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Appendix H

Sediment Sampling Standard Operating Procedures

1.0 OVERVIEW

This policy provides guidance on proper sediment sampling procedures (shallow and deep sample collection).

2.0 PROCEDURE/POLICY

2.1 General Requirements

The following requirements are applicable to the collection of sediment samples:

- Wear personal protective equipment required by the task/project Task Hazard Analysis.
- Sampling equipment and supplies to be used for sediment sampling will be determined during the task/project Field Readiness Assessment.
- All sampling and mixing equipment will be decontaminated in accordance with SWP FSP-7.5, "Decontamination Procedures."
- All sampling devices will be constructed from stainless steel materials. If liners are used for the collection of samples for environmental analysis, the liner will be new and sealed in factory supplied packaging upon arrival onto the site and will be composed of materials appropriate for task/project data quality objectives (DQOs) (generally Teflon® or stainless steel).
- Rope used to lower sediment collection devices in deep water will be new nylon or polyethylene rope with a minimum diameter of ½ inch. If the sediment sampling device is lowered on extension rods, the preferred rod material should be stainless steel.
- Once collected, all sediment samples will be prepared, packaged and shipped in accordance with SWP FSP-1.3, "Preparation of Soils for Environmental Analysis." Liners used as sample containers will be subject to similar requirements as soil containers except that the ends will be capped with Teflon® lined caps and taped with electrical tape.
- All equipment and procedures used to collect sediment samples will be documented in accordance with SWP FSP-7.1, "Field Documentation." An example Soil/Sediment Sampling Log is presented in Exhibit 1.

2.2 Scoop and Spoon Sampling Procedure

2.2.1 Shallow Water Sediment Collection

The following general procedure is applicable to sediment sampling with scoops and spoons:

1. Unwrap the spoon/scoop and sample collection bowl and mobilize to the sediment sample location. When wading to the location, approach the sampling point from the downstream direction. When sampling from the edge of the water body, use caution to avoid knocking soils from the bank into the water column.
2. Advance the spoon/scoop into the sediment, retrieve a sample and place into the collection bowl.
3. Repeat process until a sufficient volume of soil is collected.
4. Decant water from the collection bowl after sampling is complete.
5. Promptly return to the bank, scan the sample with the photoionization detector (PID) or other air monitoring device as applicable or required by the task/project DQOs.
6. Prepare the sediment sample for laboratory analysis (refer to SWP FSP-1.3, "Preparation of Soils for Environmental Analysis").

2.2.2 Deep Water Sediment Collection

For waters that are too deep to wade and less than eight feet deep, spoons/scoops may be used if the following general procedure is followed:

1. Attach the handle of a spoon/scoop to a piece of conduit using stainless steel hose clamps.
2. Mobile to the sample location by watercraft; or by accessing the location from a bridge, dock, or by standing on the bank.
3. Unwrap the spoon/scoop and collection bowl; lower the spoon/scoop through the water column and into the sediment.
4. Gently retrieve the sample. Take care to avoid rapid movement through the water column as sediment may be lost during the retrieval.
5. Repeat process until a sufficient volume of soil is collected.
6. Decant water from the collection bowl after sampling is complete.

7. Scan the sample with the photoionization detector (PID) or other air monitoring device as applicable or required by the task/project DQOs.
8. Prepare the sediment sample for laboratory analysis (refer to SWP FSP-1.3, "Preparation of Soils for Environmental Analysis").

2.3 Sediment Core Sampling

An example of a sediment coring device is presented in Exhibit 2. The following general procedure is applicable to sediment sampling using a manual sediment core device:

1. Unwrap a sediment core tube and insert a liner (if required as part of task/project DQOs). If the sediment is anticipated to be uncohesive, install a stainless steel catcher in the nose of the core tube.
2. Attach the core tube to the "T" handle and appropriate length of extension rods.
3. Mobilize to the sample location. If wading, approach the location from the downstream direction.
4. Insert the sediment core tube through the water column and into the sediment for the full length of the tube. If the sediment has hard substrate or has a high gravel content, gently rotate the core tube as it is inserted.
5. Once filled, carefully extract the core tube and return the tube to the surface. Since the core tube is usually subjected to suction forces during extraction, assistance may be required to extract the tube. Use proper lifting techniques. If on a watercraft equipped with a hoist, use the hoist to retrieve the core tube.
6. Once at the surface, discharge the contents of the tube into the collection bowl or remove liner and cap the ends.
7. For sediment in the collection bowl, decant any water to the extent practical and scan with the photoionization detector (PID) or other air monitoring device as required by the task/project DQOs.
8. Prepare the sample for analysis (refer to SWP FSP-1.3, "Preparation of Soils for Environmental Analysis").

Note: Sediment core tubes can be used in deep water (greater than 15 ft deep) with soft sediments by attaching the core tube to nylon rope and allowing the tube to free fall through the water column and into the sediment.

2.4 Dredge Sampling

The following general procedure is applicable to sediment sample collection with dredges [Ponar® Dredge procedure presented here (Exhibits 2 and 3)]:

1. Unwrap the dredge and attach to new rope.
2. Remove the pin that secures the release pin on the dredge. Apply pressure on the release pin to hold it in place by pulling up in the top of the scissor mechanism where the rope connects to the dredge. **CAUTION:** If the pin releases, the dredge will quickly close because of the upward pressure be exerted. The scissor mechanism will pinch fingers if they are in the mechanism (Exhibit 3).
3. Carefully place the dredge, while maintaining pressure on the pin/scissor mechanism, over the edge of the watercraft/bridge/dock and lower through the water column and into the sediment.
4. When the dredge impacts the sediment, the pin releases. Pull up the dredge (which forces it to close) and bring up to the surface.
5. Carefully retrieve dredge, allow water to drain, and discharge contents into the collection bowl.
6. Repeat process until sufficient volume of sediment is collected.
7. Scan with the photoionization detector (PID) or other air monitoring device as required by the task/project DQOs.
8. Prepare the sample for analysis (refer to SWP FSP-1.3, "Preparation of Soils for Environmental Analysis").

3.0 REFERENCES AND GUIDANCE

United States Army Corps of Engineers. 2001. Requirements for the Preparation of Sampling and Analysis Plans. EM 200-1-3. February 1, 2001.

United States Environmental Protection Agency. 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. United States Environmental Protection Agency Region IV. November, 2001.

Exhibit 1. Example Soil/Sediment Sampling Log

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Soil/Sediment Sampling Log

Project ______ Project No ______ Page ____ of ____

Site Location ______ Date ______

Boring No./Sample ID ______ Replicate No. ______ Code No. ______

Weather ______ Sampling Time Begin ______ End ______

Sample Data

Collection Method: ______

Sample Depth: ______ Moisture Content ______

Color ______ Odor ______

Description: ______

Refusal: ______ Driller: ______

Constituents Sampled	Container Description	Number	Preservative

Sampling Personnel: ______

Remarks: ______

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Exhibit 2. Typical Sediment Sampling Devices

Hand Core Sediment Sampler	Ideal Use
	Good for collecting sediment and sludge samples at depth and obtaining an undisturbed sediment core

