ENERGYSOLUTIONS

SUPPLEMENTAL SOURCE AREA INVESTIGTION FOR THE AREAS INSIDE THE WAREHOUSE

FOR THE

LEICA, INC. SITE
CHEEKTOWAGA, NEW YORK

Prepared for:

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1 INTRODUCTION

Energy*Solutions*, LLC (Energy*Solutions*) has prepared this work plan on behalf of Leica Microsystems Inc. (Leica). The main purpose of this Work Plan is to describe activities to be performed during the investigation of soils in the vicinity of the potential INT-2 source area within the former manufacturing facility warehouse located at 203 Eggert Road in Cheektowaga, NY (as depicted on Figure 1). The soils investigation will address the soils surrounding the INT-2 well pair located inside the main warehouse of the former Leica facility including wells INT-2R (overburden) and INT-2A (bedrock).. The INT-2 area is located in the former central courtyard area of the warehouse. Groundwater quality and flow directions in areas beneath the main warehouse will also be assessed.

2 PURPOSE

There are three primary purposes for this sampling effort. The first is to confirm whether significant source material is still located within the immediate vicinity of the INT-2 well pair located within the main warehouse area, and if so to what extent. Groundwater data collected to date from all six wells (INT-2R, INT-2A, INT-10, INT-10A, INT-11, INT-11A) confirms the presence of chlorinated solvents in both the shallow and bedrock groundwater zones at the INT-2, INT-10 and INT-11 locations. The highest chlorinated solvent concentrations detected in groundwater at the site to date have been detected in the INT-2 wells. In order to prepare for future remedial activities, this investigation is intended to confirm the aerial and vertical extent of the source areas that have contributed to the groundwater contamination in the INT-2 area. Soils data from the area surrounding the INT-2 well pair will aid in determining the appropriate aerial extent for future injections for enhance bioremediation.

The second purpose of this investigation is to provide additional groundwater data within the main warehouse area in between the INT-2, INT-10 and INT-11 well pairs. This data will provide additional information regarding the potential presence of VOCs in the groundwater between these well pair locations. This data will also assist in determining the groundwater flow directions beneath the building.

The third purpose of this investigation is to collect additional groundwater data beneath the two areas within the warehouse where elevated sub-slab VOCs have been detected previously but the groundwater quality has not been assessed. These areas include the 8hr-003 sub-slab location sampled in September of 2011 with total VOC concentrations of 12,860 ug/m^3, the sample ss-30min-021 also sampled in September of 2011 with total VOC concentrations of 36,850 ug/m^3 , and sample 8hr-045 (September 2012) with total VOC concentrations of 226,200 ug/m^3. As shown on Figure 2, the 8hr-003 sample was collected from a location in the former central courtyard area approximately 90 feet west of the INT-2 sample. The ss-30min-021 sample was collected from a location in the

former central courtyard approximately 60 feet north and slightly west of the INT-2 sample and the 8hr-045 sample was collected from a location in the north sawtooth area approximately 30 feet north of the ss-30min-021 sample.

Groundwater testing in these areas will assist us in determining whether the elevated sub-slab concentrations are caused by groundwater contamination or by surface spills. This data will be useful in determining whether the issue can be addressed by the warehouse-wide Sub Slab Depressurization System alone, or whether supplemental groundwater remediation may be needed.

3 SAMPLING PLAN

3.1 SAMPLING LOCATIONS

Approximate sampling locations are shown on the Site Drawing of Proposed Sampling Locations, Figure 3. Due to the potential presence of facility utility service lines, SamSon warehousing operations and other potential obstructions, these sampling locations may be adjusted in the field based on actual conditions and accessibility.

Soil sampling locations have been selected in order to provide specific data regarding the contaminant concentrations in the vicinity of the INT-2 well pair. Soils data from this area will provide additional confirmation regarding whether the original releases occurred inside the warehouse and subsequently penetrated the floor, or whether the original releases of contamination occurred deeper in the soil horizon (e.g., groundwater contamination). Data will also provide information needed to determine the extent of the INT-2 source area contributing to the groundwater contamination.

We anticipate collecting soil samples in four radial directions from the existing INT-2 well pair as shown on Figure 3. Samples will be collected at typical distances of 20 and 50 feet from the well pair in each of the four directions shown on Figure 3.

Samples may be collected at distances greater than 50 feet from the well pair. If PID readings from soils collected from the boring at the 50 foot distance indicate significant contamination is present, an additional boring may be advanced further from the well pair and samples collected at the discretion of the field technician. We anticipate this supplemental boring would be advanced at a location that would be an additional 20 feet further from the well pair, depending on any structural obstructions in the area.

3.1.1 Well INT-2 Area Soil Sampling

Based on the results of the samples collected in November of 2013, the potential for both significant surface and subsurface contamination exists in this area. The total VOC concentration in the soil sample collected from a depth of 12 inches below the floor was 1,790 ug/kg. In addition, total VOC concentrations in the soil samples collected from the

depths of seven and 11 feet below the floor were 8,720 ug/kg and 64,400 ug/kg, respectively. Based on this existing data, Energy*Solutions* plans to collect supplemental samples in this area at the surface immediately below the slab, and in the deeper soils at the 5 to 7 and the 9 to 11 foot intervals. Samples from these three intervals will be collected from each of the eight sampling locations surrounding the INT-2 wells as shown on Figure 3. Additional samples may be collected during the operation if elevated PID readings are encountered in any of the borings at any of the vertical intervals.

3.1.2 Groundwater Grab Sampling

Six groundwater grab samples will be collected during the investigation at the locations shown on Figure 3. Data from these six samples will be used to determine groundwater quality in areas that have not been investigated previously.

Two of the locations to be sampled, which are located within the former central courtyard area, have demonstrated elevated sub-slab vapor concentrations in past analyses including: sample ss-30min-021 collected in September of 2011 with a total VOC concentration of 226,200 ug/m^3; and sample 8hr-003 collected also in September of 2011 with a total VOC concentration of 12,860 ug/m^3. Groundwater grab samples collected from beneath these two elevated sub-slab readings will provide information regarding groundwater contamination in this area.

The remaining four groundwater grab sample locations are planned for the southern sawtooth area and the former central courtyard area of the warehouse. One of these four samples will be collected from the central courtyard area, and the remaining samples will be collected from the southern sawtooth area as shown on Figure 3.

3.2 SAMPLING METHODS

Prior to advancing any borings within the building, a Ground Penetrating Radar (GPR) utility locating service will be used to confirm that no utility lines are present beneath each boring location. When clearance has been confirmed, the concrete floor will be cored with a 3" core bit to provide access for the GeoProbe through the concrete floor.

Borings for soil samples will be advanced using a GeoProbe unit. Continuous PID readings will be taken of the material recovered from each bore hole at two foot intervals starting at the surface and continuing to the bedrock. Soil samples will be collected using the acetate sleeves provided by the GeoProbe and at the specified vertical intervals from each of the various locations described in Section 4.1, above. All soil samples will be collected using EPA 5035 method approved Encore samplers. If elevated PID readings are encountered in additional vertical zones not included in the intervals specified in Section 4.1, additional samples may be collected and submitted for analysis at the discretion of the field technician.

Temporary wells used for the collection of groundwater grab samples will also be installed using the GeoProbe. After the utilities have been cleared and the floor has been cored, a borehole will be advanced by the GeoProbe. Soil will be screened in two foot intervals down to the bedrock surface. The field team will have additional sampling containers available in the event that an elevated PID reading is recorded and the collection of a soil sample is appropriate.

Temporary 1" PVC wells will be installed in the borehole at each of the six groundwater grab sample locations. Each temporary well will include a 5 foot screen with the bottom of the PVC screen positioned just above the bedrock surface. Once the PVC has been inserted in the borehole, the annulus between the well and the boring will be filled with sand to one foot above the screen, and native backfill to within approximately three feet of the floor. The remaining three feet of annulus will be filled with bentonite grout up to a level flush with the floor. The 1" PVC piping will be finished with a cap and cut so the cap top is flush with the floor surface. Once the PVC well has been completed, the groundwater will be allowed to stabilize for approximately 24 hours and then the samples will be collected.

If sufficient water is available in the wells, groundwater samples will be collected using the Low Flow/Low Stress method described in Energy*Solutions* "Low Flow/Low Stress Groundwater Purging" Standard Operating Procedure, included in Appendix B. Dedicated tubing and latex gloves will be used for each well to ensure there is no cross contamination between samples. The field sampling crew will observe and record required groundwater quality measurements (i.e., pH, Temperature, Specific Conductance, Dissolved Oxygen, and ORP), until readings have stabilized as required by the sampling method. After the readings have stabilized, groundwater samples will be collected into laboratory supplied, cleaned glassware and submitted to ALS Environmental under chain-of-custody and analyzed for VOCs via EPA Method 8260. If sufficient water is not available to utilize the low flow sampling method, samples will either be collected using a peristaltic pump or ½" micro bailers. In situations where sufficient water is not present in a well, the well will remain in place and monitored periodically until sufficient water is available to permit the collection of a groundwater sample.

3.2.1 Sample Handling and Analysis

Samples will be collected, handled, and submitted to the laboratory in accordance with Energy*Solutions* Standard Operating Procedures (SOPs), included in Appendix B. Soils logging information and PID readings will be recorded by the site technician in a field log. Each soil and groundwater sample submitted to the laboratory will be analyzed for the presence of VOCs using EPA method 8260.

Soil and groundwater samples will be collected using disposable latex or nitrile sampling gloves and specified sampling tools. The sampling gloves will be discarded after the collection of each sample.

3.2.2 Decontamination of Sampling Equipment

Re-useable sampling equipment will be decontaminated prior to collection of the first sample, and following collection of each subsequent sample using the decontamination procedures outlined in Energy*Solutions' Decontamination of Field Equipment* SOP, included in Appendix B.

3.2.3 Sample Container Preservation and Storage

Sample container preservation and storage shall follow the requirements outlined in Energy*Solutions Sample Handling SOP*, included in Appendix B. Additional requirements for analytical methods, sample containers, preservation, and holding times are provided in Table 3-1. All containers used to collect samples for laboratory analysis will be pre-cleaned containers supplied by the laboratory. The containers will be shipped from the laboratory in sealed boxes. Prior to use, the sample bottles will be inspected by the Energy*Solutions* Field Team Leader to verify their integrity. Labeling of the sample jars and the completion of Chain-of-Custody (COC) records will also be performed in accordance with Energy*Solutions' Sample Handling SO*P, included in Appendix B.

Table 3-1
Sample Handling and Analytical Protocols

Parameter	Matrix	Analytical Method	Containers	Preservation	Holding Time
VOCs	groundwater	8260 analysis	40 ml vials	4^0 C	14 days
VOCs	soil	8260 analysis	Encore Samplers	4^0 C	14 days

3.3 ANALYTICAL METHOD REQUIREMENTS

The analytical methods to be used for the analysis of samples are contained in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846,* EPA publication number EPA/530-SW-846.3-1). The specific analytical methods to be performed by the laboratory are outlined in Table 3-1.

3.4 QUALITY CONTROL REQUIREMENTS

Quality control samples will be collected in accordance with the *Collection of Quality Control Samples* SOP, included in Appendix B. The types of quality control samples to be collected in the field are identified in Table 3-2 below.

