.
- Record a detailed description of the sample location on the data sheet.
- Allow canister to sample for chosen sample duration. The final vacuum reading should be between 5 and 10 inches of mercury. Do not allow the canister to equilibrate with the atmosphere. When the appropriate duration has elapsed, shut the valve.
- Remove flow controller from canister, obtain final canister pressure readings, and replace brass cap on the canister, per the steps listed in Section 4 of this SOP.
- Record the stop time and final vacuum reading on the sampling data sheet and the canister sample tag.
- Record sample information of the Chain of Custody and prepare sample for transportation to the laboratory.

4. 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 should be taken to keep all sampling equipment, especially the canisters, safe from damage.

Canister Vacuum Check

The canister vacuum check will be performed for 100% of the canisters.

Prior to Sampling

- Attach pressure gauge to the canister inlet.
- Open valve completely.

- Record reading. The canister should show a vacuum of approximately -28 inches of Hg. If the canister has a vacuum of less than -25 inches of Hg (adjusted for any elevation effects), then:
  - Label the canister with "Insufficient vacuum – No Sample";
  - Set canister aside for return to the laboratory; and
  - Contact project manager and lab coordinator if canister failures affect field work.
- Close valve completely.
- Remove the pressure gauge.

After Sampling

- Attach a pressure gauge to the canister inlet.
- Open valve completely.
- Record reading. There should still be a slight vacuum in the canister. If the canister does not show a significant net loss in vacuum after sampling, evaluate and document the problem. If necessary, contact the project manager immediately to determine the value of using another canister to recollect the sample.
- Close valve completely.
- Remove the pressure gauge.
- Seal canister with plug (cap).

5. ***Shipping***

- Sample information shall be recorded on a chain of custody for the laboratory following procedures outlined in **SOP No. 26**.
- Samples will 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** and check with one of the office hazardous shipping personnel.

1. Objective

This document defines the standard operating procedure (SOP) and necessary equipment for sub-slab soil-gas sampling with canisters.

Work involving location access must be conducted by a team of at least two personnel. One member of the team will be designated as the field lead. The field lead will be responsible for interaction with site occupants.

SOPs providing additional related guidance are listed below:

- SOP No. 3 – Calibration and maintenance of Field Instruments
- SOP No. 8 – Field Reporting and Documentation.
- SOP No. 26 – Sample Control and Custody Procedures.
- SOP No. 51 – Vapor Sample Classification Packaging and Shipping

2. Equipment

Personnel implementing this guideline must ensure that the following are in place:

- Field book
- Leather gloves
- Ultra-fine permanent marker
- Paper towels or Kimwipes
- Calculator
- Decontamination equipment
- Sample logs
- Small brush or broom
- 15 mL hand pump with gauge
- Vacuum pressure gauge (-30 to 0 inches mercury)
- Peristaltic pump
- Bios Dry Cal flow meter or equivalent device
- Portable analyzer with Flame Ionization Detector (FID) (e.g., Thermo Environmental TVA 1000, Photovac MicroFID)

- Portable analyzer with Photo-ionization detector (PID)(e.g., Mini-RAE)
- LEL meter (e.g., 4-gas meter)
- Landfill gas detector (e.g., Landtec GEM 500)
- Tracer gas meter (e.g., Dielectric MGD-2002 or equivalent)
- Tracer gas shroud (e.g., plastic tote)
- Tracer gas (e.g. Grade 5.0 helium) with regulator
- Canisters with flow controllers (project specific appropriate size, supplied by the laboratory) or equivalent
- Swagelok® T-Connector (2 per sample train assembly) – ¼” ID
- Swagelok® Port Connector (3 per sample train assembly) – ¼” ID to ¼” ID
- Swagelok® Ball Valves (3 per sample train assembly) – ¼” ID
- Swagelok® Barb Connector (2 per sample train assembly) – ¼” ID
- Swagelok® Bulkhead Reducing Union (1 per sample train assembly) – ¼” ID
- Swagelok® Ferrules (6 per sample) – ¼” ID
- Swagelok® Nuts (6 per sample) – ¼” ID
- Teflon® hard tubing (food or laboratory grade) – 1/8” ID – ¼” OD
- Tygon® soft tubing (food or laboratory grade) – 3/16” ID – 3/8” OD
- Small diameter continuous SS-316 stainless tubing – 1/8” OD
- Tedlar bags (1 – 1 liter and 1 – 3 liter per sample)
- Hydrogen gas
- Calibration gas
- Watch or timer
- Lighting (e.g., head lamps)
- Rotary hammer drill
- 7/8 concrete drill bit
- 5/16 concrete drill bit
- Extension cord with GFI adapter