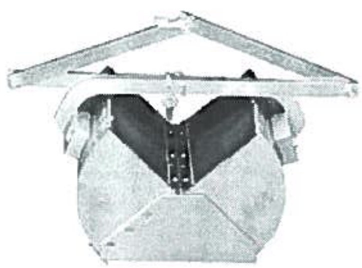
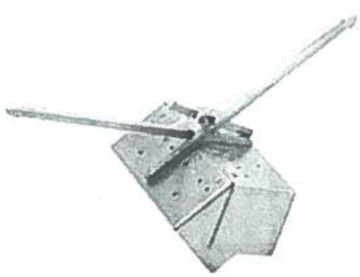
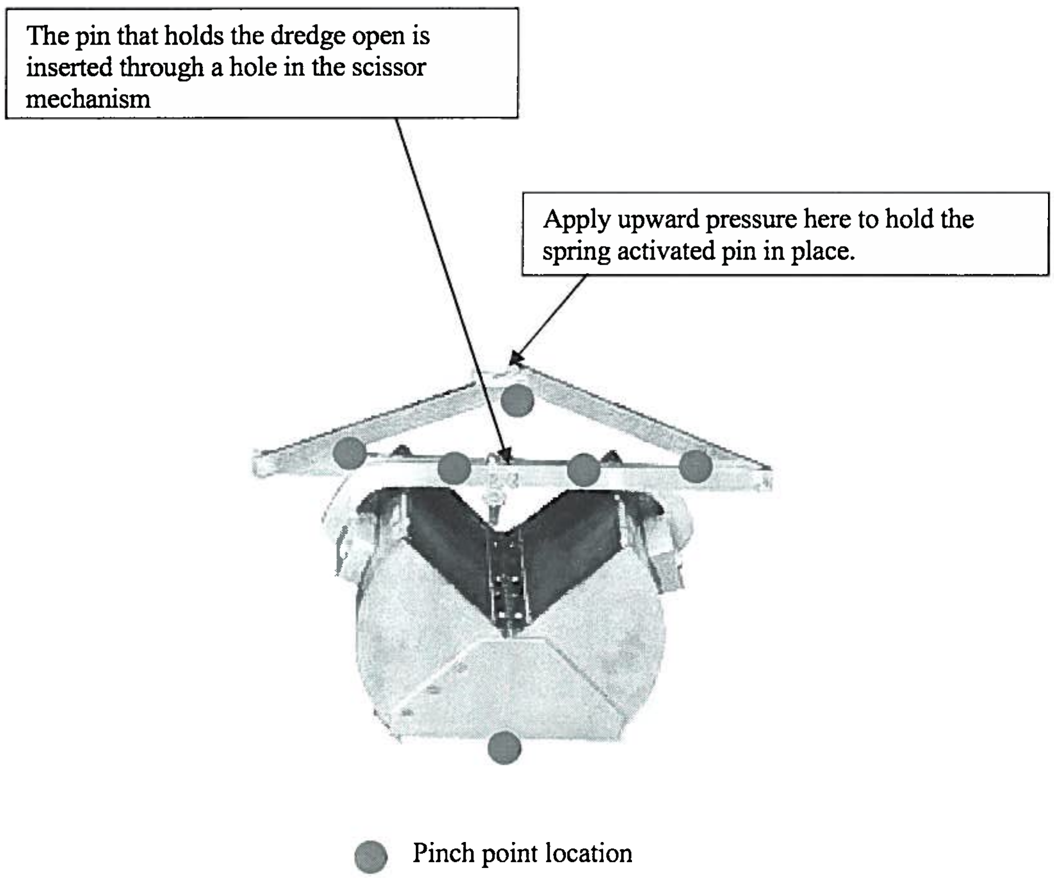
Dredges	Ideal Use
	**Heavyweight Deep Water Dredge** Good for collecting most types of surface sediment through deep water. *Weight 25 pounds*
	**Bottom Sampling Dredge** Lightweight and good for sampling silt and sand sediments. *Weight 4 pounds*

Exhibit 3. The Ponar® Dredge



Refer to SWP HSP-3.15, "Manual Soil, Sediment and Waste Sampling" for additional safety information.

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Field Equipment Decontamination

Rev. #: 3

Rev Date: April 26, 2010

Approval Signatures

Prepared by: ______________________ Date: 4/26/2010
Keith Shepherd

Reviewed by: ______________________ Date: 4/26/2010
Richard Murphy (Technical Expert)

I. Scope and Application

Equipment decontamination is performed to ensure that sampling equipment that contacts a sample, or monitoring equipment that is brought into contact with environmental media to be sampled, is free from analytes of interest and/or constituents that would interfere with laboratory analysis for analytes of interest. Equipment must be cleaned prior to use for sampling or contact with environmental media to be sampled, and prior to shipment or storage. The effectiveness of the decontamination procedure should be verified by collecting and analyzing equipment blank samples.

The equipment cleaning procedures described herein includes pre-field, in the field, and post-field cleaning of sampling tools which will be conducted at an established equipment decontamination area (EDA) on site (as appropriate). Equipment that may require decontamination at a given site includes: soil sampling tools; groundwater, sediment, and surface-water sampling devices; water testing instruments; down-hole instruments; and other activity-specific sampling equipment. Non-disposable equipment will be cleaned before collecting each sample, between sampling events, and prior to leaving the site. Cleaning procedures for sampling equipment will be monitored by collecting equipment blank samples as specified in the applicable work plan or field sampling plan. Dedicated and/or disposable (not to be re-used) sampling equipment will not require decontamination.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, and site-specific training, as needed. In addition, ARCADIS field sampling personnel will be versed in the relevant SOPs and possess the skills and experience necessary to successfully complete the desired fieldwork. The project HASP and other documents will identify any other training requirements such as site specific safety training or access control requirements.

III. Equipment List

- health and safety equipment, as required in the site Health and Safety Plan (HASP)
- distilled water

- Non-phosphate detergent such as Alconox or, if sampling for phosphorus phosphorus-containing compounds, Luminox (or equivalent).
- tap water
- rinsate collection plastic containers
- DOT-approved waste shipping container(s), as specified in the work plan or field sampling plan (if decontamination waste is to be shipped for disposal)
- brushes
- large heavy-duty garbage bags
- spray bottles
- (Optional) – Isoprophyl alcohol (free of ketones) or methanol
- Ziploc-type bags
- plastic sheeting

IV. Cautions

Rinse equipment thoroughly and allow the equipment to dry before re-use or storage to prevent introducing solvent into sample medium. If manual drying of equipment is required, use clean lint-free material to wipe the equipment dry.

Store decontaminated equipment in a clean, dry environment. Do not store near combustion engine exhausts.

If equipment is damaged to the extent that decontamination is uncertain due to cracks or dents, the equipment should not be used and should be discarded or submitted for repair prior to use for sample collection.

A proper shipping determination will be performed by a DOT-trained individual for cleaning materials shipped by ARCADIS.

V. Health and Safety Considerations

Review the material safety data sheets (MSDS) for the cleaning materials used in decontamination. If solvent is used during decontamination, work in a well-ventilated area and stand upwind while applying solvent to equipment. Apply solvent in a manner that minimizes potential for exposure to workers. Follow health and safety procedures outlined in the HASP.

VI. Procedure

A designated area will be established to clean sampling equipment in the field prior to sample collection. Equipment cleaning areas will be set up within or adjacent to the specific work area, but not at a location exposed to combustion engine exhaust. Detergent solutions will be prepared in clean containers for use in equipment decontamination.

Cleaning Sampling Equipment

1. Wash the equipment/pump with potable water.

2. Wash with detergent solution (Alconox, Liquinox or equivalent) to remove all visible particulate matter and any residual oils or grease.

3. If equipment is very dirty, precleaning with a brush and tap water may be necessary.

4. (Optional) – Flush with isopropyl alcohol (free of ketones) or with methanol. This step is optional but should be considered when sampling in highly impacted media such as non-aqueous phase liquids or if equipment blanks from previous sampling events showed the potential for cross contamination of organics.

5. Rinse with distilled/deionized water.

Decontaminating Submersible Pumps

Submersible pumps may be used during well development, groundwater sampling, or other investigative activities. The pumps will be cleaned and flushed before and between uses. This cleaning process will consist of an external detergent solution wash and tap water rinse, a flush of detergent solution through the pump, followed by a flush of potable water through the pump. Flushing will be accomplished by using an appropriate container filled with detergent solution and another contained filled with potable water. The pump will run long enough to effectively flush the pump housing and hose (unless new, disposable hose is used). Caution should be exercised to avoid contact with the pump casing and water in the container while the pump is running (do not use metal drums or garbage cans) to avoid electric shock. Disconnect the pump from the power source before handling. The pump and hose should be placed on or in clean polyethylene sheeting to avoid contact with the ground surface.

VII. Waste Management

Equipment decontamination rinsate will be managed in conjunction with all other waste produced during the field sampling effort. Waste management procedures are outlined in the work plan or Waste Management Plan (WMP).

VIII. Data Recording and Management

Equipment cleaning and decontamination will be noted in the field notebook. Information will include the type of equipment cleaned, the decontamination location and any deviations from this SOP. Specific factors that should be noted include solvent used (if any), and source of water.

Any unusual field conditions should be noted if there is potential to impact the efficiency of the decontamination or subsequent sample collection.

An inventory of the solvents brought on site and used and removed from the site will be maintained in the files. Records will be maintained for any solvents used in decontamination, including lot number and expiration date.

Containers with decontamination fluids will be labeled.

IX. Quality Assurance

Equipment blanks should be collected to verify that the decontamination procedures are effective in minimizing potential for cross contamination. The equipment blank is prepared by pouring deionized water over the clean and dry tools and collecting the deionized water into appropriate sample containers. Equipment blanks should be analyzed for the same set of parameters that are performed on the field samples collected with the equipment that was cleaned. Equipment blanks are collected per equipment set, which represents all of the tools needed to collect a specific sample.

X. References

USEPA Region 9, Field Sampling Guidance #1230, Sampling Equipment Decontamination.