Table 3-2
Quality Control Sample Frequency

Parameter	Matrix	Sample Type	Frequency
VOCs	Soil, Water	Equipment Blank	1/day/20 samples
VOCs	Soil, Water	Duplicate	1/day/20 samples
VOCs	Soil, Water	Trip Blank	1/day/20 samples

Laboratory quality control sample data provided with the data package will include the following sample results:

- Laboratory Control Spike
- Method Blank
- Matrix Spike/Matrix Spike Duplicate

3.5 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

Field instrumentation to be used at the Site (i.e., PID) will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the instrument manufacturer's specifications. Copies of the calibration and operation instructions from the manufacturer will be kept with the instrument when it is used at the Site. It is the Field Team Leader's responsibility to be familiar with these instructions. Calibration records will be documented in the field logs to provide a historical record of instrument performance.

Equipment to be used in the field during field sampling will be examined daily to verify that it is in good operating condition.

3.6 INSPECTION/ACCEPTANCE FOR SUPPLIES AND CONSUMABLES

Supplies and consumables will be checked before they are taken to the job site and prior to each use. Defective materials will be taken out of service.

3.7 DATA MANAGEMENT

3.7.1 Field Data

Field data collected during this project will be managed in accordance with the following Standard Operating Procedures that are contained in Appendix B.

- Field Record Keeping

- Lithologically Describing and Logging Soil Samples
- Collecting Soil and Sediment Samples

The field data collected will be managed using forms and bound field notebooks. Laboratory data will be transcribed onto a computer-based management system. This data will be summarized in a manner that provides efficiency in data reduction, tabulation, and evaluation. All measurements taken during this project will be identified by source, type, and sample location to avoid ambiguity. Field records will include the following minimum information:

- a chronological listing of significant site events and sampling activities;
- site name, field team members, signature, and date on each page;
- site conditions, notes or sketches of sampling locations and sample descriptions;
- sample times;
- record of all measurements (e.g. field screening parameters);
- boring logs;
- photographic log (if taken); and
- well completion reports (as applicable).

3.7.2 Laboratory Data

The laboratory will be responsible for maintaining analytical logbooks and laboratory data as well as a sample inventory for submittal to Energy*Solutions* on an as-required basis. Samples will be maintained by the laboratory for a period of at least 30 days after issuance of the final report under the conditions prescribed by the appropriate analytical methods for additional analysis, if necessary.

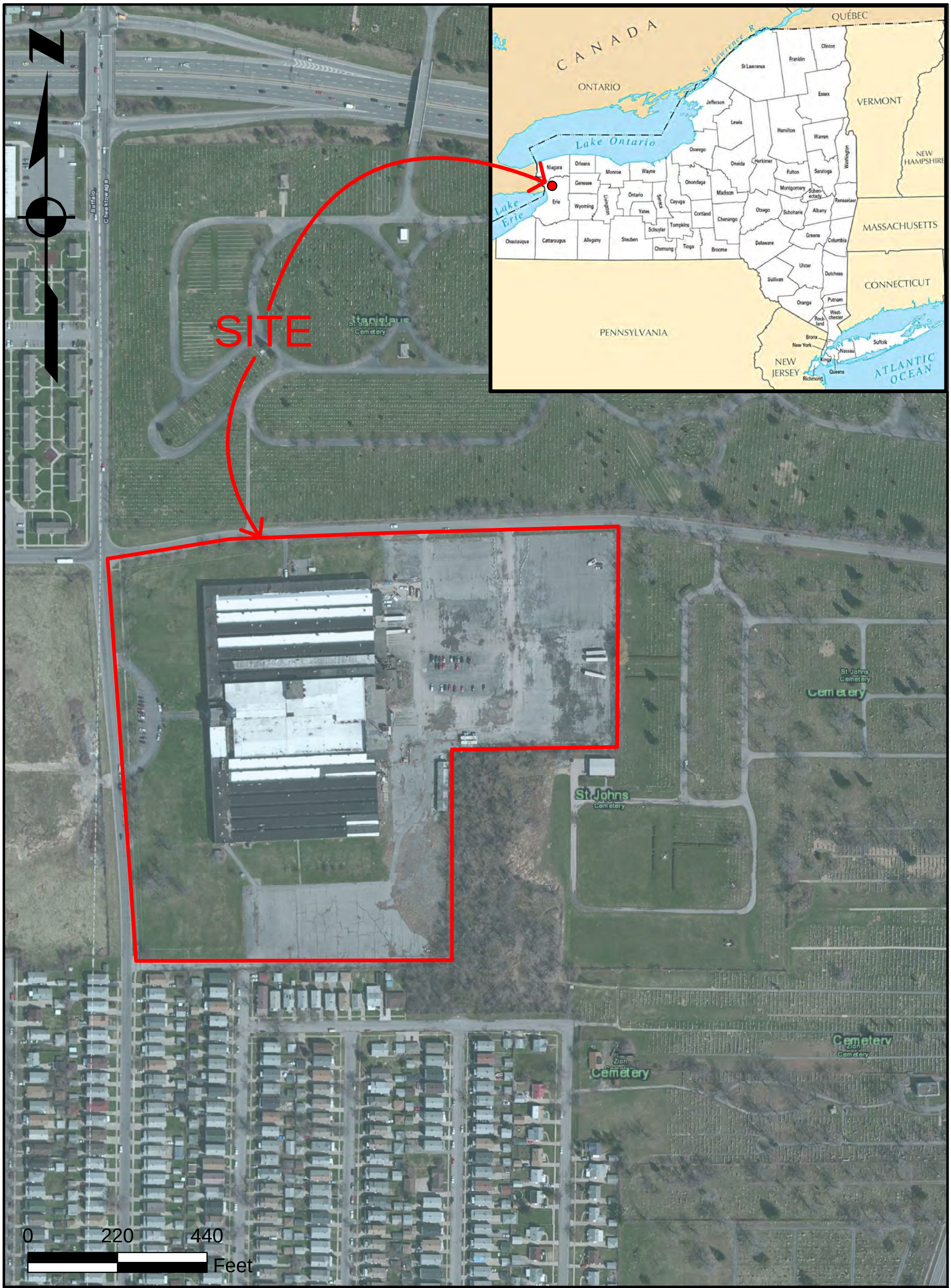
Evidentiary files for the analytical portion of the project will be maintained by the laboratory and will consist of the following records:

- Project-related plans;
- Project login data;
- Sample identification documents;
- Chain-of-Custody records;
- Project-related correspondence;
- Raw data sheets QC data;
- Copies of all final reports pertaining to the project;
- Sample preparation records.

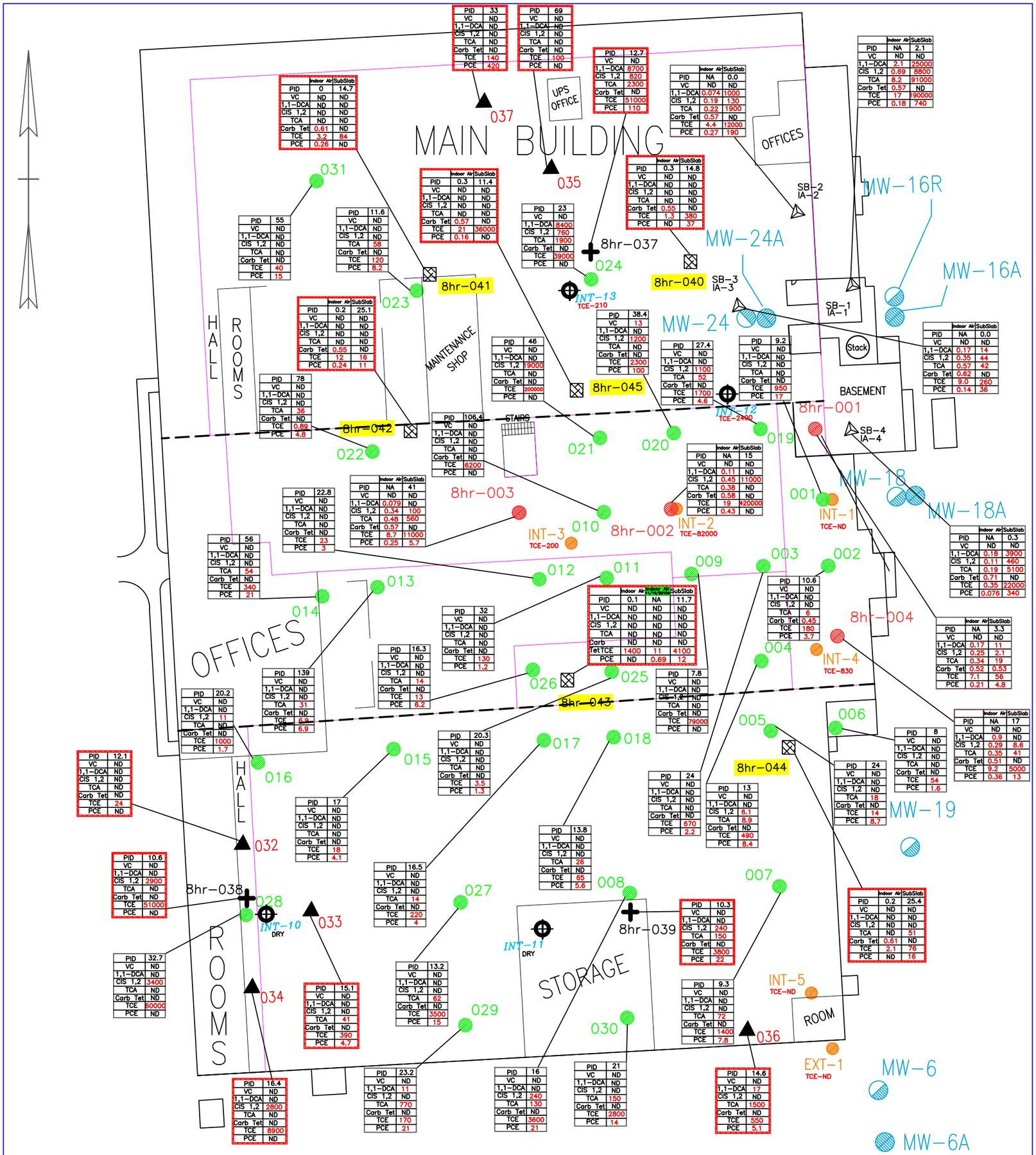
The evidentiary file materials will be the responsibility of the laboratory's representative with respect to maintenance and document removal.