- Measuring tape
- Quikrete concrete crack sealer (14lb bottle)
- Concrete trowel
- Modeling clay
- Shop vacuum
- Spray bottle with water
- Safety equipment (e.g. first aid kit, eye wash, 20lb fire extinguisher, etc.)
- Standard field tools (e.g., ratchet set, safety cutting tools, wrenches, etc.)
- Shipping supplies (e.g., UN boxes, shipping labels, hazard labels, packing tape)

3. Preliminary Procedures

Prior to mobilizing to install Sub-slab monitoring probes (SSMPs), ensure the following:

- Access has been granted for the building in question for the period necessary for installation;
- A utility locate has been conducted to determine where utilities are entering the building. The owner of the building should also be consulted for their knowledge of any additional known utilities.
- Perform daily safety meeting, reviewing weather, procedures, and location concerns (access, animals, etc.)
- Verify that the occupant is present and is at least 18 years old. If no occupant is at least 18 years of age, installation will be rescheduled.
- Mobilize equipment into the location, minimizing re-entries.
- Verify that screening instruments are operating properly. Instruments indicating negative concentrations shall be re-zeroed.
- Assess indoor air quality, using a four gas meter, methane detector, FID and PID, in the room where a SSMP is to be installed. If necessary locate any sources for potential elevated readings.
- If VOCs or LEL readings are above the levels stated in the site Health and Safety Plan (HASP) work will cease until ambient air conditions have resumed safe levels.
- If oxygen levels drop below 19.6% vacate the residence.

4. Sub-slab preparation

- Collect sub-slab soil-gas samples at up to three locations per building of interest.
- Mentally divide the slab into three rectangles of roughly equal size and select sample locations near the center of each rectangle. Adjust the locations as needed to account for logistical factors. Select an area where visible damage to the floor will be minimized. Avoid areas with tile or wood floors.
- Construct a sampling probe using a reducer connected to a short length of 1/4" stainless steel tubing. Select a length of stainless steel tubing so that the bottom of the probe is close to the bottom of the sub-slab (typically a 4" probe for a 6" sub-slab). Attach the reducer with Valve #1 via a port connector, as shown in the sample train configuration in **Figure 1.**
    - If possible, pre-cut the 1/4" stainless steel tubing before deploying to the field and bring a variety of lengths (e.g. 4", 6", and 12")
- Drill down into the slab approximately 1 to 2 inches using a rotary hammer drill with a 7/8" diameter concrete bit. Clean out the dust using a shop vacuum (do not use a shop vacuum to clean out the dust from drilling if the hole extends all the way through the sub-slab).
- Continue drilling down using a 5/16" diameter concrete bit to below the slab. Use the drill bit to measure the thickness of the slab and record the value.
- Use modeling clay to seal the hole until the sampling train configuration is set.
- Label the SSMP with indelible marker or paint pen.
- Record all measurements in the project logbook, including:
    - Slab thickness;
    - Borehole diameter; and
    - Time when clay seal was installed

5. Sub-slab sampling

- Perform canister vacuum check, per the steps listed in **Section 7** of this SOP.