USEPA Region 1, Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.

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Appendix I

Groundwater Sampling Standard Operating Procedures

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GROUNDWATER SAMPLE COLLECTION

Rev. #: 1

Rev Date: 7/8/11

Standard Operating Procedure: Groundwater Sample Collection

I. Introduction

Groundwater samples will be collected using the low-flow (minimal drawdown) technique (Puls and Barcelona 1996) for newly installed monitoring wells. The use of low-flow purging and sampling will minimize the stresses (pressure gradients, drawdown, heating, and turbulence) associated with more conventional purging techniques, reduce mixing of stagnant casing water with formation water, and facilitate the direct withdrawal of groundwater from the formation surrounding the well screen.

No monitoring wells will be sampled until well development has been performed, and sampling will be conducted no sooner than 24 hours following well development. Any synoptic water level measurement events will be completed under static groundwater conditions, prior to the initiation of purging and sampling activities. When one round of water levels is taken to generate water elevation data, the water levels will be taken prior to sampling or other activities.

II. Materials

The following materials, as required, shall be available during groundwater sampling:

- Peristaltic or bladder pump for purging and sampling;
- Sample tubing;
- Power source (i.e., generator);
- Photoionization detector (PID);
- Appropriate health and safety equipment as specified in the Health and Safety Plan (HASP);
- Plastic sheeting (for each sampling location);
- Five-gallon buckets for temporary containment of purge water;
- Dedicated or disposable bailers;
- Field filters (if necessary);
- New disposable polypropylene rope;
- Clear glass or plastic measuring cup graduated in milliliters;
- Buckets to measure purge water;
- Water level probe;

- Portable electronic meter(s) capable of measuring pH, conductivity, temperature, dissolved oxygen (DO), oxidation-reduction potential (ORP), salinity, and/or turbidity;
- Flow-through cell to be used in the measurement of field parameters;
- Appropriate water sample containers;
- Appropriate blanks (trip blank supplied by the laboratory);
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials;
- Groundwater sampling logs;
- Chain-of-custody forms;
- Indelible ink pens;
- Site map with well locations and groundwater contours maps; and
- Keys to wells.

III. Procedures

Monitoring well sampling procedures are as follows:

A. Ensure the appropriate equipment has been acquired.

B. Use safety equipment, as required in the HASP.

C. Prior to sampling any monitoring well, collect depth-to-water and PID headspace screening measurements from all Site monitoring wells as follows:

   1. Measure and record the background PID reading.

   2. Unlock and open the well cover while standing upwind of the well.

   3. Remove and replace rusted or broken well caps and locks as necessary.

   4. Obtain and record depth-to-water and total well depth measurements using an electronic water level indicator (sounder); depths will be measured and recorded to the nearest 0.01 foot.

   5. Clean the water level indicator after each use.

D. Determine a well sampling order, generally from historically least to historically most impacted, or if the wells are being sampled for the first time, use or distance from the source area to gauge the relative levels of impact at the various monitoring wells.

E. Begin purging and sampling activities. Identify the site and well being sampled in the field log, along with date, arrival time, and weather conditions. Identify the personnel and equipment utilized and other pertinent data.

F. Place the plastic sheeting adjacent to the well to use as a clean work area.

G. Set out on plastic sheeting the decontaminated and/or disposable sampling device and meters.

H. Label all sample containers with the following information (at a minimum):

1. Site name;

2. Sample location / ID;

3. Date and time of sampling;

4. Analyses requested;

5. Type of preservative (if any); and

6. Initials of sampling personnel.

I. Pump, safety cable, and tubing will be lowered slowly into the monitoring well to a depth corresponding to the center of the saturated screen section of the well. Any internal combustion power sources should be placed downwind of the monitoring well at a distance sufficient to prevent the migration of engine exhaust into the sampling area.

Measure the water level again with the pump in the monitoring well before starting the pump. Start pumping the well at 200 to 500 milliliters per minute. Ideally, the pump rate should cause little or no water level drawdown in the well. Although a maximum acceptable drawdown of 0.3 foot is commonly used, the acceptable level of drawdown will be determined in the field on a Site-specific and well-specific basis. In general, for wells screened below the water table, drawdown will be acceptable as long as the water level can be stabilized at a constant pumping rate, at a level above the top of the well screen. For wells screened across the water table, drawdown will be acceptable if the water level can be stabilized at a constant pumping rate, at a level above the intake of the pump. The water level should be monitored every 3 to 5 minutes (or as appropriate) during pumping. Care should be taken not to cause pump suction to be broken or entrainment of air in the sample. Record pumping rate adjustments and depths to water. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to minimize drawdown.

If minimal draw down cannot be maintained, water should be purged from the well at the minimum sustainable pumping rate. If the indicator parameters do not stabilize before the water level reaches the pump intake, then purging should be interrupted and the water level allowed to recover before groundwater samples are collected.

J. During monitoring well purging, monitor the field indicator parameters (turbidity, temperature, specific conductance, pH, DO, and ORP every 3 to 5 minutes (or as appropriate) using a portable electronic meter(s). The well is considered stabilized and ready for sample collection as soon as the indicator parameters meeting the following criteria for three consecutive readings (taken over a minimum period of 15 minutes):

   1. pH measurements remain stable within 0.1 standard unit;
   2. Specific conductivity varies by no more than 3 percent;
   3. ORP remains stable within 10 millivolts;
   4. DO varies no more than 10 percent; and
   5. A constant non-turbid discharge (<10 nephelometric turbidity units) is achieved, or turbidity over three consecutive readings varies no more than 10 percent.

   Measurements for DO and ORP must be obtained using a flow-through cell; however, other parameters may be taken in a clean container such as a glass beaker if individual meters are being used to obtain the field parameter measurements.

K. When conventional volumetric purging is used, an attempt should be made to purge at least three but no greater than five well volumes of water prior to sampling. Monitoring of field parameters should be conducted at a frequency of at least one measurement per well volume. If three well volumes cannot be removed before the water level reaches the pump intake, then the purging should be interrupted and the well water level allowed to recover (at least 75 percent) prior to sample collection. Sampling should be conducted as soon as possible (no longer than 24 hours) after cessation of purging.

L. After purging has been completed, obtain the groundwater sample needed for analysis directly from the sampling device in the appropriate container and tightly screw on the caps. If samples are to be field-filtered, connect field-filter sampling device. Allow approximately three sample volumes to flow through the filter before collecting the groundwater sample.

M. Make sure that all samples are labeled as indicated in the Field Sampling Plan. Secure the samples with packing material and store at 4 degrees Celsius on wet ice in an insulated transport container provided by the laboratory.

N. After all sampling containers have been filled, collect an additional, post-sampling set of field parameter measurements, and record these measurements along with the color, appearance, and odor of the sample on the field log.

O. Record the time sampling procedures were completed on the field logs.

P. Place all disposable sampling materials (plastic sheeting, disposable bailers, and health and safety equipment) in appropriately labeled containers. Go to the next well and repeat Step E through Step P until all wells are sampled.

Q. Complete the procedures for packaging, shipping, and handling with associated chain-of-custody forms.

IV. References

Puls, R.W., and M.J. Barcelona. 1996. Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures, EPA/540/S-95/504.

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Field Equipment Decontamination

Rev. #: 3

Rev Date: April 26, 2010

Approval Signatures

Prepared by: ______________________ Date: 4/26/2010
Keith Shepherd

Reviewed by: ______________________ Date: 4/26/2010
Richard Murphy (Technical Expert)

I. Scope and Application

Equipment decontamination is performed to ensure that sampling equipment that contacts a sample, or monitoring equipment that is brought into contact with environmental media to be sampled, is free from analytes of interest and/or constituents that would interfere with laboratory analysis for analytes of interest. Equipment must be cleaned prior to use for sampling or contact with environmental media to be sampled, and prior to shipment or storage. The effectiveness of the decontamination procedure should be verified by collecting and analyzing equipment blank samples.

The equipment cleaning procedures described herein includes pre-field, in the field, and post-field cleaning of sampling tools which will be conducted at an established equipment decontamination area (EDA) on site (as appropriate). Equipment that may require decontamination at a given site includes: soil sampling tools; groundwater, sediment, and surface-water sampling devices; water testing instruments; down-hole instruments; and other activity-specific sampling equipment. Non-disposable equipment will be cleaned before collecting each sample, between sampling events, and prior to leaving the site. Cleaning procedures for sampling equipment will be monitored by collecting equipment blank samples as specified in the applicable work plan or field sampling plan. Dedicated and/or disposable (not to be re-used) sampling equipment will not require decontamination.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, and site-specific training, as needed. In addition, ARCADIS field sampling personnel will be versed in the relevant SOPs and possess the skills and experience necessary to successfully complete the desired fieldwork. The project HASP and other documents will identify any other training requirements such as site specific safety training or access control requirements.