APPENDIX A
FIGURES

Figure 1: Vicinity Map
Figure 2: Sub-Slab Gas Investigation Sampling Data
Figure 3: Site Drawing of Proposed Sampling Locations



DOCUMENT CONTROL NO.	PROJECT	LEICA MICROSYSTEMS INC. 203 EGGERT ROAD CHEEKTOWAGA, NY	ENERGYSOLUTIONS 209 E.Chippens Hill Rd Burlington, CT 06013 801-303-1092	PROJECT # 137015 FILENAME:
REVISION NO.	DRAWING	Vicinity Map		SCALE: SEE SCALEBAR DATE: 4/13/17 BY: DRS CK: REM FIGURE # 1



LEGEND

- 8hr-037 = 8 hour subslab correlation samples (9/2012)
- 033 = 30-minute Subslab samples (9/2012)
- INT-12 TCE-2400 = Groundwater grab samples with TCE data (9/2012)
- 8hr-042 = DOH compliant Indoor air & subslab samples (9/2012)
- MW-2 = OVERBURDEN MONITORING WELL
- MW-2A = BEDROCK MONITORING WELL
- 025 = 30 MINUTE SUBSLAB SAMPLES (9/2011)
- 8hr-002 = DOH COMPLIANT INDOOR AIR AND SUBSLAB SAMPLES (9/2011)
- INT-1 TCE-ND = GROUNDWATER GRAB SAMPLES WITH TCE DATA (6/2011)
- SB-4 IA-4 = INDOOR AIR AND SUBSLAB AIR SAMPLES (3/2010)
- Courtyard Foundation
- Possible Foundation
- Non-support Interior Walls
- 2012 Sample Data

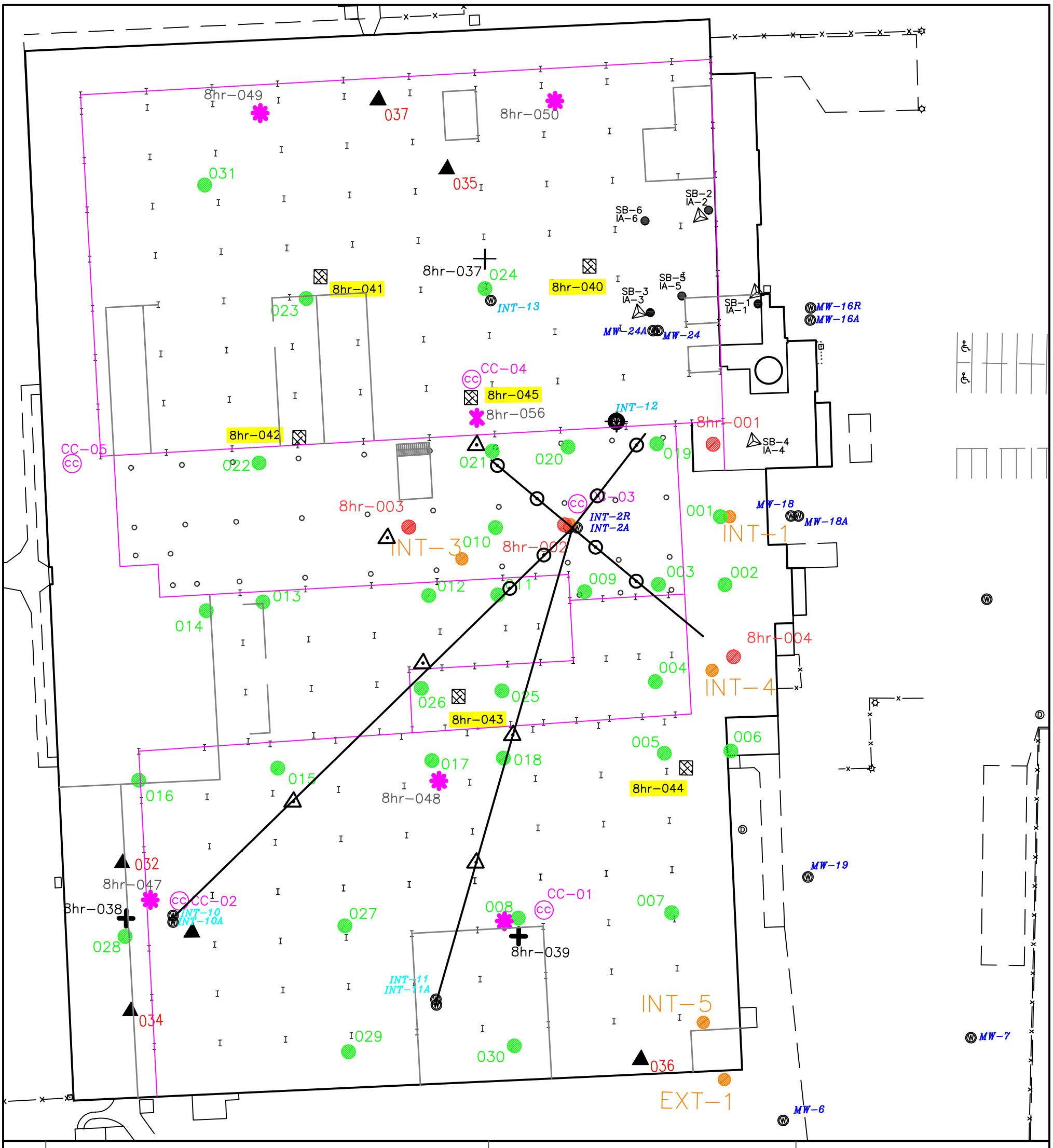
NOTE:
All detections (above Lab MRL) are shown in red text

Indoor Air 11/19/2012 = Indoor Air Retest (11-19-2012)

0' 60' 120'

DOCUMENT CONTROL NO.	PROJECT	LEICA MICROSYSTEMS INC.	PROJECT # 137015
			FILENAME:
REVISION NO.	DRAWING	**Sub-Slab Gas Investigation Sample Data**	SCALE: See Scalebar DATE: 1/30/13
			BY: DRS CK: RM
			FIGURE # 2

ENERGY SOLUTIONS
209 E. CHIPPENS HILL RD
BURLINGTON, CT. 06013
(203)770-0855



LEGEND

NEW Proposed Soil and Groundwater Grab Sample Locations	*OLD* Previously Collected Sample Locations and Data
⊙ Proposed Soil Sample Location	= Indoor Air Sample (4/2013)
△ Proposed Groundwater Grab Sample Location	= Concrete Sample (4/2013)
	SB–6 IA–6 = SSDS Indoor Air and Subslab Air Samples (4/2013)
	MW–24 = Groundwater Monitoring Well Location
	8hr–037 = 8 hour subslab correlation samples (9/2012)
	033 = 30–minute Subslab samples (9/2012)
	SB–4 IA–4 = INDOOR AIR AND SUBSLAB AIR SAMPLES (BEGINING 3/2010)

INT–12 = Groundwater grab samples (9/2012)

8hr–042 = DOH method Indoor air & subslab samples (9/2012)

INT–1 = GROUNDWATER GRAB SAMPLE LOCATIONS (6/2011) *ABANDONED*

025 = 30 MINUTE SUBSLAB SAMPLES (9/2011)

8hr–002 = DOH METHOD INDOOR AIR AND SUBSLAB SAMPLES (9/2011)

Possible Foundation

Non–support Interior Walls

DOCUMENT CONTROL NO.	PROJECT	LEICA MICROSYSTEMS INC. 203 EGGERT RD CHEEKTOWAGA, NY	ENERGYSOLUTIONS 209 E. CHIPPENS HILL RD BURLINGTON, CT. 06013 (203)770–0855
REVISION NO.	DRAWING	PROPOSED SOIL AND GROUNDWATER GRAB SAMPLE LOCATIONS	PROJECT # 137015 FILENAME: SCALE: 1":60' DATE: 4/11/17 BY: DRS CK: RM FIGURE # 3

APPENDIX B

ENERGY*SOLUTIONS* STANDARD OPERATING PROCEDURES

ENERGYSOLUTIONS

Standard Operating Procedure
Sample Handling

Authored By:	Daniel Slywka Name, Title	6/19/2012 Date
Reviewed By:	Robert McPeak Name, Title	6/19/2012 Date
Approved By	Robert McPeak Name, Title	6/19/2012 Date

- [ ] New
- [ ] Title Change
- [ ] Revision
- [X] Rewrite
- [ ] Cancellation

Effective Date 6/19/12

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1. PURPOSE AND SCOPE

1.1 Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for sample handling that will aid in achieving consistent methods of data collection.

1.2 Scope

This SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner that will maintain the utmost sample integrity. While the following procedures are appropriate for most sampling events, applicable local, state and Federal sample handling protocols and guidelines must be reviewed and considered. If necessary, modifications to the SOP can be addressed on a site-specific basis. Any modification must be clearly stated in the work plan or field sampling plan prepared for the site; these documents will always take precedence over this SOP.

2. REFERENCES

2.1 Reference 1: Standard Operating Procedure Decontamination of Field Equipment

2.2 Reference 2: Standard Operating Procedure Collection of QC Samples

3. GENERAL

3.1 Definitions

3.1.1 *Sample Container*– A glass or plastic jar or vial container used to contain and transport media from the field to the laboratory

3.1.2 *Quality Control Samples*– Samples collected for analysis which demonstrate the quality of the sample collection and handling procedures which confirm data validity.

3.1.3 *Sample Preservation*– media (such as HCL) placed in the sampling container which preserves the sample and ensures the sample analyzed by the laboratory represents the condition of the sample in the field as closely as possible.

3.1.4 *Chain of Custody*– A form which includes all pertinent information associated with the sampling effort in order to ensure the identification of individual samples and provide confirmation that custody remained in tact and that tampering or substitutions were precluded.

3.2 **Responsibilities**

3.2.1 The Project Manager is responsible for providing the affected employees with this SOP as necessary.
3.2.2 The Field Team Leader (FTL) is responsible for ensuring that the feld team complies with this procedure when collecting samples.
3.2.2 All Employees are responsible for adhering to this SOP when recording field activities.

3.3 **Precautions and Limitations**

"None"

3.4 **Records**

3.4.1 Field Notebooks;

3.4.2 Field standard documents

4.0 CONSIDERATIONS

2.1 Sample Containers

Prior to the sampling event, consideration must be given to the type and number of containers that will be used to store and transport the samples. The sample matrix, the analytical method, the laboratory's quality assurance/quality control (QA/QC) requirements, contaminants potentially present and local, state or Federal regulatory requirements factor into the selection of a sample container. **Typically, the contracted laboratory will select and provide the appropriate number and type of sample containers based upon the analytical methods and scope of work requested.**

Prior to sampling, make sure that the laboratory is clear on the scope of work and the objectives of the project. When performing non-routine sampling, it is also recommended that the sampling crew request instructions from the laboratory regarding the volume of sample required (e.g., matrix spike analyses for soil may require extra samples), the proper technique for filling and preserving the sample containers and the type and number of containers supplied per analytical parameter.

Sample container selection is usually based upon some combination of the following criteria:

a. Reactivity of Container Material with Sample

For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for

contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample. Species of metals will adhere to the sides of glass containers in an aqueous matrix; therefore, plastic bottles (e.g., nalgene) must be used. If metals analyses are to be performed along with other analyses, then a separate plastic bottle must be used. In the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive locations on the surface of the container.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analytical method and the sample matrix. Individual laboratories may provide larger volume containers or request multiple containers for a sample to ensure sufficient sample for duplicates or other QA/QC checks. Wide mouth containers are recommended to facilitate transfer of the sample from the sampler into the container without spillage or sample disturbance. Aqueous samples analyzed for volatile organic compounds (VOCs) must be placed in 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., Teflon™) septum. Non-aqueous samples for VOC analysis should normally be collected in Encore Samplers or preserved 40 mil vials as specified in EPA method 5035. In some cases they may be collected in the standard non-preserved vials or in wide mouth 4-ounce (oz.) jars. These jars should have PTFE-lined screw caps. Consult the site specific sampling plan or the project manager to ensure the proper VOC sampling methods are used.

c. Color of Container

Typically, amber glass containers will be provided by the laboratory and will be used to prevent photo degradation of the sample, except when samples are being collected for metals analyses. If amber containers are not available, then containers holding the samples should be protected from light (i.e., placed in cooler with ice immediately after filling).

d. Container Closures

Container closures (i.e., caps and lids) must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample and the container cap must be replaced immediately after filling. Container caps should be constructed of a material that is inert with respect to the sampled material, such as PTFE. Alternately, the caps may be separated from the sample by a closure liner that is inert to the sample material. If soil or sediment samples are being collected, the threads of the container must be wiped clean with dedicated paper towels (or Kim wipes™) so the cap can be properly closed.

e. Decontamination of Sample Containers

Sample containers should be laboratory pre-cleaned, preferably by the laboratory performing the analysis. (The cleaning procedure will be dictated by the specific

analysis to be performed on the sample.) Sample containers should be examined upon receipt to ensure that each appears clean. Do not mistake any preservative that was already deposited in the sample container by the laboratory for unwanted residue. Sample bottles received from a laboratory should not be field cleaned. If there is any question regarding the integrity of the bottle, the laboratory should be contacted and the bottle(s) replaced.

f. Sample Bottle Storage and Transportation

Extreme care should always be taken to avoid contamination of the sample bottles. Sample shuttles or coolers and sample bottles must be stored and transported in clean environments. Sample bottles and clean sample equipment should never be stored near solvents, gasoline or other equipment that is a potential source of cross contamination. When under chain of custody, sample bottles should either be custody sealed in a cooler or shuttle that is secured inside a locked vehicle or other designated secure area, or in the presence of authorized personnel.