- Setup the sample train configuration as shown in **Figure 1**. Teflon® tubing will be connected directly using ferrule connections. The flow controller (one for each canister provided by the laboratory) will be connected to the canister inlet. **Do not reuse flow controllers** between locations. Each flow controller is pre-set by the laboratory to collect the sample over a two-hour period. Flow controllers can be set to a different rate if desired by project, depending on size of container to be filled. For a 1-Liter canister set at 28 inches mercury (Hg) over a two hour period the flow rate is set at 6.7 ml/min.
- Perform sample train leak check, per the steps listed in **Section 7** of this SOP.
- Remove the temporary modeling clay and install the probe in the hole, with the sampling train configuration already attached. Use the tubing in the sampling train configuration to hold the union at the correct height in the hole (just below the top). Use modeling clay to seal around the probe to set it in place.
- Open Valve #1 located at the end of the stainless steel tubing.
- Attach a hand pump with 15 mL stroke volume and built-in vacuum gauge to the purge tubing connected to Valve #2. Two or three strokes should purge out the system. There should not be much vacuum build up on the gauge during purging if the sub-slab material is dry and porous.
    - If the sampling point will hold a -15 inches of Hg vacuum for 1 minute, the sampling location is not suitable for canister sampling. Unplug the probe by inserting a wire the length of the probe or by forcing air into the probe. If this does not work, install a sampling probe at another location.
- Place an enclosure of ≥40L volume over the SSMP and assembled sample train as shown in **Figure 1**. The enclosure should have openings for:
    - The 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 #2 (out).
- The enclosure should have sufficient glove access to open or close all valves within. As shown in **Figure 1.**
- Introduce helium gas into the enclosure at a known rate until the atmosphere within the enclosure has a concentration of approximately 50% tracer gas. The helium check will be performed within the first 30 minutes of sample collection.

- Open Ball Valve #2
- Connect a peristaltic pump to the purge tubing connected to Valve #2 to collect a sample in a 1-Liter Tedlar bag. The 1-Liter Tedlar bag should be filled at a rate no faster than 200 ml/min.
- Close Valve #2.
- From the soil vapors in the 1-Liter Tedlar bag obtain readings for helium with the helium gas detector. If helium readings are elevated, analyze the Tedlar bag using a landfill gas detector to obtain a direct methane reading. Following procedures listed in **Section 7** for elevated helium readings in Tedlar bags.
- Open canister valve completely and record the time.
- After approximately 2 hours, or if the vacuum gauge reading drops below -5 inches of Hg before 2 hours, close the canister valve completely. Record the time. **The vacuum gauge should reach less than -10 inches of Hg, but should not be allowed to drop below -2 inches of Hg.**
- Open Valve #3.
- Connect peristaltic pump to tubing connected to Valve #3 to collect a sample in a 3-Liter Tedlar bag. The 3-Liter Tedlar bag should be filled at a rate no faster than 200 ml/min.
- From the soil vapor in the 3-Liter Tedlar bag obtain readings for total volatile organics with a photoionization detector (PID), with a Flame Ionization Detector (FID), for H_2S, CO, oxygen (O_2), and lower explosive limit (LEL) with a 4-gas meter, and for CO_2, CH4, LEL, and oxygen (O_2) with a landfill gas meter. Record readings from each instrument.
- Break down sampling train configuration.
- Remove flow controller from canister, obtain final canister pressure readings, and replace brass cap on the canister, per the steps listed in **Section 4** of this SOP.
- Decontaminate any non-designated equipment (e.g., Swagelok® connectors and valves) following procedures listed in **Section 8**.

6. Seal the sampling probe

- Pull the probe form the floor using the attached Valve #1 and decon. .
- Temporarily plug the hole with modeling clay.

- Remove all modeling clay that was used for the seal and fill the hole with Quikrete® Gray Concrete Crack Sealer or equivalent until it is flush with the remainder of the sub-slab. Use a concrete trowel to smooth out excess concrete, if necessary.

7. 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 should be taken to keep all sampling equipment, especially the canisters, safe from damage.

Field Duplicates

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

Field duplicates are collected by attaching a T-fitting to the end of the tubing prior to the flow controller. A canister with a flow controller is attached to each end of the T-fitting. For sampling, both canister valves are opened and closed simultaneously. Use the procedure described above to collect samples.

Canister Vacuum Check

The canister vacuum check will be performed for 100% of the canisters.

Prior to Sampling

- Attach the pressure gauge provided by the laboratory to the canister inlet.
- Open valve completely.
- Record reading. The canister should show a vacuum of approximately -28 inches of Hg. If the canister has a vacuum of less than -25 inches of Hg (after adjustment for any elevation effects), then:
    - Label the canister with “Insufficient vacuum – No Sample”;
    - Set canister aside for return to the laboratory; and
    - Contact project manager and lab coordinator if canister failures affect field work.
- Close valve completely.
- Remove the pressure gauge.