III. Equipment List

- health and safety equipment, as required in the site Health and Safety Plan (HASP)
- distilled water

- Non-phosphate detergent such as Alconox or, if sampling for phosphorus phosphorus-containing compounds, Luminox (or equivalent).
- tap water
- rinsate collection plastic containers
- DOT-approved waste shipping container(s), as specified in the work plan or field sampling plan (if decontamination waste is to be shipped for disposal)
- brushes
- large heavy-duty garbage bags
- spray bottles
- (Optional) – Isoprophyl alcohol (free of ketones) or methanol
- Ziploc-type bags
- plastic sheeting

IV. Cautions

Rinse equipment thoroughly and allow the equipment to dry before re-use or storage to prevent introducing solvent into sample medium. If manual drying of equipment is required, use clean lint-free material to wipe the equipment dry.

Store decontaminated equipment in a clean, dry environment. Do not store near combustion engine exhausts.

If equipment is damaged to the extent that decontamination is uncertain due to cracks or dents, the equipment should not be used and should be discarded or submitted for repair prior to use for sample collection.

A proper shipping determination will be performed by a DOT-trained individual for cleaning materials shipped by ARCADIS.

V. Health and Safety Considerations

Review the material safety data sheets (MSDS) for the cleaning materials used in decontamination. If solvent is used during decontamination, work in a well-ventilated area and stand upwind while applying solvent to equipment. Apply solvent in a manner that minimizes potential for exposure to workers. Follow health and safety procedures outlined in the HASP.

VI. Procedure

A designated area will be established to clean sampling equipment in the field prior to sample collection. Equipment cleaning areas will be set up within or adjacent to the specific work area, but not at a location exposed to combustion engine exhaust. Detergent solutions will be prepared in clean containers for use in equipment decontamination.

Cleaning Sampling Equipment

1. Wash the equipment/pump with potable water.

2. Wash with detergent solution (Alconox, Liquinox or equivalent) to remove all visible particulate matter and any residual oils or grease.

3. If equipment is very dirty, precleaning with a brush and tap water may be necessary.

4. (Optional) – Flush with isopropyl alcohol (free of ketones) or with methanol. This step is optional but should be considered when sampling in highly impacted media such as non-aqueous phase liquids or if equipment blanks from previous sampling events showed the potential for cross contamination of organics.

5. Rinse with distilled/deionized water.

Decontaminating Submersible Pumps

Submersible pumps may be used during well development, groundwater sampling, or other investigative activities. The pumps will be cleaned and flushed before and between uses. This cleaning process will consist of an external detergent solution wash and tap water rinse, a flush of detergent solution through the pump, followed by a flush of potable water through the pump. Flushing will be accomplished by using an appropriate container filled with detergent solution and another contained filled with potable water. The pump will run long enough to effectively flush the pump housing and hose (unless new, disposable hose is used). Caution should be exercised to avoid contact with the pump casing and water in the container while the pump is running (do not use metal drums or garbage cans) to avoid electric shock. Disconnect the pump from the power source before handling. The pump and hose should be placed on or in clean polyethylene sheeting to avoid contact with the ground surface.

VII. Waste Management

Equipment decontamination rinsate will be managed in conjunction with all other waste produced during the field sampling effort. Waste management procedures are outlined in the work plan or Waste Management Plan (WMP).

VIII. Data Recording and Management

Equipment cleaning and decontamination will be noted in the field notebook. Information will include the type of equipment cleaned, the decontamination location and any deviations from this SOP. Specific factors that should be noted include solvent used (if any), and source of water.

Any unusual field conditions should be noted if there is potential to impact the efficiency of the decontamination or subsequent sample collection.

An inventory of the solvents brought on site and used and removed from the site will be maintained in the files. Records will be maintained for any solvents used in decontamination, including lot number and expiration date.

Containers with decontamination fluids will be labeled.

IX. Quality Assurance

Equipment blanks should be collected to verify that the decontamination procedures are effective in minimizing potential for cross contamination. The equipment blank is prepared by pouring deionized water over the clean and dry tools and collecting the deionized water into appropriate sample containers. Equipment blanks should be analyzed for the same set of parameters that are performed on the field samples collected with the equipment that was cleaned. Equipment blanks are collected per equipment set, which represents all of the tools needed to collect a specific sample.

X. References

USEPA Region 9, Field Sampling Guidance #1230, Sampling Equipment Decontamination.

USEPA Region 1, Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.

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Appendix J

Monitor Well Installation Standard Operating Procedures

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MONITOR WELL INSTALLATION PROCEDURES

Rev. #: 1

Rev Date: 7/8/11

Pre-packed Screen Monitoring Well Installation Procedures

Prior to commencing work, all underground utilities will be located by the Mississippi One Call Center, by field personnel with appropriate devices, and/or by a private utility locator. Also, consistent with ARCADIS subsurface drilling policies, soil probing will be attempted to feet below ground surface at or adjacent to the intended locations where drilling/soil borings will take place.

Direct-push drilling is the preferred technique for subsurface sampling because it minimizes the generation of soil cuttings and the introduction of foreign fluids into the probehole. Direct-push techniques are also known to cause less disturbance to the natural formations. A pre-packed screen is an assembly consisting of an inner slotted screen surrounded by a wire mesh sleeve that acts as a support for filter media. Because the filter media is placed around the screen at the surface, pre-packed screens allow more control over the filter pack grain size and eliminate bridging of the filter media. Use of pre-packed screens may make it possible to use finer grained filter pack sand than is used for conventional well filter pack, providing less turbid samples.

I. Temporary Monitoring Well Installation using Pre-Packed Screens

The prepacked screens are constructed in 3- to 5-foot length sections, which have an outside diameter of about 1.5 to 2.0 inches and an inside diameter of 0.75 to 1.0 inch. The screen length will be determined in the field, but will not exceed 10 feet in length. The inner component of the prepacked screens consists of a flush-threaded, 0.5-inch Schedule 40 polyvinyl chloride (PVC) with 0.01-inch slots. The outer component of the screen is stainless steel wire mesh with a pore size of 0.011 inch. The space between the inner slotted pipe and outer wire mesh is filled with 20/40 silica sand.

The specific procedure for installing direct-push pre-packed screen monitoring wells is as follows. Equivalent pre-packed screen materials can also be used.

- The installation begins by advancing a 2.25-inch outside diameter probe rods to depth with a direct-push machine.

- Pre-packed screens are then assembled and installed through the 1.5-inch inside diameter of the probe rods using corresponding 0.75-inch Schedule 40 PVC riser.

- The pre-pack tool string is attached to an expendable anchor point with a locking connector that is threaded to the bottom of the leading screen. Once the connector is locked onto the anchor point, the rod string is slowly retracted until the lower end of the rods is approximately 3 feet above the top prepack. A threaded bottom plug with an expendable point is another way to set the well.

- A minimum 2-foot sand barrier will be installed above the top prepack to avoid contaminating the well screens with bentonite or cement during installation (if the wells are converted to permanent wells). If the formation is stable and does not collapse around the riser as the rod string is retracted, environmental grade 20/40 mesh sand may be installed through the probe rods to provide the minimum 2-foot barrier.

Groundwater samples can be collected with a check valve assembly (with 3/8-inch outside diameter poly tubing), a stainless steel mini-bailer assembly, or a peristaltic pump when appropriate. Groundwater samples collected using pre-packed screens should be considered screening-level data, suitable for obtaining a general understanding of groundwater quality.

II. Conversion of Temporary to Permanent Monitoring Wells

The following steps may be followed to convert a temporary well to a permanent well:

- Granular bentonite or bentonite slurry will be installed in the annulus to form a well seal. A high-pressure grout pump may be used as a tremie cement/bentonite slurry to fill the well annulus.

- The grout mixture should be installed with a tremie tube from the bottom up to accomplish a tight seal without voids.

- These wells will be allowed to equilibrate overnight and groundwater measurements will be collected to determine groundwater flow direction.

Wells will be completed with a flush-mount (curb box) cover when installed in areas exposed to vehicle access or in residential areas. In areas not exposed to vehicle access, a vented protective steel casing will be located over the riser casing extending at least 1.5 feet below grade and 2 to 3 feet above grade secured by a neat concrete seal. The concrete seal will be flush with the ground surface and will extend approximately 1.5 feet below grade and laterally at least 1 foot in all directions from the protective casing and will slope gently to drain water away from the well. Monitoring wells will be labeled with the appropriate designation both on the inner and outer well casings.