4.2 Sample Filtering

Aqueous samples collected for dissolved metals analyses may require filtering to remove suspended sediment from the sample. Filtering must be performed prior to preserving the sample. If the sample container received from the laboratory contains preservative, then an interim container must be used to transport the sample from the collection point to the filtering apparatus. To ensure that interim containers are contaminant free, they should be supplied by the laboratory.

4.3 Decontamination of Sampling Equipment

Refer to the SOP for the Decontamination of Field Equipment for guidance on decontamination of re-usable sampling equipment.

4.4 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and subsequent review and interpretation of analytical data. Refer to the SOPs for Collection of Quality Control Samples and Field Record Keeping for detailed guidance concerning these procedures.

4.5 Sample Preservation Requirements

Certain analytical methods require that the sample be preserved in order to stabilize and maintain sample integrity. Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. Care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling, thereby diluting the preservative.

When samples are preserved in the field, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and

adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher grade.

4.6 Sample Labels

Sample labels should be provided with the sample containers, but this should be verified with the laboratory. If desired, labels may be pre-printed by computer with blanks provided for variable information collected in the field. If necessary, masking tape may be used for labels in the field, but this practice should be avoided. Sample containers should always be labeled prior to opening the container to avoid cross contamination and problems associated with marking wet or dirty paper. Indelible ink markers should be used for labeling and labels should be covered with clear tape.

At a minimum, sample containers will be labeled with the following information:

site name;
project number;
initials of sampler;
sample identification code;
analytical method;
date and time of collection; and
preservative added (if applicable).

These are common sample identification codes that may be used on sample labels.

1. Sample type (medium) abbreviation may be as presented below.

ground water sample	=	GW
surface water sample	=	SW
sediment sample	=	SED
solid waste sample	=	WASTE
waste water sample	=	WW
chip sample	=	CHIP
wipe sample	=	WIPE
soil sample	=	SOIL
influent sample	=	INF
effluent sample	=	EFF
air sample	=	AIR
dust sample	=	DUST

2. Sample location abbreviation may use the identifier system established for the site. Examples of sample location abbreviations are presented below.

soil boring	=	"SB-" followed by the designated number of the boring

monitoring well	=	"MW-" followed by the designated number of the well
surface water	=	"SW-" followed by the designated number of the sampling location
surface soil	=	"SS-" followed by the designated number of the sampling location
sediment	=	"SD-" followed by the designated number of the sampling location
discharge outfall	=	"OF-" followed by the designated number of the outfall location
air	=	"AS-" followed by the designated number of the air station

3. Where applicable, depth intervals may be designated in feet or tenths of a foot (e.g., 0.5-1.0 ft).

4. Analytical parameter designations are commonly abbreviated as presented below.

volatile organic compound	=	VOC
semi volatile organic compound	=	SVOC
polychlorinated biphenyl	=	PCB
pesticide	=	PEST
metals	=	METAL
non-metallic inorganic	=	INO
geotechnical	=	GA

5. Quality control qualifiers commonly are abbreviated as presented below.

field replicate	=	R
trip or travel blank	=	TB
field or rinsate blank	=	FB
matrix spike and matrix spike duplicate	=	MS/MSD

For example, the designation "SOIL/SB-10/12-14/VOC" would indicate that the sample was a soil sample collected at Soil Boring SB-10, that it was collected at a depth interval of 12 to 14 feet below land surface, and it was selected to be analyzed for volatile organic compounds. A sample designated "GW/MW-10/R/SVOC" would indicate a replicate

sample of ground water collected from Monitoring Well MW-10 and selected to be analyzed for semi volatile organic compounds.

Occasionally, the contracted laboratory supplies preprinted or bar-coded labels on the sample containers. These labels are acceptable; however, care must be exercised to ensure that coded-alike containers are not confused with other similar containers. The sampler should initial and record the time and date on each container in a blank portion of the label or on a separately attached label.

4.7 Sample Packing

Before packing containers in the cooler, all sample labels should be checked for accuracy and the caps checked for tightness. Any irregularities concerning the condition of the samples or containers should be noted on the chain-of-custody form. The bottles must be carefully packed to prevent breakage during transport. If there are any samples known or suspected to be highly contaminated, they should be packaged individually to prevent cross-contamination. Sufficient ice packs should be placed in the cooler to maintain the temperature at 4 degrees Celsius (^{o}C) until delivery to the laboratory. Consult the work plan to determine if a particular cooling agent is specified for preservation (e.g., the United States Environmental Protection Agency does not condone the use of blue packs because they claim that the samples will not hold at 4^{o}C.) The chain of custody form should be properly completed, placed in a "zip-loc" bag and placed in the cooler. One copy must be maintained for the project file. The cooler should be sealed with strapping tape and a cooler-custody seal. The cooler drains should be taped shut to prevent leakage. The custody seal number should be noted in the field book or on the chain of custody form.

4.8 Chain-of-Custody Forms

Most contracted laboratories have their own Chain-of-Custody (COC) forms. If appropriate, use of the laboratory supplied COC forms are preferred because it reduces the chance of miscommunication between the samplers and the receiving laboratory. Otherwise, the field Team Leader (FTL) is responsible for obtaining appropriate blank COC forms from the PM for use during the sampling event.

2.8.1 Prior to initiation of field activities, the FTL is responsible for ensuring that an ample supply of COC forms are onsite to cover all of the scheduled sampling, including extra blank forms for contingency purposes.

2.8.2 The FTL reviews and familiarizes himself with the COC form and contacts the issuing laboratory for clarification of any questions concerning proper completion of the COC form.

2.8.3 Pre-completion of the COC form and sample bottle labels is limited to site generic information, e.g., site name and address, and project number.

2.8.4 The format of various COC forms will differ; however, the following information must be included on all COC forms accompanying samples collected by

Energy*Solutions*: Energy*Solutions* project number; project name; name address and telephone number and contact person; unique sample identification numbers; sample matrix; date and time samples were collected; volume, type, and quantity of sample containers; preservatives; and analyses requested. Reference methods must be specified when appropriate, e.g., *VOCs+15 (via 624).* Special instructions and considerations should be noted in the comment section, e.g., *sample bottle not full, run TPH first*.

2.8.5 The FTL or his/her designee completes the COC form as soon as practicable after collection of the samples. Note: sample bottle labels must be completed at the time of sample collection and prior to collection of the next sample.

2.8.6 If sample custody is directly relinquished, e.g., laboratory pickup at the project site, the FTL or his/her designee: 1) signs, dates, and notes the time of the transfer; 2) gives the COC to the receiver to sign, date, and note the time; 3) takes the COC back from the receiver and reviews for completeness rectifying any deficiencies; and 4) gives the completed COC back to the receiver, retaining the appropriate carbon copy for the project files. If the COC form does not have carbon copies, a photocopy or handwritten duplicate with appropriate signatures must be made (**no exceptions**).

2.8.7 If sample custody is indirectly relinquished, e.g., express mailed to the receiving laboratory, the FTL or his/her designee: 1) signs, dates, and notes the time of the transfer; 2) places the completed COC form into the sample shuttle retaining the appropriate carbon copy; 3) completes the express mail slip and retains the appropriate carbon copy; and 4) attaches the retained copies of the COC form and express mail slip together for the project file. If the COC form does not have carbon copies, a photocopy or handwritten duplicate with appropriate signatures must be made (**no exceptions**).

4.9 Sample Delivery

Samples should be delivered to the laboratory within 24 hours of collection. If samples are shipped prior to or on a weekend or holiday, the laboratory should be contacted to confirm that someone will be available to accept delivery. Check the work plan to determine whether a shorter delivery time is imperative.

5.0 EQUIPMENT AND MATERIALS

5.1 General Equipment

a. Sample bottles of proper size and type
b. Cooler with ice (wet or blue pack)
c. Field notebook, appropriate field form(s), chain of custody form(s), custody seals
d. Black pen and indelible marker
e. Packing tape and "zip-loc" bags
f. Overnight shipping forms and laboratory address
g. Health and Safety plan (HASP)
h. Work plan/scope of work
i. Pertinent SOPs for specified tasks and their respective equipment and materials
j. Container labels

5.2 Preservatives

Preservatives for specific samples/analytes, as specified by the laboratory. Preservatives must be stored in secure spill-proof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

5.3 Miscellaneous Equipment (if appropriate)

a. graduated pipettes
b. pipette bulbs
c. Litmus paper
d. glass stirring rods
e. filtering equipment

5.4 Personal Protective Equipment (if needed)

a. protective goggles
b. disposable gloves
c. protective clothing (e.g., Tyvek™)
d. portable water supply for immediate flushing of spillage, if appropriate.
e. shovel and container for immediate containerization of spillage-impacted soil, if appropriate.

6.0 PROCEDURE

6.1 Pre-Packaging

1. Examine all bottles and verify that they are clean and of the proper type, number and volume capacity for the sampling to be conducted.

2. Label bottles carefully and clearly with the appropriate information as described in Section 2.6.

3. Collect samples in the proper manner (refer to the specific sampling SOP which addresses the sampling technique being performed).

4. Chemically preserve samples as required. Field preservation must be done immediately and should not be performed later than 30 minutes after sample collection.

5. Seal containers carefully.

6. Conduct QC sampling as required.

6.2 Packing the Shipping Container

1. Each sample container should be placed in the shipping cooler as soon as possible following the collection of the sample. Samples should not be allowed to warm up prior to packing them into the laboratory cooler for shipping.

2. Arrange containers in front of assigned coolers. Organize and carefully pack all samples in cooler immediately after collection. Pack samples so that breakage will not occur. There must be a cushion of padding (e.g., bubble wrap, vermiculite or ice in zip lock bags) between each sample container and between the containers and the top, bottom and sides of the cooler. Smaller containers, such as 40-ml vials, can be placed in "zip-lock" bags to protect them and keep them dry.

3. Complete, insert into a zip lock bag and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment to the laboratory, it may be easier to tape the chain of custody form to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody record as a courtesy to the laboratory personnel. Any other irregularities should also be noted.

4. Add additional ice as necessary to ensure that it will last until receipt by the laboratory. Ice cubes should be double packed in "zip-lock" bags to prevent leakage.

5. Seal the cooler with packing or strapping tape (make several complete revolutions) and a custody seal covered with clear tape (if available). Record the number of the custody seal in the field notebook and on the field form. If samples are shipped in the mail they should be properly labeled and comply with shipping regulations. Maintain the shipping bill along

with the chain-of-custody form for the project files and call the laboratory the next day to confirm receipt.

6. Unless specified otherwise in the superseding site-specific work plan or field sampling plan, this SOP shall govern the manner in which sample handling is performed by Energy*Solutions'* personnel. However, if field conditions or other factors dictate the need, reasonable deviation from the SOP is acceptable. Any departure from the SOP must be documented in the site-specific field notebook or project file, along with an explanation as to why the deviation was necessary.