After Sampling

- Attach the pressure gauge provided by the laboratory to the canister inlet.
- Open valve completely.
- Record reading. There should still be a slight vacuum in the canister. If the canister does not show a significant net loss in vacuum after sampling, evaluate and document the problem. If necessary, contact the project manager immediately to determine the value of using another canister to recollect the sample.
- Close valve completely.
- Remove the pressure gauge.

Sample Train Vacuum Leak Check

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

- Assemble the sampling apparatus as shown in **Figure 1**.
- Keep the canister and Ball Valve #1 in the "off" or "closed" position. Ball Valve #2 should be in the "open" position.
- Attach the 15 mL hand pump to sample train attached where indicated.
- Withdraw air from the sampling apparatus until a vacuum of at least -10 inches of Hg is achieved. Observe the induced vacuum for at least five minutes.
- If the change in vacuum over five minutes is equal to or less than -0.5 inches of Hg, the system leak rate is acceptable.
- If the change in vacuum over five minutes is greater than -0.5 inches of Hg, check, tighten or replace the fittings and connections and repeat the leak check.

Tracer Compound Check

All samples will be collected using a tracer compound.

- Helium tracer gas should be introduced near the SSMP to test the integrity of the probe seal and the above ground connections.
- Collect the 1-Liter Tedlar sub-slab bag per procedures in **Section 5**.
- If the concentration of the tracer gas in a sample is $\leq$10% of the concentration of the tracer gas in the enclosure, the sample is acceptable.

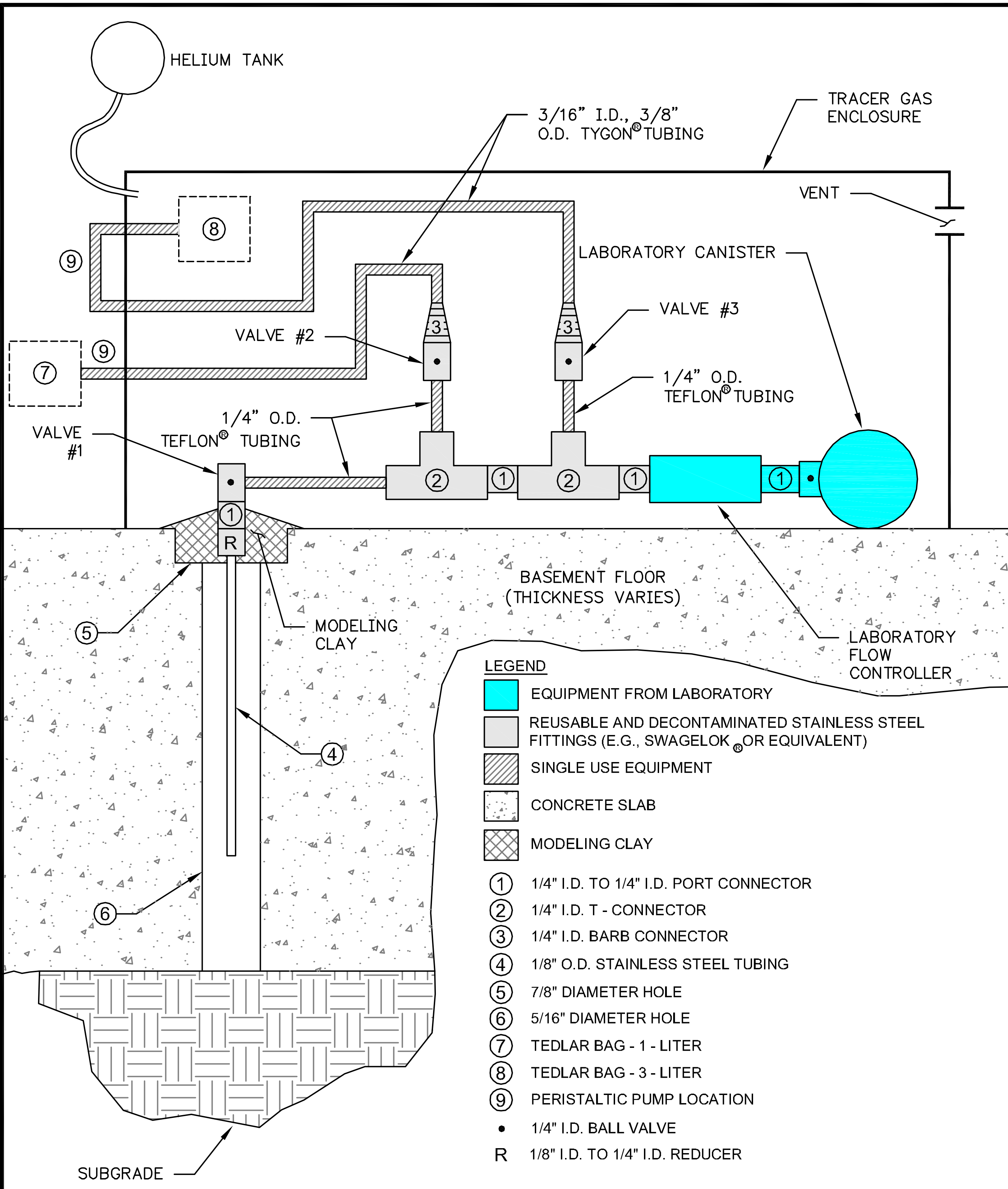
- If the concentration of the tracer gas in the sample is >10% of the concentration of the tracer gas in the enclosure, analyze the 1-Liter Tedlar bag using a landfill gas detector to obtain a direct methane reading. If methane levels are not elevated then tighten or replace the fittings and connections and repeat the leak check.