The supervising geologist will specify the monitoring well designs to the drilling contractor before installation.

The supervising geologist is responsible for recording the exact construction details as relayed by the drilling contractor and actual measurements. Both the supervising geologist and drilling contractor are responsible for tabulating all materials used, such as casing footage and screen or bags of bentonite, cement, and sand.

III. Conversion of Temporary to Double-Cased Permanent Monitoring Wells

Double-cased monitoring wells will be installed to assess groundwater where the borings penetrate soil and/or groundwater zones potentially containing elevated levels of constituents of interest. An outer casing will be used to minimize the potential for the drilling process to draw or carry contamination down. Hollow-stem auger drilling methods or a direct push drill rig with the ability to advance a longer isolation casing will be used to install the wells.

The specific procedure for installing double-cased direct push monitoring wells is as follows. Equivalent direct-push techniques can also be used.

- The borehole for the outer casing will be advanced with a large-diameter hollow-stem auger or direct-push device to the required depth. Soil will be continuously sampled using a 2-inch diameter split-spoon sampler and visually classified by the supervising scientist.

- Then, a large-diameter PVC outer casing will be installed through the hollow-stem augers or direct-push device. To complete the installation, the outer casing will be hydraulically pushed approximately 1 foot beyond the bottom of the boring. The annular space of the borehole will then be filled with a cement/bentonite grout mixture using a tremie pipe installed to the bottom of the borehole.

- The cement/bentonite grout in the annulus will be allowed to cure for at least 24 hours before the boring is advanced.

- After the grout has cured for a minimum of 24 hours, the boring will be advanced through the outer casing using a smaller-diameter hollow-stem auger or direct-push device to the required depth.

- During advancement of the boring, soil will be continuously sampled with a 2-inch diameter split-spoon sampler, or 4-foot Macrocore sampler, and will be visually classified by the supervising scientist.

The direct-push well will be installed in accordance with the procedures described in Section I.

Wells will be completed with a flush-mount (curb box) cover when installed in areas exposed to vehicle access or in residential areas. In areas not exposed to vehicle access, a vented protective steel casing will be located over the riser casing extending at least 1.5 feet below grade and 2 to 3 feet above grade secured by a neat concrete seal. The concrete seal will be flush with the ground surface and will extend approximately 1.5 feet below grade and laterally at least 1 foot in all directions from the protective casing and will slope gently to drain water away from the well. Monitoring wells will be labeled with the appropriate designation on the outer well casing.

The supervising geologist will specify the monitoring well designs to the drilling contractor before installation.

The supervising geologist is responsible for recording the exact construction details as relayed by the drilling contractor and actual measurements. Both the supervising geologist and drilling contractor are responsible for tabulating all materials used, such as casing footage and screen or bags of bentonite, cement, and sand.

IV. Development

Development will not be performed within 24 hours of the monitoring well installation. Development will be accomplished by surging and evacuating water by slow pumping. As an alternative to surging and pumping, shallow overburden wells may be developed by using a new, disposable hand bailer to entrain the water and fine-grained solids in and around the well screen and remove these materials. Each well will be developed until turbidity is reduced to 10 nephelometric turbidity units (NTUs) or less. In the event that the wells cannot be developed to 10 NTUs, development will proceed until three consecutive measurements of pH, conductivity, and temperature (taken at 5-minute intervals) agree within 10 percent.

Materials for well development include:

- Appropriate health and safety equipment;
- Appropriate cleaning equipment;
- Bottom-loading bailer;
- Polypropylene rope;
- Plastic sheeting;
- pH, conductivity, and temperature meters;
- Nephelometric turbidity meter;

- Graduated buckets;
- Disposable gloves;
- Drums to collect purge fluids;
- Pump/tubing/foot valve/surge block; and
- Generator.

The procedure for developing a well using the pumping method is outlined below:

When developing a well using the pumping method, new cleaned polypropylene tubing equipped with a foot valve and surge block will be extended to the screened portion of the well. The diameter of the surge block will be within 0.5 inch of the well diameter. The tubing will be connected to a hydrolift-type pumping system that allows up and down movement of the surge block. The tubing will also be manually lifted and lowered within the screened interval. The pumping rate will be about two times the anticipated well purging rate. Surging will be repeated as many times as necessary within the well screen interval until the groundwater is relatively clear. Any tubing will be disposed of between wells; clean, new tubing will be used at each well.

Detailed procedures for groundwater well development are as follows:

1. Use appropriate safety equipment.
2. All equipment entering each monitoring well will be cleaned as specified in Attachment 10.
3. Attach appropriate pump and lower tubing into well.
4. Tum on pump. If well runs dry, shut off pump and allow to recover.
5. Surging by raising and lowering the tubing in the well will be performed several times to pull in fine-grained materials.
6. Steps 4 and 5 will be repeated until groundwater is relatively silt free.
7. Step 6 will be repeated until entire well screen has been developed.

V. Survey

A field survey control program will be conducted using standard instrument survey techniques to document the well location, as well as the ground, inner casing, and outer casing elevations, to the North American Vertical Datum of 1988.

VI. Equipment Cleaning

Downhole equipment will be cleaned with high-pressure steam cleaning equipment using a tap water source. Downhole equipment will be cleaned prior to use on the Site, between each monitoring well location, and at the completion of the drilling prior to leaving the Site as discussed in Attachment 12.

Traditional Groundwater Monitoring Well Installation and Development Procedures

Prior to commencing work, all underground utilities will be located by the Mississippi One Call Center, by field personnel with appropriate devices, and/or by a private utility locator. Also, consistent with best management practices, soil probing will be attempted to 5 feet below ground surface at or adjacent to the intended locations where drilling/soil borings will take place.

I. Monitoring Wells in Overburden

Monitoring wells will be installed by placing the screen and casing assembly with bottom cap into the auger string once the screen interval has been selected. At that time, a washed silica sand pack will be placed in the annular space opposite the screen to 1 to 2 feet above the top of the screen. A graded filter sand pack appropriate to the size of the screened soil interval will be used. The upper 0.5 foot of the sand pack will consist of #00 morie sand to impede bentonite infiltrating into the sand pack. Hydrated bentonite will be added to the annulus between the casing and the borehole wall for at least 2 feet. A cement/bentonite grout will then be added above the bentonite during the extraction of the augers to ground surface. For each 94-pound bag of cement, 6 to 7 gallons of water and approximately 7 pounds of granular or powdered bentonite will be added to make the grout mixture. During placement of sand and bentonite, frequent measurements will be made to check the height of the sand pack and thickness of bentonite by a weighted tape measure.

Monitoring wells will be constructed of 2-inch polyvinyl chloride well screen and riser. The well screen will be installed from approximately 2 feet above the water table to just above the anticipated aquitard depth with a maximum screen length of 15 feet. During advancement of the boring, soil will be continuously sampled with a 2-inch diameter split-spoon sampler, or 4-foot Macrocore sampler, and will be visually classified by the supervising scientist.

Wells will be completed with a flush-mount (curb box) cover when installed in areas exposed to vehicle access or in residential areas. In areas not exposed to vehicle access, a vented protective steel casing will be located over the riser casing extending at least 1.5 feet below grade and 2 to 3 feet above grade secured by a neat concrete seal. The concrete seal will be flush with the ground surface and will extend approximately 1.5 feet below grade and laterally at least 1 foot in all directions from the protective casing and will slope gently to drain water away from the well. Monitoring wells will be labeled with the appropriate designation both on the inner and outer well casings. A typical overburden monitoring well detail is shown on Figures 5-1 and 5-2.

The supervising geologist will specify the monitoring well designs to the drilling contractor before installation.

The supervising geologist is responsible for recording the exact construction details as relayed by the drilling contractor and actual measurements. Both the supervising geologist and drilling contractor are responsible for tabulating all materials used, such as casing footage and screen or bags of bentonite, cement, and sand.

II. Development

All monitoring wells will be developed of fine-grained materials that may have collected in the sand filter pack placed around the screen during installation. Development will not be performed within 24 hours of the monitoring well installation of protective casing and concrete pad. Development will be accomplished by surging and evacuating water by slow pumping. As an alternative to surging and pumping, shallow overburden wells may be developed by using a new, disposable hand bailer to entrain the water and fine-grained solids in and around the well screen and remove these materials. Each well will be developed until turbidity is reduced to 10 nephelometric turbidity units (NTUs) or less. In the event that the wells cannot be developed to 10 NTUs, development will proceed until three consecutive measurements of pH, conductivity, and temperature (taken at 5-minute intervals) agree within 10 percent.