ENERGYSOLUTIONS

Standard Operating Procedure
Low-Flow / Low Stress Groundwater Purging

Authored By:	Daniel Slywka Name, Title	6/19/12 Date
Reviewed By:	Robert McPeak Name, Title	6/19/12 Date
Approved By	Robert McPeak Name, Title	6/19/12 Date

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Section **Page**

1. PURPOSE AND SCOPE

1.1 Purpose

The purpose of this standard operating procedure (SOP) is to establish guidelines for Low Flow or Low Stress Purging of groundwater monitoring wells. As part of the SOP for the purging of groundwater monitoring wells, purging collection equipment must be considered, equipment decontamination, and pre-sampling procedures (e.g., water level measurement, collecting water quality readings, and purging of wells) must be implemented. Sampling objectives must be established in the work plan.

1.2 Scope

The scope of this SOP is to cover the purging techniques and equipment used in the Low Flow or Low Stress Purging of environmental monitoring wells. The scope of the sampling will be established in the site-specific work plan.

2. REFERENCES

2.1 Reference 1 "EPA EQASOP-GW-001 "Low Stress (Low Flow) SOP", Revision Number: 3, Dated July 30, 1996, Revised January 19, 2010"

3. GENERAL

3.1 Definitions

3.2 Responsibilities

3.2.1 The Field Team Leader (FTL) is responsible for distributing this and all other applicable SOPs to the employees affected by and expected to adhere by these SOPs.

3.2.2 All Employees are responsible for adhering to this SOP when conducting Groundwater monitoring, when not directed explicitely by regulators or other specific direction in the Sampling and Analysis Plan (SAP) or a site specific Work Plan.

3.3 Precautions and Limitations

"None"

3.4 Records

3.4.1 Field Notebook, Varies

3.4.2 Groundwater Quality Data Sheets (where required)

4. REQUIREMENTS AND GUIDANCE

4.1 Equipment and Supplies

4.1.1 Informational Supplies, Health and Safety Plan, SAP or work plan, data from previous rounds of sampling (if available), equipment manuals
4.1.2 Well Keys, well opening tools
4.1.3 Pumps, electric submersible, bladder pumps ect.
4.1.4 Appropriate sized tubing for the pump and well size.
4.1.5 Water Level Indicator
4.1.6 Flow Measurement Supplies and stopwatch
4.1.7 Power Source, battery, generator, nitrogen tank, based on pump.
4.1.8 Water Quality Instrument and flow through cell
4.1.9 Decontamination Supplies
4.1.10 Field Notebook and pens
4.1.11 Photo Ionization Instrument (PID)

4.2 Preliminary Site Activities (as Applicable)

a. Check area surrounding wells and curb boxes for evidence of damage or tampering, and record all pertinent observations.
b. Lay out a clean sheet of polyethylene to stage monitoring and pumping equipment on
c. Remove well cap and if appropriate measure VOCs at the rim of the well with the PID
d. Perform water level measurements according to EnergySolutions “Water Level Measurements” SOP

4.3 Low Flow Purging

Purging and sampling of wells in increasing chemical concentrations (if known) is advantageous. The use of dedicated well pumps is recommended to minimize disturbances to the filter pack as well as to prevent potential cross contamination.

4.3.1 Measure the water level prior to installing the pump and tubing, and record in the field notebook
4.3.2 Install the pump to be used to purge and sample the well. Lower the pump slowly and carefully to minimize disturbance, to the appropriate depth (depth previously used in that well or the mid water column depth).
4.3.4 Before starting the pump, re-measure the water level and record this reading in the field notebook. Record water level measurements at three minute intervals to ensure that no more than 0.03 feet of drawdown is maintained during purging.

4.3.5 Start the pumping system slowly and increase the speed until discharge occurs. Check the water level and ensure there are no pumping system leaks. Try to match previous pumping rates with previous rounds of sampling at the subject well, otherwise adjust the pump speed until there is little or no water level drawdown. If the reading indicates that the drawdown at the current rate remains stable and is less than 0.3 feet, continue purging. Monitor and record water levels and pumping rates every 3 to 5 minutes during purging. Record any pumping rate adjustments. If the initial water level is above the well screen, do not let the water level drop below the well screen.

4.3.6 After the water level has stabilized, connect the water quality instrument and flow through cell. If excessive turbidity is anticipated with pump re-start, allow the pump to purge the turbid volume of water prior to attaching the flow through cell. During well purging, monitor field parameters, turbidity, temperature, specific conductance, pH, oxygen reduction potential (ORP), and dissolved oxygen (DO) at 3 to 5 minute intervals. The pumping rate must move enough water to "turn over" the volume of the flow through cell during the measurement interval.

Prior to sampling, stabilization must be achieved in the well when three consecutive readings are within the following parameters:

Turbidity – 10% if values are greater than 5 NTU, if less than 5 NTU, three consecutive readings at less than 5 NTU indicates stabilization
Dissolved Oxygen – 10% if values are greater than 0.5 mg/L, if three consecutive measurements of less than 0.5 mg/L are recorded consider that parameter stabilized
Specific Conductance – three consecutive readings within 3% of each other
Temperature – three consecutive readings within 3% of each other
pH – three consecutive readings within plus or minus 0.1 s.u.
Oxygen Reduction Potential – three consecutive readings within plus or minus 10 millivolts

4.3.7 Once water levels and field parameters have stabilized for three consecutive readings the well is considered "stabilized" and is ready for sampling, refer to EnergySolutions "Groundwater Sampling" SOP for guidance on post purging sampling activities.

ENERGYSOLUTIONS

Standard Operating Procedure
Groundwater Sampling

Authored By:	Dan Slywka Name, Title	6/19/12 Date
Reviewed By:	 Name, Title	6/19/12 Date
Approved By	Robert McPeak Name, Title	6/19/12 Date

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Section **Page**

1. PURPOSE AND SCOPE

1.1 Purpose

The purpose of this standard operating procedure (SOP) is to establish guidelines for the sampling of groundwater monitoring wells. As part of the SOP for the sampling of groundwater monitoring wells, sample collection equipment must be considered, and equipment decontamination and pre-sampling procedures (e.g., water level measurement, collecting water quality readings, and purging of wells) must be implemented. Sampling objectives must be established in the work plan.

1.2 Scope

The scope of this SOP is to cover the sampling techniques and equipment used in the collection of groundwater samples from environmental monitoring wells. The scope of the sampling will be established in the site-specific work plan.

2. REFERENCES

2.1 Standard Operating Procedure Field Record Keeping

2.2 Standard Operating Procedure Sample Handling

2.3 Standard Operating Procedures Decontamination of Field Equipment

2.4 Standard Operating Procedure Colleting Quality Control Samples

3. GENERAL

3.1 Definitions

"None"

3.2 Responsibilities

3.2.1 The Field Team Leader (FTL) is responsible for distributing this and all other applicable SOPs to the employees affected by and expected to adhere by these SOPs.

3.2.2 All Employees are responsible for adhering to this SOP when conducting Groundwater monitoring, when not directed explicitly by regulators or other specific direction in the Sampling and Analysis Plan (SAP) or a site specific Work Plan.

3.3 Precautions and Limitations

"None"

3.4 Records

3.4.1 Field Notebook, Varies

3.4.2 Groundwater Quality Data Sheets (where required)

4. REQUIREMENTS AND GUIDANCE

The requirements for sampling a monitoring well include the following tasks: measurement of water levels, purging of the well prior to sampling, and sampling of the well.

4.1 Water Level Measurement

Water level readings must be collected from each monitoring well prior to purging and sampling. Water level readings are required to determine groundwater flow direction. Specific equipment is required to obtain the depth to groundwater (DTW) and the Total Depth (TD) of the well. Specific equipment is required to collect water levels, they may include but not limited to, the following;

a. Water Level Indicator
b. Field Notebook to record DTW and TD readings.

4.2 Groundwater Purging and Sample Collection

In order to sample ground water from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but is not necessarily limited to, the following:

a. pumps (centrifugal, peristaltic, bladder, electric submersible, bilge, hand-operated diaphragm, etc.);
b. appropriate discharge tubing;
c. appropriate compressed gas if using bladder -type or gas-displacement device;
d. portable generator and gasoline or alternate power supply if using an electric submersible pump;
e. plastic sheeting;

f. applicable field forms (e.g., groundwater sampling field worksheet, groundwater pumping field worksheet well inspection worksheet, etc.) and field notebook;
g. well location and site map;
h. stop watch, digital watch with second increments, or watch with a second hand;
i. black pen and water-proof marker;
j. tools (e.g., pipe wrenches, screwdrivers, socket wrench and sockets, hammer, pliers, flashlight, pen knife, etc.);
k. appropriate health and safety equipment, as specified in the site health and safety plan (HASP);
l. Water Quality Meter
m. extra supplies and batteries (for meters, thermometers, flashlight, etc.);
n. disposable gloves; and
o. reference copies of site sampling and analysis plan (SAP) and HASP.
p. Water level indicator

For each sampling event, all field measurement and sampling equipment that will enter a well must be decontaminated prior to its entry into the well.

Calibrate field measuring equipment (e.g., thermometers, pH, conductivity and dissolved oxygen meters, etc.) before use or as required in the manufacturer's manual for the instrument. Document, initial and date the calibration procedures on the appropriate field form, and in the field notebook.

5.0 PROCEDURE

5.1 Purge the well prior to sampling either by the Low-Flow/Low-Stress Method (EnergySolutions SOP "Low-Flow/Low-Stress Groundwater Monitoring Well Purging"), or by the volume adjusted purging method. The well should ultimately be pumped or bailed in accordance with the SAP or site specific work plan.

5.2 If well has been pumped to near dryness, the well should be allowed to recover to a volume sufficient for sampling. In general, sampling should take place within two hours of purging; however, for wells with slow recharge, the two hour limit may be exceeded to allow for sufficient recovery of the water volume.

5.3 Record the physical appearance of the purge water (i.e., color, turbidity, odor, etc.) on the appropriate field form. Note any changes that occur during the purging.

5.4 If a pump is used to collect the sample, then use the same pump used to purge the well. If need be, reduce the discharge rate to facilitate filling sample containers and to avoid problems that can occur while filling sample containers.

5.5 When sampling, remove the cap from each container, pour in the sample and replace and secure the cap immediately.

5.6 Fill each appropriate, pre-labeled sample container carefully and cautiously to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in an ice-filled (wet ice or blue pack) cooler for storage.

5.7 If VOCs are being tested for, then, add additional water for form a meniscus on the water surface within the sample container prior containers and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.

5.8 As required, record the start and end time for sampling and the sampling method (e.g., bailer or pump). Measure and record pH, dissolved oxygen, temperature, and specific conductivity, if required.

5.9 Complete all necessary field worksheets and chain-of-custody forms. Secure the cooler with sufficient packing tape and a custody seal for shipment via courier or shipping company.

ENERGYSOLUTIONS

Standard Operating Procedure
Field Record Keeping

Authored By:	Daniel Slywka Name, Title	6/19/2012 Date
Reviewed By:	Robert McPeak Name, Title	6/19/2012 Date
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1. PURPOSE AND SCOPE

1.1 Purpose

This standard operating procedure (SOP) establishes the procedures to be used for documenting and recording field activities. These activities include but are not limited to: site walk-throughs; geophysical testing; monitoring well installation; aquifer testing; air, water, groundwater, soil, and waste sampling; remediation waste removal; and installation, operation, and maintenance of remediation systems.

Field data is only as good as its documentation. Because memories fail and project personnel may change with time and task, thorough documentation is needed to accurately and permanently record observations made and information collected in the field. Standardization of field documentation helps to ensure that all pertinent information is recorded in a readily recoverable and understandable format.