8. *Decontamination*

- Designated stainless steel Swagelok® connectors or equivalent will be thoroughly decontaminated using an Alconox® wash followed by a distilled water rinse.
- Multiple sets of stainless steel Swagelok® connectors or equivalent will be available to sample crews to allow for equipment to be cleaned and dried sufficiently before being reused.
- **Do not reuse Tygon® and Teflon® tubing.** Tubing will be disposed of after sampling each SSMP. Do not reuse ferrules from compression fittings.

9. *Shipping*

- Sample information shall be recorded on a chain of custody for the laboratory following procedures outlined in **SOP No. 26**.
- Samples will be shipped to the laboratory following DOT regulations, as outlined in **SOP No. 51**.



NOT TO SCALE

SOP 47 SUB-SLAB PURGING AND SAMPLING ROXANA, ILLINOIS	PROJECT NO. 21562593

URS

DRN. BY:djd February 2011 DSGN. BY:kwh CHKD. BY:	Sub-Slab Sampling Configuration	FIG. NO. 1

File: P:\ENVIRONMENTAL\SHELL OIL PRODUCT US\B-ROXANA-ROUTE 111\2156XXXX_ROXANA INVESTIGATION & ASSESSMENT\VAPOR INTRUSION\SOPS\FIGURE 1 SUB-SLAB SAMPLING CONFIGURATION.DWG Last edited: MAR. 10, 11 @ 11:38 a.m. by: david_deguire

1. Purpose and Scope

This document defines the standard protocols for sample handling, documentation, and tracking. This SOP is intended to be used together with several other SOPs. Applicable SOPs are listed below:

- SOP No. 26 - Sample Control and Custody Procedures
- SOP No. 46 – Indoor Air Sampling with Summa Canisters

2. Procedures For Sample Identification, Handling, And Documentation

2.1 Sample Identification

Samples collected during site activities shall have discrete sample identification numbers. These numbers are necessary to identify and track each of the many samples collected for analysis during the life of project. In addition, the sample identification numbers can be used in a database to identify and retrieve the analytical results received from the laboratory.

Each sample is identified by a unique code which indicates the sample location type, sample location number, sample depth, and date collected. The sample locations will be numbered sequentially.

An example of the sample identification number codes for indoor air sampling for field analysis will be: 1stStreetE403-030911-IA.

An example of the sample identification number codes for outdoor air sampling for field analysis will be: 1stStreetE403-030911-OA.

An example of the sample identification number codes for Sub-Slab soil gas sampling for field analysis will be: 1stStreetE403-030911-SS-A.

Where VMP indicates a Vapor Monitoring Port sample, 1 indicates the site location, 5 indicates the bottom of the sample depth interval, 090110 indicates the date the sample was collected.