Materials for well development include:

- Appropriate health and safety equipment;
- Appropriate cleaning equipment;
- Bottom-loading bailer;
- Polypropylene rope;
- Plastic sheeting;
- pH, conductivity, and temperature meters;
- Nephelometric turbidity meter;
- Graduated buckets;
- Disposable gloves;
- Drums to collect purge fluids;
- Pump/tubing/foot valve/surge block; and
- Generator.

The procedure for developing a well using the pumping method is outlined below:

When developing a well using the pumping method, new cleaned polypropylene tubing equipped with a foot valve and surge block will be extended to the screened portion of the well. The diameter of the surge block will be within 0.5 inch of the well diameter. The tubing will be connected to a hydrolift-type pumping system that allows up and down movement of the surge block. The tubing will also be manually lifted and lowered within the screened interval. The pumping rate will be about two times the anticipated well purging rate. Surging will be repeated as many times as necessary within the well screen interval until the groundwater is relatively clear. Any tubing will be disposed of between wells; clean, new tubing will be used at each well.

Detailed procedures for groundwater well development are as follows:

1. Use appropriate safety equipment.

2. All equipment entering each monitoring well will be cleaned as specified in Attachment 12.

3. Attach appropriate pump and lower tubing into well.

4. Turn on pump. If well runs dry, shut off pump and allow to recover.

5. Surging by raising and lowering the tubing in the well will be performed several times to pull in fine-grained materials.

6. Steps 4 and 5 will be repeated until groundwater is relatively silt free.

7. Step 6 will be repeated until entire well screen has been developed.

ARCADIS

Appendix K

Soil Gas, Indoor Air, and Ambient Air Standard Operating Procedures

ARCADIS

Infrastructure, environment, buildings

Imagine the result

Sub-Slab Soil-Gas Sampling Using Method TO-15 – Temporary Probe Approach

SOP # 427199

Rev. #: 4

Rev Date: July 8, 2010

Approval Signatures

Prepared by: ______________________ Date: 07/08/2010
Mitch Wacksman and Andrew Gutherz

Approved by: ______________________ Date: 07/08/2010
Christopher Lutes and Nadine Weinberg

I. Scope and Application

This document describes the procedures for installing temporary sub-slab sampling probes and collect sub-slab soil gas samples for the analysis of volatile organic compounds (VOCs) by United States Environmental Protection Agency (USEPA) Method TO-15. Method TO-15 uses a 1-liter, 3-liter, or 6-liter SUMMA® passivated stainless steel canister. An evacuated 6-liter SUMMA canister (less than 28 inches of mercury [Hg]) will provide a recoverable whole-gas sample of approximately 5 liters when allowed to fill to a vacuum of 5 inches of Hg. The whole-air sample is then analyzed for VOCs using a quadrupole or ion-trap gas chromatograph/mass spectrometer (GC/MS) system to provide compound detection limits of 0.5 parts per billion volume (ppbv).

These procedures are not recommended if the probe is to be sampled more than once. Under those conditions refer to ARCADIS SOP for permanent sub-slab soil gas installations. The following sections list the necessary equipment and detailed instructions for installing temporary sub-slab soil gas probes and collecting soil-gas samples for VOC analysis.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety training, including 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training. Site supervisor training, site-specific training, first-aid, and cardiopulmonary resuscitation (CPR) may be appropriate at some sites. ARCADIS field sampling personnel will be well versed in the relevant SOPs and possess the required skills and experience necessary to successfully complete the desired field work. ARCADIS personnel responsible for leading sub-slab soil-gas sample collection activities must have previous sub-slab soil-gas sampling experience.

III. Health and Safety Considerations

All sampling personnel should review the appropriate health and safety plan (HASP) and job loss analysis (JLA) prior to beginning work to be aware of all potential hazards associated with the job site and the specific task. Field sampling must be carefully conducted to minimize the potential for injury and the spread of hazardous substances. For sub-slab vapor probe installation, drilling with an electric concrete impact drill should be done only by personnel with prior experience using such a piece of equipment and with the appropriate health and safety measures in place as presented in the JLA. It is possible to encounter high concentrations of VOCs in sub-slab soil gas, so the amount of time the borehole remains open should be minimized. For the same reason, when installing sub-slab probes in spaces with minimal dilution potential, such as closets, it is advisable to provide local ventilation. Finally, sub-slab probe installation should be completed 24 hours in advance or after any indoor air sampling to avoid cross contamination of the indoor air samples.

IV. Equipment List

The equipment required to install a temporary sub-slab vapor probe is presented below. Modifications to account for project- or regulatory-specific requirements should be noted in the accompanying work plan:

- Appropriate personal protective equipment (PPE; as required by the HASP and the JLA);
- Hammer drill (Hilti, Bosch Hammer, or equilivant);
- 1/2 inch-diameter concrete drill bit (drill bit length contingent on slab thickness);
- Hand tools including open-end wrench (typically 9/16-inch), pliers, channel lock pliers, etc;
- 1/4-inch OD tubing (Teflon, nylon, or Teflon-lined); Note that Nylaflow tubing has a somewhat higher background level of BTEX and much poorer recovery of tirchlorobenzene and naphthalene then Teflon, so should not be used on sites where these compounds are a concern (Hayes, 2006).
- Teflon® tape;
- Work gloves;
- Nitrle gloves;
- Hydrated bentonite, VOC-free modeling clay that complies with ASTM D4236 (McMaster Carr 6102T11 recommended) or wax to seal drill hole (see cautions section);
- Whisk broom and dust pan;
- Bottle brush;
- Ground fault circuit interrupter (GFCI);
- Extension cords rated for amperage required for hammer drill;
- Plastic sheeting; and

- Shop vacuum with clean fine-particle filter.

The equipment required for sub-slab soil gas sample collection is presented below:

- 1, 3, or 6-liter stainless steel SUMMA® canisters (order at least one extra, if feasible) (batch certified canisters or individual certified canisters as required by the project) ;
- Flow controllers with in-line particulate filters and vacuum gauges; flow controllers are pre-calibrated to specified sample duration (e.g., 30 minutes, 8 hours, 24 hours) or flow rate (e.g., 200 milliliters per minute [mL/min]); confirm with the laboratory that the flow controller comes with an in-line particulate filter and pressure gauge (order at least one extra, if feasible);
- Extra 1/4-inch Swagelok front and back compression sleeves;
- Swage-Lok fittings;
- Decontaminated stainless steel Swagelok or comparable "T" fitting and needle valve for isolation of purge pump;
- Two 3-inch lengths of 1/4-inch OD Teflon tubing;
- Stainless steel duplicate "T" fitting provided by the laboratory (if collecting duplicate [i.e., split] samples);
- Portable vacuum pump capable of producing very low flow rates (e.g., 100 to 200 milliliters per minute [mL/min]); vacuum pump should also be equipped with a vacuum gauge;
- Rotameter or an electric flow sensor if vacuum pump does not have and accurate flow gauge;
- Tracer gas testing supplies if applicable (refer to SOP "Adminstering Tracer Gas" #416199);
- Appropriate-sized open-end wrench (typically 9/16-inch and1/2");

- Photo Ionization Detector (PID) with a lamp of 11.7 eV; detectable to ppb range (optional);
- Tedlar bag to collect purge air;
- Portable weather meter, if appropriate (temperature, barometric pressure, humidity, etc);
- Quick setting grout or sika flex to seal abandoned holes;
- Chain-of-custody (COC) form;
- Sample collection log (attached); and
- Field notebook.

V. Cautions

The following cautions and field tips should be reviewed and considered prior to installing or collecting a sub-slab soil gas sample.

- When drilling sample collection holes be mindful of utilities that may be in the area. Always complete utility location, identification and marking before installing subslab ports as required by the ARCADIS Utility Location Policy and Procedure. Be aware that public utility locator organizations frequently do not provide location information within buildings so alternative lines of evidence must be used. If the driller is concerned about a particular location, consult the project manager about moving it to another location. Don't be hesitant to use your Stop Work Authority, if something doesn't seem right stop and remedy the situation.
- Sampling personnel should not handle hazardous substances (such as gasoline), permanent marking pens, wear/apply fragrances, or smoke cigarettes/cigars before and/or during the sampling event.
- Ensure that the flow controller is pre-calibrated to the proper sample collection duration (confirm with laboratory). Sample integrity can be compromised if sample collection is extended to the point that the canister reaches atmospheric pressure. Sample integrity is maintained if sample collection is terminated prior to the target duration and a measurable vacuum (e.g., 3–7 inches Hg) remains in the canister when sample collection is terminated. Do not let sample canister reach atmospheric pressure (e.g., 0-inches Hg).