Field documentation becomes part of the legal record of site activities and as such the utmost care and consideration must be given to its generation and maintenance.

1.2 Scope

The scope of this SOP is to generate quality field records that are easily interpreted, readily available, and show the progression of field activities on a chronological basis.

2. REFERENCES

2.1 Reference 1: Sample Handling

2.2 Reference 2: Standard Operating Procedure Decontamination of Field Equipment

2.1 Reference 3: Standard Operating Procedure Groundwater Sampling

2.2 Reference 4: Standard Operating Procedure Measuring Water Levels

2.3 Reference 5: Standard Operating Procedure Low-Flow/Low Stress Groundwater Purging/Sampling

2.4 Reference 6: Standard Operating Procedure, Collecting Soil and Sediment Samples

3. GENERAL

3.1 Definitions

3.1.1 *Filed Notebook* – A bound book used to maintain records of field activities

3.2 Responsibilities

3.2.1 The Supervisor is responsible for providing the affected employees with this SOP as necessary.

3.2.2 All Employees are responsible for adhering to this SOP when recording field activities.

3.3 Precautions and Limitations

"None"

3.4 Records

3.4.1 Field Notebooks;

3.4.2 Field standard documents

4. REQUIREMENTS AND GUIDANCE

4.1 General

Field notebooks must be bound and should have numbered, water resistant pages. All pertinent information regarding the site and sampling procedures must be documented. Notations should be made in logbook fashion, noting the time and date of all entries.

4.2 Materials

The following materials are needed for proper documentation of field activities:

- a bound, waterproof field notebook;
- black pens, indelible markers, and grease or wax pencils;
- all weather clip board and form holder;
- appropriate project and task specific forms (e.g., sample data sheets and boring logs); and,
- camera and film (optional).

4.3 General Procedures

4.3.1 The project manager (PM) identifies and procures all forms required for proper recording of field activities. Project specific needs, i.e., client and regulatory documentation requirements, must be considered. The required forms should be referenced and included in formal work plans, proposals or other documents.

4.3.2 The PM briefs the designated field team leader (FTL) on project documentation requirements for the task(s) at hand, gives the FTL the field notebook and provides one clean copy of each required form, if they are not already provided in the work plan.

4.3.3 The FTL is responsible for maintaining the field notebook during field activities and for bringing an adequate number of specified forms to the field site.

4.3.4 The FTL retains or assigns documentation responsibilities to field team members (FTMs) as appropriate. The number of individuals recording field activities should be minimized.

4.3.5 Whenever an alteration to a field book or data form entry is required, the incorrect entry is to be struck out with only a single line followed by the initials of the recorder making the change (e.g., ~~79 ug/l~~ JD). The revised information should be recorded next to the original entry.

4.3.6 The FTL is responsible for collecting and reviewing all field documentation at the end of each day. If possible, deficiencies in the record should be corrected immediately and the cause of the deficiency addressed.

4.3.7 The FTL is responsible for photocopying field documentation daily. Copies should be maintained physically separate from the originals. If photocopying facilities are not available at the site, field office or hotel, the FTL should copy all field documentation immediately upon returning to the office.

4.3.8 Upon return to the office, the FTL relinquishes the photocopies of the field notebook and all other field documentation to the PM.

4.3.9 The PM maintains field documentation for the project. The field notebook and all other original documents are placed in a folder labeled "Field Notes - Originals" and copies are placed in a separate folder labeled "Field Notes - Working Copies." Field notes should be filed chronologically and, where appropriate, the file folder label should include the dates when the field work was performed. Original documents are kept and eventually archived with the site files. Working copies of field notes should be used for reference during data reduction and report writing.

4.4 **Procedure for Maintaining the Field Notebook**

4.4.1 The PM issues a field notebook for the project which includes the following information prominently displayed on the cover or first page: the project name; number; location; and the message:

If found, please return to:
Energy*Solutions*
100 Mill Plain Road, Second Floor
Danbury, CT 06811
Attention: <project manager> or
call <project manager's phone number>
REWARD OFFERED.

4.4.2 In addition, each page of the field notebook should be sequentially numbered. Under no circumstances should pages ever be removed from the field notebook.

4.4.3 The field notebook is brought to the site during every planned and scheduled site visit. If the notebook is not brought to the site, notes should be kept on another medium using the same

format as the official field notebook; these notes must be transcribed into the official field notebook as soon as practicable, along with a notation of when the transcription was made.

4.4.4 The field notebook is maintained and recorded in by one person (usually the FTL) for any given task or block of time. A change in custody is to be documented in the notebook and initialed by each individual.

4.4.5 A fresh page is used to begin each day's entries, with the day and date prominently recorded at the top followed by the weather conditions, e.g., *Friday April 23, 1993 - overcast, expected high 50º F, chance of showers*.

The next entry should include time of arrival at site, personnel present (Energy*Solutions*, Client, Regulatory, and subcontractors), and general purpose of site visit. This should be followed by a brief description of site conditions noting changes from the last time Energy*Solutions* was onsite.

4.4.6 Subsequent entries should be made in chronological order with times noted. The field notebook is a log of actions, occurrences, and activities at the site and as such should be written in the first person active voice and provide a description of who, what, where, why, when, and how. General types of information recorded in the field notebook include but are not limited to:

- arrival and departures of both Energy*Solutions* and non-Energy*Solutions* personnel and equipment;
- descriptions of both formal and informal meetings including identification of person or organization calling the meeting, purpose, location, time, attendees, topics discussed, and decisions made;
- all conversations with the client, the general public, and regulatory personnel;
- significant site- or work-related discussions between personnel and subcontractors, e.g., when decisions are made or orders given;
- telephone conversations with Energy*Solutions*, client, regulatory, and subcontracted personnel;
- health and safety procedures including level of protection, monitoring of vital signs, frequency of air monitoring, and any change (i.e., downgrade or upgrade) in the level of protection for both Energy*Solutions* and non- Energy*Solutions*
- personnel;
- deviations from the health and safety plan;
- significant changes in weather from first arrival at the site, e.g., high winds, heavy precipitation, or temperature extremes;
- air monitoring results, e.g., photo-ionization detector readings;
- site reconnaissance information such as topography, geologic features, water bodies, cultural features, and areas of suspected contamination;
- task designation and work progress;
- observations of potential contamination, e.g., stressed vegetation, stained soil, sheen on surface or ground water, etc. (descriptions should be objective and use of pejorative and/or non-technical terms, e.g., smelly and slimy, avoided);
- liberal use of sketches, drawings, and maps including measured or approximate dimensions or distances to clarify, amplify and enhance verbal descriptions;

- sample description including unique identification number, location, matrix, sample device, odor, color, texture, response to field instruments, and sample containers filled (some information may be redundant when field sample data sheets or other forms are used; nonetheless, this information should be faithfully recorded in the field notebook);
- description of photographs taken;
- deviations from the work plan;
- delays, unusual situations, problems and accidents or injuries;
- equipment and instrument problems;
- decontamination and calibration procedures;
- peripheral activities which may impact field activities; and
- time of departure of Energy*Solutions* personnel and a description of site conditions at the time of departure, e.g., non- Energy*Solutions* personnel remaining on site, vehicles, equipment, wastes, and other materials left on site, site security, etc.

4.4.7 If simultaneous activities are occurring, the FTL must make provisions for recording of activities by personnel at the work face and subsequent transcription into the field notebook. When multiple tasks are performed at remote site locations for extended periods of time, the use of additional field notebooks may be allowed with PM approval.

4.4.8 The last daily entry should be followed by the FTL's signature.

4.5 Procedure for Other Field Documentation Forms and Documents

4.5.1 Other task or project specific forms and documents may be required or appropriate for documentation of field activities, e.g., boring logs, monitoring well construction logs, air monitoring logs, sample data sheets, and chain-of-custody. Refer to the SOP Sample Handling (Energy*Solutions* Document No. 82A8496) for information regarding the proper procedure for filling out chain-of-custody forms. The FTL is responsible for ensuring that all forms are completed fully and properly.

4.5.2 Prior to initiation of field activities, the PM identifies, obtains, and provides the FTL with a copy of various documents, forms, and logs to be used.

4.5.3 The FTL reviews and familiarizes herself/himself with all forms and contacts the PM for clarification of any questions concerning proper completion of the forms.

4.5.4 The FTL brings adequate copies of the appropriate forms to the field site.

4.5.5 Pre-completion of forms is limited to site generic information, e.g., site name and address, and Energy*Solutions* project number.

4.5.6 Although of varying purpose and layout, the following information must be included on all forms: project name and Energy*Solutions* project number; date and time; and the name of the Energy*Solutions* employee completing the form.

4.5.7 As a general rule, all lines, boxes, etc. must be filled out and all queries or prompts answered, i.e., there should be no blank spaces left on the form. If a particular item does not apply write *NA* in the space or otherwise mark appropriately. If you are unsure of how a particular query should be answered, consult other staff members or qualify your answer.

ENERGYSOLUTIONS

Standard Operating Procedure
Decontamination of Field Equipment

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1. PURPOSE AND SCOPE

1.1 Purpose

The purpose of this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during drilling, soil sampling, and water sampling activities. The objective of decontamination is to ensure that all drilling, soil-sampling and water-sampling equipment is decontaminated (i.e., free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling locations/events and activities onsite to eliminate the potential for cross contamination from one borehole/sampling point or well to the next; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

The following SOP is largely adapted from the New Jersey Department of Environmental Protection and Energy's (NJDEPE) *Field Sampling Procedures Manual, May 1992*. However, in determining decontamination procedures on a site-specific basis, state and Federal regulatory and agency requirements and guidance must be considered. Decontamination procedures must be in compliance with state and/or Federal protocols in order that regulatory agency scrutiny of the procedures and data collected do not result in non-acceptance (invalidation) of the work undertaken and data collected.

2. REFERENCES

2.1 Reference 1: Standard Operating Procedure Groundwater Sampling

2.2 Reference 2: Standard Operating Procedure Measuring Water Levels

2.3 Reference 3: Standard Operating Procedure Low-Flow/Low Stress Groundwater Purging/Sampling

2.4 Reference 4: Standard Operating Procedure, Collecting Soil and Sediment Samples

3. GENERAL

3.1 Definitions

3.1.1 External laboratory-grade glassware detergent: Non-phosphate soap such as alconox.

3.2 Responsibilities

3.2.1 The Field Team Leader (FTL) is responsible for distributing this and all other applicable SOPs to the employees affected by and expected to adhere to these SOPs.

3.2.2 All Employees are responsible for adhering to this SOP when conducting field sampling of environmental media, unless directed explicitly by regulators or by the Sampling and Analysis Plan (SAP) or by a site specific Work Plan to do otherwise.

3.3 Precautions and Limitations

"None"

3.4 Records

3.4.1 Field Notebook, Varies

4. REQUIREMENTS AND GUIDANCE

4.1 Decontamination of Heavy Equipment

Items such as drill rigs, well casing, auger flights, augers, rods, samplers, pumps, tools, backhoes and any piece of equipment that can potentially come in contact (directly or indirectly) with the sampling matrix should be decontaminated prior to and after each usage during a site investigation (i.e. use only decontaminated equipment). Drilling rigs and associated items mentioned previously should be properly decontaminated by the contractor before arrival on site. Heavy equipment can be steam cleaned or manually scrubbed.

4.1.1 Steam generators and power washers use potable water to provide a high pressure medium to remove visible debris. They are also efficient in terms of ease of handling and will generate low volumes of wash solutions. Potential disadvantages include the need for a fixed or portable power source and water supply and they may not be practical for use on small pieces of equipment or for one day sampling events.