The sampling locations and sample sequence identifiers will be established prior to field activities for each sample to be collected. On-site personnel will obtain assistance from the Project Manager in defining any special sampling requirements. Other sample identification may be specified by the project manager on an individual project basis.

2.2 Sample Labeling

Sample labels will be filled out as completely as possible by a designated member of the sampling team prior to beginning field sampling activities each day. The date, time, sampler's signature, and the last field of the sample identification number should not be completed until the time of sample collection. All sample labels shall be filled out using waterproof ink. At a minimum, each label shall contain the following information:

- Sampler's company affiliation
- Site location
- Sample identification code (Indoor Air – IA; Outdoor Air – OA; & Sub-Slab – SS)
- Date and time of sample collection
- Analyses required
- Canister ID
- Initial and final vacuum readings
- Sampler's signature or initials.

2.3 Sample Handling

This section discusses proper sample containers, preservatives, and handling and shipping procedures.

2.3.1 Sample Handling and Shipping

After sample collection, each container will be labeled as described above, and then stored in a fashion which will protect the stems of the Summa™ canisters. A determination will be made prior to sample collection if the samples will be handled as hazardous materials for shipping and transportation purposes. If the samples are to be handled as hazardous material, a designated hazardous material shipper will be required to pack and ship samples.

The sample containers will be placed right side up in a UN approved shipping box. No more than the specified number of samples will be placed in an individual box for shipment (check regulations prior to packing). The box will be taped with a custody seal for delivery to the laboratory. Samples will be hand delivered or shipped by overnight express carrier for delivery to the analytical laboratory. All samples must be shipped for laboratory receipt and analyses within specific holding times. This may require daily shipment of samples with short holding times. A chain-of-custody (COC) form will accompany each box.

2.4 Sample Documentation and Tracking

This section describes documentation required in the field notes and on the sample Chain-of-Custody forms.

2.4.1 Field Notes

Documentation of observations and data acquired in the field will provide information on the acquisition of samples and also provide a permanent record of field activities. The observations and data will be recorded using pens with permanent waterproof ink in a permanently bound weatherproof field log book containing consecutively numbered pages.

The information in the field book will include the following as a minimum. Additional information is included in the specific SOPs regarding the field books.

- Project name
- Location of sample
- Sampler's printed name and signature
- Date and time of sample collection
- Sample identification code including QC and QA identification
- Sample depth (if applicable)
- Number and volume of samples
- Sampling methods or reference to the appropriate SOP
- Sample handling
- Analytes of interest
- Field observations
- Results of any field measurements
- Personnel present
- Level of PPE used during sampling.

Changes or deletions in the field book should be lined out with a single strike mark, initialed, and remain legible. Sufficient information should be recorded to allow the sampling event to be reconstructed without relying on the sampler's memory.

Each page in the field books will be signed by the person making the entry at the end of the day, as well as on the bottom of each page. Anyone making entries in another person's field book will sign and date those entries.

2.4.2 Sample Chain-of-Custody

During field sampling activities, traceability of the sample must be maintained from the time the samples are collected until laboratory data are issued. Initial information concerning collection of the samples will be recorded in the field log book as described above. Information on the custody, transfer, handling, and shipping of samples will be recorded on a COC form. The COC is a three-part carbonless form.

The sampler will be responsible for initiating and filling out the COC form. The COC will be signed by the sampler when the sampler relinquishes the samples to anyone else. One COC form will be completed for each set of samples collected daily. The COC will contain the following information:

- Sampler's signature and company affiliation
- Project number
- Date and time of collection
- Sample identification number
- Canister ID
- Initial and final vacuum readings
- Analyses requested
- Number of containers
- Signature of persons relinquishing custody, dates, and times
- Signature of persons accepting custody, dates, and times
- Method of shipment
- Shipping air bill number (if appropriate).

The person responsible for delivery of the samples to the laboratory will sign the COC form, retain the last copy of the three-part COC form, document the method of shipment, and send the original and the second copy of the COC form with the samples. Upon receipt at the laboratory, the person receiving the samples will sign the COC form and return the second copy to the Project Manager. Copies of the COC forms documenting custody changes and all custody documentation will be received and kept in the central files. The original COC forms will remain with the samples until final disposition of the samples by the laboratory.