- Field personnel will properly seal the vapor probe at the slab surface to prevent leaks of atmosphere into the soil vapor probe during purging and sampling. Temporary points should be fit snug into the pre-drilled hole using Teflon® tape or modeling clay and sealed with hydrated bentonite, clay or wax at the surface. If this is not done properly, the integrity of the sample port may be compromised.

- Modeling clay or other materials used to seal the hole should only be obtained from an approved ARCADIS source and should not be purchased off the shelf from an unapproved retail source. Data indicate that some modeling clays may contain VOCs that can affect sample results.

- It is important to record the canister pressure, start and stop times and sample identification on a proper field sampling form. Often Summa canisters are collected over a 24 hour period. The time/pressure should be recorded at the start of sampling, and then again one or two hours later. It is a good practice to lightly tap the pressure gauge with your finger before reading it to make sure it isn't stuck. If the canister is running correctly for a 24 hour period then the vacuum will have decreased slightly after an hour or two (for example from 29" to 27"). Consult your project manager (PM), risk assessor or air sampling expert by phone if the Summa canister does not appear to be working properly.

- Ensure that there is still measureable vacuum in the Summa after sampling. Sometimes the gauges sent from the lab have offset errors, or they stick.

- When sampling carefully consider elevation. If your site is over 2,000' above sea level or the difference in elevation between your site and your lab is more than 2,000' then pressure effects will be significant. If you take your samples at a high elevation they will contain less air for a given ending pressure reading. High elevation samples analyzed at low elevation will result in more dilution at the lab, which could affect reporting limits. Conversely low elevation samples when received at high elevation may appear to not have much vacuum left in them http://www.uigi.com/Atmos_pressure.html.

- If possible, have equipment shipped two to three days before the scheduled start of the sampling event so that all materials can be checked. Order replacements if needed.

- Requesting extra canisters from the laboratory should also be considered to ensure that you have enough equipment on site in case of an equipment failure.

- Check the seal around the soil-gas sampling port by using a tracer gas (e.g., helium) or other method established in the appropriate guidance document.

VI. Procedure

Temporary sub-slab soil vapor probes are installed using equipment and procedures that allows the point to be installed quickly and abandoned after an initial sample is collected. These procedures are not recommended if the probe is to be sampled more than once. Under those conditions refer to ARCADIS SOP for permanent sub-slab soil gas installations.

Sub-slab Soil Gas Point Installation

1. Complete the ARCADIS Utility Locate SOP prior to drilling activities.

2. Remove, only to the extent necessary, any covering on top of the slab (e.g., carpet).

3. Lay down plastic sheeting to keep the work area clean. Check to make sure shop vacuum is working properly and fine concrete particles will not pass through filter

4. Drill a 1/2-inch-diameter hole into the concrete slab using the electric drill. Do not fully penetrate the slab at this time. Stop drilling approximately 1 inch short of penetrating the slab.

5. Use the shop vacuum, bottle brush and dust broom to clean up the work area and material that may have fallen into and around the drill hole..

6. Advance the 1/2-inch drill bit the remaining thickness of the slab and approximately 3 inches into the sub-slab material to create an open cavity. Note (if possible) from the drill cuttings any evidence for the types of materials in the immediate sub-slab – i.e. moisture barriers, sand, gravel, shrinkage gap?

7. Use the bottle brush, whisk broom, and dust pan to quickly clean material around and within the hole. The hole should not be left open for any extended length of time to ensure that VOCs below the slab do not migrate into indoor air. Do not use the shop vacuum to clean up the drill hole after the full thickness of the slab has been penetrated.

8. Re-drill the 1/2 – inch hole to ensure it remains clear. This can also be accomplished using a piece of steel rod, sample tubing, or even a piece of heavy wire (coat hanger).

9. Wrap the tubing with Teflon® tape or modeling clay, to the extent necessary, for a snug fit of tubing and hole.

10. Insert the tubing approximately 2 to 3 inches into the slab; tubing should not contact material beneath the slab. Tubing should be capped with clay or other fitting so it does not provide a pathway for vapor movement.

11. Prepare a hydrated bentonite mixture and apply bentonite at slab surface around the tubing. Instead of hydrated bentonite, either VOC free modeling clay (McMaster-Carr #6102T11) or wax may be used for the temporary seal around the tubing where it enters the slab.

12. Proceed to soil gas sample collection after waiting a minimum of 1 hour for equilibration following probe installation.

Sub-Slab Soil Gas Sample Collection

Once the temporary sample probe is installed, the following procedure should be used to collect the sample in the Summa canister.

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

   a. wind speed and direction;

   b. ambient temperature;

   c. barometric pressure; and

   d. relative humidity.

2. Assemble the sample train by removing the cap from the SUMMA canister and connecting the Swagelok T-fitting to the can using a short length of 1/4-inch OD Teflon tubing. The flow controller with in-line particulate filter and vacuum gauge is then attached to the T-fitting. The Swagelok (or similar) two-way valve is connected to the free end of the T-fitting using a short length of ¼-inch OD Teflon tubing.

3. When collecting duplicate or other quality assurance/quality control (QA/QC) samples as required by applicable regulations and guidance, couple two SUMMA canisters using stainless steel Swagelok duplicate sample T-fitting supplied by the laboratory. Attach flow controller with in-line particulate filter and vacuum gauge to duplicate sample T-fitting provided by the laboratory.

4. Perform a leak-down-test by replacing the nut which secures sample tubing with the cap from the canister. This will create a closed system. Open the canister valve and quickly close it; the vacuum should increase approaching 30" Hg. If there are no leaks in the system this vacuum should be held. If vacuum holds proceed with sample collection; if not attempt to rectify the situation by tightening fittings.

5. Attach Teflon sample tubing from the temporary probe to the flow controller using Swagelok fittings.

6. Connect the two-way valve and the portable purge pump using a length of Teflon sample tubing.

7. Record on the sample log and COC form the flow controller number with the appropriate SUMMA® canister number.

8. If appropriate, the seal around the soil-gas sampling port and the numerous connections comprising the sampling train will be evaluated for leaks using helium as a tracer gas. The helium tracer gas will be administered according to the methods established in the appropriate guidance documents and SOP: Administering Helium Tracer Gas.

9. Open the two-way valve and purge the soil-gas sampling port and tubing with the portable sampling pump. Purge approximately three volumes of air from the soil-gas sampling port and sampling line using a flow rate of 200 mL/min or less. Purge volume is calculated by the following equation "purge volume = 3 x Pi x inner radius of tubing^2 x length of tubing. Purge air will be collected into a Tedlar bag to provide that VOCs are not released into interior spaces. Measure organic vapor levels and tracer gas within the Tedlar bag, as appropriate.

10. Close the two-way valve to isolate the purge pump.

11. Open the SUMMA® canister valve to initiate sample collection. Record on the sample log (attached) the time sampling began and the canister pressure.

If the initial vacuum pressure registers less than -25 inches of Hg, then the SUMMA® canister is not appropriate for use and another canister should be used.

Sampling flow rate should be 200 mL/min or less.

12. Take a photograph of the SUMMA® canister and surrounding area unless prohibited by the building owner.

13. Check the SUMMA canister approximately half way through the sample duration and note progress on sample logs.

Termination of Sample Collection

1. Arrive at the SUMMA® canister location at least 10 to 15 minutes prior to the end of the required sampling interval in order to have sufficient time to terminate the sample collection.

2. Record the final vacuum pressure. Stop collecting the sample by closing the SUMMA® canister valves. The canister should have a minimum amount of vacuum (ideally 3-7 inches of Hg or slightly greater).

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

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

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

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

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

8. A Shipping Determination must be performed, by DOT-trained personnel, for all environmental and geotechnical samples that are to be shipped, as well as some types of environmental equipment/supplies that are to be shipped.

9. Remove the tubing and grout the hole in the slab with quick-setting hydraulic cement powder, Sika-Flex, or other material similar to the slab. This step must be done carefully to ensure that the abandoned sampling point does not become a preferential flow pathway.

10. Replace the surface covering (e.g., carpet) to the extent practicable. Sample collection location should be returned to pre-sampling conditions/

VII. Waste Management

The volume of waste materials generated by these activities should be minimal. Personal protective equipment, such as gloves and other disposable equipment (i.e., tubing) should be collected by field personnel for proper disposal.