4.1.2 Manual scrubbing involves using a non-phosphate, laboratory-grade glassware detergent solution, followed by a thorough water rinse. This method can be as effective as a steam generator but is labor intensive and generates large volumes of wash and rinse solutions.

4.1.3 Drilling equipment utilized in the presence of thick sticky oils (e.g., PCBs) may need special decontamination procedures before actual steam cleaning or scrubbing.

4.1.4 The wash solutions may have to be contained, sampled and disposed of in a proper manner depending on the type of contaminants encountered and Federal, state and local procedures.

4.2 Procedure for Non-Aqueous Sampling Equipment

4.2.1 All equipment should be decontaminated prior to beginning sampling events and after each individual sample is collected.

4.2.2 A location for a decontamination station should be selected. It should be located away from any potential sources of cross contamination. The decontamination station must in no way contaminate an otherwise clean area. Decontamination should be performed over a container and the residual liquid material must be properly disposed.

4.2.3 Wear disposable gloves while cleaning equipment to avoid cross contamination and change gloves as needed.

4.2.4 Disassemble sampling devices and scrub with a brush in a non-phosphate, laboratory-grade detergent and tap water solution to remove visual or gross contamination.

4.2.5 Rinse with generous amounts of tap water.

4.2.6 Rinse with distilled or de-ionized water.

4.2.7 Place clean equipment on a clean plastic sheet to dry (e.g., polyethylene).

4.2.8 Reassemble the cleaned equipment as necessary.

4.2.9 If metal samples are to be collected, an acid rinse (10% nitric acid) followed by a distilled and de-ionized water rinse. If analysis of metals is required and carbon steel sampling devices are used instead of stainless steel, it may be necessary to reduce the nitric acid rinse from 10% to 1% to reduce the leaching of metals from the sampler to the sample. It is then necessary to use a 1% nitric acid rinse after the tap water rinse.

4.3 Decontamination of Submersible Pumps

Submersible pumps and wire leads must be cleaned and flushed prior to and between each use according to the following protocol.

4.3.1 Wash pump casing and cable using an external laboratory-grade glassware detergent plus tap water;
4.3.2 tap water rinse;
4.3.3 flush 10-20 gallon of potable water through the pump*;
4.3.4 distilled or de-ionized water rinse;
4.3.5 for submersible pumps with bottom cavities, e.g. Grunfos Rediflo Pumps, the recessed screw at the bottom of the pump must be removed and the cavity should be rinsed out with distilled or de-ionized water and then filled with distilled or de-ionized water; and
4.3.6 pump and wires should be placed on clean polyethylene sheeting.

* For submersible pumps smaller than four inches in diameter, the number of gallons to be flushed can be proportionately reduced (i.e., three inches -- 15 gallons, two inches -- 10 gallons).

Water level meters/indicators and all leads used during groundwater sampling must also be cleaned and flushed prior to and between each use with a laboratory grade detergent plus tap water, a tap water rinse and a distilled or de-ionized water rinse.

All groundwater sampling must be performed using dedicated tubing or new tubing for each well.

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1. PURPOSE AND SCOPE

1.1 Purpose

The purpose of this standard operating procedure (SOP) is to establish the procedures for collecting soil or sediment samples.

1.2 Scope

These procedures are applicable to surface, subsurface, and stockpiled soil or sediment sample collection with split-spoon samplers, thin-walled tube samplers, hand augers, scoops and other sampling devices.

2. REFERENCES

2.1 Reference 1: Standard Operating Procedure, Decontamination of Field Equipment

2.2 Reference 2: Standard Operating Procedure, Collection of QC Samples

2.3 Reference 3: Standard Operating Procedure, Sample Handling

2.4 Reference 4: Standard Operating Procedure, Record Keeping

3. GENERAL

3.1 Definitions

3.1.1 *Sediment*– a naturally occurring material that is broken down by processes of weathering and erosion, and is subsequently transported by the action of fluids such as wind, water, or ice, and/or by the force of gravity acting on the particle itself

3.1.2 *Quality Control Samples*– Samples collected for analysis which demonstrate the quality of the sample collection and handling procedures which confirm data validity.

3.1.3 *Sample Preservative*– media (such as HCL) placed in the sampling container which preserves the sample and ensures the sample analyzed by the laboratory represents the condition of the sample in the field as closely as possible.

3.1.4 *Chain of Custody*– A form which includes all pertinent information associated with the sampling effort in order to ensure the identification of

individual samples and provide confirmation that custody remained in tact and that tampering or substitutions were precluded.

3.2 Responsibilities

3.2.1 The Project Manager is responsible for providing the affected employees with this SOP as necessary.

3.2.2 The Field Team Leader (FTL) is responsible for ensuring that the field team complies with this procedure when collecting samples.

3.2.2 All Employees are responsible for adhering to this SOP when recording field activities.

3.3 Precautions and Limitations

"None"

3.4 Records

3.4.1 Field Notebooks;

3.4.2 Field standard documents

4. CONSIDERATIONS

4.1 General Procedures

Soil or sediment samples can be collected from the surface, shallow subsurface, or at depth interval. Commonly, surface sampling refers to the collection of samples at a 0-6 inch depth; the minimum and maximum depth of surface samples must be defined in the sampling and analysis plan (SAP). Surface soil or sediment samples are usually collected with a stainless steel trowel or scoop. Subsurface samples may be collected with a split-spoon sampler, thin-walled tube sampler or directly from a boring device such as a bucket auger. Subaqueous sediment samples can also be collected with specialized samplers such as Ponar or Eckman Dredges. Borings may be advanced by hand augering, power-assisted hand augering, pneumatic drill, or with a drill rig. In some situations, subsurface samples are collected via excavation with a back hoe or other heavy equipment. When samples are collected at depth, the water content should be noted since "soil sampling" is generally restricted to the unsaturated zone. Sediment samples in many cases will be collected below surface water and will be saturated.

Soil or sediment samples can be collected in either a random (simple, stratified, or systematic) or biased manner. The SAP should not only specify sampling locations and depth, but should also indicate the type of sampling (random or biased) and the reason behind selection of the sampling points in order to allow sampling personnel to make field modifications to the SAP which are consistent with the purpose of the sampling.

4.2 Grab Samples

Either grab or composite samples can be taken. A grab sample is a discrete aliquot that is representative of one specific sample site at a specific point in time. Because the entire sample is

collected at one particular point and all at one time, a grab sample is representative of only those conditions. As a rule, when collecting samples at hazardous wastes sites, only grab sampling should be employed.

4.3 **Composite Samples**

A composite sample is a non-discrete sample composed of more than one specific aliquot collected at various sampling points. Soil or sediment samples may be composited in the field or several samples may be submitted to the laboratory to be composited by weight. The method used is dependent on the regulatory requirements and should be approved and described in the SAP. While compositing samples may have some merit when performed for specific purposes, and under known conditions, the information obtained may not be particularly useful. A commonly used application of composite samples is characterizing stockpiled soils for treatment or waste disposal. To avoid off gassing of contaminants, care must be exercised when composite samples are to be analyzed for volatile organic compounds (VOCS).

5. EQUIPMENT AND MATERIALS

The equipment and materials required for proper collection of soil or sediment samples will be project/site/phase/task specific and will depend upon the techniques and methodologies employed. Sample collection methods, materials, and quality assurance/quality control (QA/QC) requirements should be specified in the SAP. Equipment and materials required for proper collection of soil or sediment samples may include but are not necessarily limited to the following:

- A detailed Sampling and Analysis Plan (SAP);
- field notebook, maps, boring log, and field data sheets;
- containers for investigation derived waste (IDR) as required;
- decontamination supplies including: non-phosphate laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents, aluminum foil, and plastic sheeting, garbage bags.
- SAP specified sampling device(s), e.g., Split-spoon sampler, thin-walled tube sampler, stainless steel hand auger, or stainless steel trowel, etc.;
- stainless steel spoons, spatulas, scrapers, probes and other small tools;
- stainless steel mixing bowl;
- disposable sampling gloves (sterile non-powdered latex or vinyl examination gloves);
- laboratory-supplied and cleaned sample containers;
- sample labels, chain-of-custody/analytical request forms, custody seals;
- sample shuttle/cooler with blue or wet ice;
- zip-lock bags and packing material;
- black pen and indelible marker;
- tape measure;
- paper towels;
- masking and packing tape;
- overnight (express) mail forms.

6. DECONTAMINATION

All sampling equipment should be properly decontaminated prior to use and all reusable sampling equipment should be thoroughly decontaminated immediately after use. Where possible, thoroughly pre-cleaned and aluminum foil-wrapped sampling equipment should be used and dedicated to individual sampling locations and depth intervals. In some cases the use of dedicated samplers may be impractical therefore, when collecting numerous samples, it may be necessary to decontaminate equipment in the field. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting should be changed after each sample is collected and discarded in an appropriate manner.

7. SAMPLING PROCEDURES

1) Determine the type and quantity of sampling equipment required. In cases where it is not known which type of sampling equipment will work best, several types of systems and devices should be on hand and available. Prior to collecting soil or sediment samples, ensure that all sampling equipment has been thoroughly cleaned.

2) Determine the amount of soil or sediment, and the size and number of sample containers needed, prepare preservatives if required, and prepare decontamination equipment and materials if reusable sample equipment is to be used.

3) For subsurface samples, the boring must be advanced with thoroughly cleaned equipment to the top of the desired sampling interval. A pre-cleaned sampling device should then be advanced through the sampling horizon (after removal of the boring tool if required). If the sampling tool is also the boring device, e.g., Bucket auger, the device should be withdrawn and cleaned prior to advancement through the sampling horizon or, preferably, another pre-cleaned device should be used to collect the sample, when possible.

4) Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil or sediment sample from the sampler, and place the sample in a laboratory-supplied pre-cleaned sample container. This should be done as quickly as possible. Samples collected for VOC analysis will typically be collected using EPA Method 5035 sampling procedures which utilize Encore Samplers or preserved vials. These sampling procedures should follow the procedures provided in Section 8. In some cases samples collected for VOC analysis may be collected using other methods. The sampling team should confirm required VOC sampling methods in the sampling plan or with the project manager.

   Samples to be analyzed for VOCS must be collected prior to other constituents and handling should be kept to a minimum. Collect the sample towards the middle of the sampler because soil or sediment at the ends of the sampler may be slough, and therefore not representative of the depth interval being sampled.

5) Label the sample container with appropriate information such as: client name, site location, sample identification (location, depth, etc.) Date and time of collection, and sampler's initials. If samples are extremely contaminated, containers should be placed in individual zip-lock bags and noted as such on the chain-of-custody form.

6) Using the remaining portion of the soil or sediment from the sampler, log the sample in detail by recording: color, odor, moisture, texture, density, consistency, organic content,

layering, grain size, etc. Samples may be screened with portable instrumentation such as a PID or OVA. These results should also be recorded in the field notebook or on the appropriate field data forms

7) Immediately after collection the sample should be cooled to 4^{o}C and placed in a cooler/sample shuttle. See sample handling procedures for proper sample handling and documentation.

8) Discard any gloves, foil, plastic, etc. in an appropriate manner that is consistent with site conditions.

9) All reusable sampling equipment must be thoroughly cleaned in accordance with the equipment decontamination procedure. Following the final decontamination, (at the conclusion of the sampling event after all samples have been taken) wrap the sampling equipment in aluminum foil for storage.

8. SAMPLING USING EPA METHOD 5035

8.1 **Sample Collection**

Samples should be collected in a manner that generates an undisturbed sample which comes directly from the soil material. Effort should be taken to collect the sample from coring devices such as split spoon samplers or GeoProbe sleeves as soon as possible after the material has been removed from the ground. Wherever possible the effects of heat wind and rain on the sample should be minimized.

Actual samples collected from the coring device must be collected using a dedicated or decontaminated small diameter sampler.

8.2 **Sample Collection Methods**

Samples may be collected using an Encore Sampler or using a small core soil sampler capable of collecting 5 grams of soil.

The small core sampler must then be able to inject the soil directly into a 40 mil vial. If a small diameter core sampler is used, the sample weights must be measured using a small portable scale and recorded. The weights can be measure by generating a tare weight for the scale and then performing a test weight of the core sampler and the soil material for each soil matrix. Once a 5 gram sample of a specific soil matrix is generated, the volume of this test sample may be used as a guide in collecting the approximately sized small core samples of that soil matrix. Additional test samples should be weighed whenever a change in the matrix is observed.

In order to collect a sample using the small core soil sampler, use the soil matrix test sample as a volume guide. Insert the coring sampler into the undisturbed soil matrix until the same approximate volume as the test sample is in the sampler. Remove excess material adhering to the core barrel, open the sample container and extrude the soil core into the sample container. The sample should be extruded into the vial on an angle to prevent the sample from dropping into the vial and splashing the preservative. Before placing the cap on the vial ensure that all soil particles that might jeopardize the seal have been removed.

8.3 **Sample Preservation**

When collecting samples for use with vials containing required sample preservatives, up to four types of samples may be required. Four separate vials will be provided including: a high concentration sample (methanol preserved), a low concentration sample (water preserved) and sample used to analyze for percent solids. All vials provided by the laboratory must be filled with 5 grams of sample material using the methods described above.

If an Encore type sampler is to be used, for storage and shipment no preservatives are required and one single sampling device is needed per sample. Prepare the sampler for shipment according to the manufacturer's instructions. Remove the cap from the end of the sampler and advanced the sampler directly into the undisturbed soil core. Before replacing the cap on the end of the sampler, ensure that the sealing device and cap are free of soil particles.

Record laboratory and field identification numbers in the field notes and on the chain of custody. After sample collection, place the containers in an iced cooler. Samples should achieve the required temperature of 4^0C +/- 2^0 as soon as possible following collection. Care should be taken to ensure that the cooler arrives at the laboratory within a maximum of 24 hours to ensure the maintenance of the cooler temperature and ensure that the analysis or sample freezing is initiated within 48 hours of collection.

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Collecting Quality Control Samples

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1. PURPOSE AND SCOPE

1.1 Purpose

The purpose of this standard operating procedure is to establish guidelines for the collection of quality control (QC) samples and to explain the measures taken to ensure the integrity of each sample collected. The objective of any QC program is to ensure that the data generated are of known and reliable quality. The acceptance of sampling data by regulatory agencies and in litigation-support investigations can depend heavily on the proper QC program to justify the results presented.

1.2 Scope

The QC sampling requirements must be determined based upon the data quality objectives for the project. In some instances, regulatory agencies, such as the USEPA, may specify or provide guidance concerning QC sampling on a project. All QC requirements should be clearly defined in the work plan developed for the project, including types of samples to be collected, sample collection methods, and frequency of sampling. This procedure provides the requirements for the collection of those samples specified in the sampling plan.

2. REFERENCES

2.1 Reference 1: Sample Handling

2.2 Reference 2: Standard Operating Procedure Decontamination of Field Equipment

2.1 Reference 3: Standard Operating Procedure Groundwater Sampling

2.2 Reference 4: Standard Operating Procedure Measuring Water Levels

2.3 Reference 5: Standard Operating Procedure Low-Flow/Low Stress Groundwater Purging/Sampling

2.4 Reference 6: Standard Operating Procedure, Collecting Soil and Sediment Samples

3. GENERAL

3.1 Definitions

3.1.1 *Field Notebook* – A bound book used to maintain records of field activities

3.2 Responsibilities

3.2.1 The Supervisor is responsible for providing the affected employees with this SOP as necessary.

3.2.2 All field employees are responsible for adhering to this SOP when collecting quality control samples.

3.3 Precautions and Limitations

"None"

3.4 Records

3.4.1 Field Notebooks;

3.4.2 Field standard documents

3. QUALITY CONTROL SAMPLES

QC Samples are used to ensure the quality of sampling activities and laboratory performance during an environmental investigation or routine monitoring at a site. Types of QC samples may include field blanks (a.k.a., equipment or rinseate blanks), trip blanks (a.k.a., travel blanks), replicates (a.k.a., duplicates or split samples), matrix spike/matrix, spike duplicates, and performance evaluation samples. A discussion pertaining to each QC sample type is provided below.

3.1 Field Blanks

Description - A field equipment blank (field blank) is collected to check on the sampling equipment handling, preparation, storage and shipment procedures implemented in the field. A field blank is performed by exposing demonstrated analyte-free water (e.g., distilled/deionized water) to the sampling process (i.e., the water must pass through or over the actual sampling equipment). Preferably, the analyte free water should be provided by the laboratory performing the sample analysis. At a selected field location documented in the field book, the water is poured from the full set of bottles through and over the dedicated field sampling device that has been decontaminated for sample collection (e.g., auger flight, split-spoon sampler, trowel, pump or bailer) and into the empty set of laboratory-supplied sample bottles. It is important that the blank be exposed to the entire sampling process, e.g., a field blank for metals should be filtered if the samples were also filtered. Field blanks are generally not required for potable well sampling events or when a sample is collected directly from a source into a sampling container without the aid of any tools. The need for field blanks as a check on the cleanliness of dedicated or disposable sampling equipment (e.g., disposable polyethylene bailers or dedicated bladder pumps) is dependent upon the scope and duration of a project and should be specified in the work plan. Field blanks are usually preserved in the same manner and analyzed for the same suite of parameters as the other samples collected during the sampling event. In some situations it may be advantageous to require equipment blanks for each type of sampling procedure (e.g., split-spoon, bailer, pump).

Field blanks may also be used to detect potential interference or cross contamination from ambient air during sampling events, especially if known sources of contamination are within close proximity or monitoring instruments indicate the presence of contamination above background levels. This field blank is a sample bottle that is filled and sealed with demonstrated analyte free water, and is opened in the field and exposed to the air at a location to check for potential atmospheric interferences. The blank is then resealed and shipped back to the laboratory for analysis.

Frequency - For short-duration sampling events, the rate of one field blank per day is usually sufficient. For sampling events lasting more than a few days, field blanks are generally performed at the rate of between 5% to 10% of the total number samples collected throughout the event.

3.2 Trip Blanks

Description - Trip blanks consist of a set of sample bottles filled at the laboratory with demonstrated analyte free water. These samples then accompany the bottles that are prepared at the laboratory into the field, and back to the laboratory along with the collected samples for analysis. **These bottles should never be opened in the field.** Trip blanks must return to the laboratory with the same set of bottles they accompanied to the field. Trip blanks are primarily used to check for "artificial" contamination of the samples and sample containers during transport to and from the laboratory for analysis. Trip Blanks are typically collected only for VOC analyses.

Frequency - Idealistically, one trip blank per cooler containing VOC samples, or test substance of other analytes of interest, should accompany each day's samples.

3.3 Replicate (Duplicate) Samples

Description - Replicate samples are collected to check on the reproducibility of results either within a laboratory or between laboratories. A replicate sample is called a split sample when it is collected with or turned over to a second party (e.g., regulatory agency, litigant's consulting firm) for an independent analysis.

With the exception of VOCs, obtaining replicate samples in a soil or sediment matrix requires homogenization of the sample aliquot prior to filling sample containers. **Samples taken for VOC analysis however must always be taken from discrete locations or intervals without mixing.** Homogenization of the sample for remaining parameters is necessary to generate two equally representative samples. Note that enough sample must be collected at one time in order to fill all necessary containers. Samples should be thoroughly mixed using a decontaminated stainless-steel bowl and spoon. Once mixing is completed, the sample should be divided in half and containers should be filled by scooping samples alternately from each half.

Replicates of aqueous samples for VOC analysis should be filled from the same bailer or other sampling device whenever possible and be the first set of containers filled. Aqueous replicate samples for other parameters are either obtained from the same sampling device or by alternately filling sample containers from the same sampling device for each parameter.

Frequency - Replicates for determining the reproducibility of laboratory results are commonly collected at a rate of 5% (one for every twenty samples collected). Split samples are at the discretion of the second party and may include every sample collected.

3.4 **Performance Evaluation Samples**

Description - In certain instances when a laboratory's quality assurance performance is in question, splitting samples may not prove as useful as providing blind performance evaluation (PE) samples to a laboratory since analytical performance and accuracy differs from laboratory to laboratory. Performance evaluation samples provide information on a laboratory's performance based upon analysis of that sample which contains parameters of a known and defined concentration. A PE sample can be used to pre-qualify a laboratory or, if submitted blind with a sample lot, may be used to evaluate the quality of the analytical data. PE samples consist of pre-measured, pre-determined samples of known origin and concentration which are submitted for analysis along with a sample shipment from the field. Deviations from known concentration may indicate improper calibration or other laboratory errors that may have influenced the results reported for those samples collected in the field.

Frequency - Performance evaluation samples are usually required by the governing agency for a project. Therefore, the frequency of submitting these samples to the laboratory is commonly at the discretion of the agency.

3.5 **Matrix Spike/Matrix Spike Duplicates**

Description -Spikes of compounds (e.g., standard compound, test substance, etc.) may be added to samples in the laboratory to determine if the matrix is interfering with constituent identification or quantification, as well as a check for systematic errors and lack of sensitivity of analytical equipment. Samples for spikes are collected in the identical manner as for standard analysis and shipped to the laboratory for spiking. Matrix spike duplicate sample collection and laboratory spiking and analysis is done to check on the reproducibility of matrix spike results. Prior to sampling, check with the laboratory to determine if additional sample volumes are required for matrix spike/matrix spike duplicate (MS/MSD) samples.

Frequency - The rate for MS/MSDs is almost always one per sample delivery group. A sample delivery group can be defined as either:

- all field samples collected during a project;
- each set of twenty field samples collected during a project; or
- each fourteen calendar day period during which field samples for a project are received by the laboratory (said period beginning with the receipt of the first sample in the sample delivery group),which ever comes first.

4. **SAMPLE COLLECTION PROCEDURES**

All Quality Assurance samples should be collected using the same procedures to collect normal samples. In addition, the following items must be considered.

4.1 Number of Samples

Determine the type and number of QA/QC samples to be collected as specified in the work plan and implement the sampling as outlined above.

4.2 **Concealing Sample Identity**

Ensure unbiased handling and analysis of performance evaluation, replicate and blank QC samples by concealing their identity by means of coding so that the analytical laboratory cannot determine which samples are included for QC purposes. Attempt to use a code that will not cause confusion if additional samples are collected in the future.

4.3 **Matrix Spike Samples**

Label selected matrix spike samples so that the laboratory knows which samples are to be spiked. For projects when only a few samples are collected during a long interval of time, it may be advantageous not to select matrix spike samples until after the samples are received by the laboratory, thus limiting the number of MS/MSDs. In this instance, frequent communication must be maintained between the sampling crew and the laboratory to ensure that an appropriate number of MS/MSDs are analyzed.

4.4 **Documentation**

Document the QC samples on the appropriate field forms and in the field notebook. On the chain of custody form, fortification, replicate and blank QC samples will be labeled using the codes discussed above and MS/MSDs will be identified as such.

4.5 Sample Handling

Place QC samples in their assigned coolers with the investigatory samples. Refer to Document No. 82A8496 for sample handling and shipping procedures.