VIII. Data Recording and Management

Information collected in the field should be recorded in the field notebook as well as written on the field sampling log and COC, as appropriate. The field notebook and sampling log must include the project name, sample date, sample start and finish time, sample location (e.g., global positioning system [GPS] coordinates, distance from permanent structure [e.g., two walls, corner of room]), canister serial number, flow controller serial number, initial vacuum reading, and final pressure reading. Field sampling logs and COC records will be transmitted to the PM.

IX. Quality Assurance

Duplicate samples should be collected in the field as a quality assurance step. Generally, duplicates are taken of 10% of samples, but project specific requirements should take precedence.

Soil-gas sample analysis will generally be performed using USEPA TO-15 methodology or a project specific constituent list. Method TO-15 uses a quadrupole or ion-trap GC/MS with a capillary column to provide optimum detection limits (typically 0.5-ppbv for most VOCs).

X. References

ASTM – "Standard Guide for Soil Gas Monitoring in the Vadose Zone", D5314-92.

Hayes, H. C., D.J. Benton and N. Khan "Impact of Sampling media on Soil Gas Measurements" Presented with short paper at AWMA Vapor Intrusion Conference January 2006, Philadelphia PA.

ITRC "Vapor Intrusion Pathway: A Practical Guide", January 2007, Appendix F: "regulators Checklist for Reviewing Soil Gas Data"

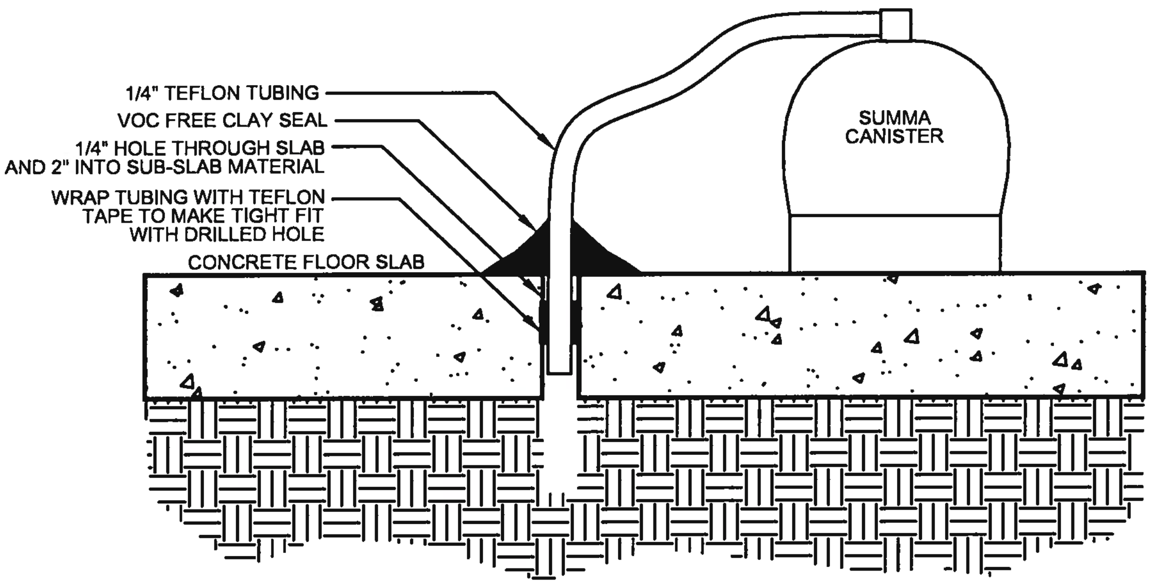

DIAGRAM OF TEMPORARY SUB-SLAB SAMPLE POINT

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Infrastructure, environment, facilities

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Indoor Air or Ambient Air Sampling and Analysis Using USEPA Method TO-15

SOP # 765199

Rev. #: 2

Rev Date: July 7, 2010

Approval Signatures

Prepared by: ______________________ Date: 07/07/2010
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Approved by: ______________________ Date: 07/07/2010
Christopher Lutes and Nadine Weinberg

I. Scope and Application

This standard operating procedure (SOP) describes the procedures to collect indoor air or ambient air samples for the analysis of volatile organic compounds (VOCs) using United States Environmental Protection Agency (USEPA) Method TO-15 (TO-15). The TO-15 method uses a 6-liter SUMMA® passivated stainless steel canister. An evacuated SUMMA® canister (<28 inches of mercury [Hg]) will provide a recoverable whole-gas sample of approximately 5 liters when allowed to fill to a vacuum of 6 inches of Hg. The whole-air sample is then analyzed for VOCs using a quadrupole or ion-trap gas chromatograph/mass spectrometer (GS/MS) system to provide compound detection limits of 0.5 parts per billion volume (ppbv).

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

II. Personnel Qualifications

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

III. Health and Safety Considerations

All sampling personnel should review the appropriate health and safety plan (HASP) and job safety analysis (JSA) prior to beginning work to be aware of all potential hazards associated with the job site and the specific task. The following are examples of hazards that are often encountered in conducting indoor air sampling:

- In crawl spaces, hazards often include low head room, limited light, poisonous insects, venomous snakes, and sharp debris.
- In residential buildings and neighborhoods unfamiliar dogs can pose a hazard. Even though proper permission for sampling may have been secured, it is still possible to encounter persons suspicious of or hostile to the sampling team.
- In occupied industrial buildings be aware of the physical hazards of ongoing industrial processes. Examples include moving forklifts and equipment pits.

IV. Equipment List

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

- 6-liter, stainless steel SUMMA® canisters (order at least one extra, if feasible);
- Flow controllers with in-line particulate filters and vacuum gauges (flow controllers are pre-calibrated by the laboratory to a specified sample duration [e.g., 8-hour]). Confirm with lab that flow controller is equipped with an in-line particulate filter and pressure gauge (order an extra set for each extra SUMMA® canister, if feasible);
- Appropriate-sized open-end wrenches (typically 9/16-inch);
- Chain-of-custody (COC) form;
- Building survey and product inventory form (example attached);
- Portable photoionization detector (PID) (for use identifying potential background sources during building survey described below);
- Sample collection log (attached);
- Camera if photography is permitted at sampling locations;
- Portable weather meter, if appropriate;
- Box, chair, tripod, or similar to hold canister above the ground surface; and
- Teflon sample tubing may be used to sample abnormal situations (i.e., sumps, where canisters must be hidden, etc.). In these situations ¼-inch Swagelok fittings or other methods may be appropriate to affix tubing to canister. Staff should check this before heading out into field.

V. Cautions

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

Ensure that the flow controller is pre-calibrated to the proper sample collection duration (confirm with laboratory). Sample integrity can be compromised if sample collection is extended to the point that the canister reaches atmospheric pressure. Sample integrity is maintained if sample collection is terminated prior to the target duration and a measurable vacuum (e.g., 5–inches Hg) remains in the canister when sample collection is terminated.

VI. Procedure

Initial Building Survey for Indoor Air Samples (if applicable to project)

1. Complete the appropriate building survey form and product inventory form (e.g., state-specific form, USEPA form, or ARCADIS form, [Attachment A]) as necessary in advance of sample collection.

2. Survey the area for the apparent presence of items or materials that may potentially produce or emit constituents of concern and interfere with analytical laboratory analysis of the collected sample. Record relevant information on survey form and document with photographs.

3. Record date, time, location, and other relevant notes on the sampling form.

4. Items or materials that contain constituents of concern and/or exhibit elevated PID readings shall be considered probable sources of VOCs. Request approval of the owner or occupant to have these items removed to a structure not attached to the target structure at least 48 hours prior to sampling if possible.

5. Set a date and time with the owner or occupant to return for placement of SUMMA® canisters.

Preparation of SUMMA®-Type Canister and Collection of Sample

1. Record the following information on the sampling form (use a hand-held weather meter, contact the local airport or other suitable information source [e.g., weatherunderground.com] to obtain the following information):

   - ambient temperature;

- barometric pressure;
- wind speed; and
- relative humidity.

2. Choose the sample location in accordance with the sampling plan. If a breathing zone sample is required, place the canister on a ladder, tripod, box, or other similar stand to locate the canister orifice 3 to 5 feet above ground or floor surface. If the canister will not be overseen for the entire sampling period, secure the canisters as appropriate (e.g., lock and chain). Canister may be affixed to wall/ceiling support with nylon rope or placed on a stable surface. In general, areas near windows, doors, air supply vents, and/or other potential sources of "drafts" shall be avoided.

3. Record SUMMA® canister serial number and flow controller number on the sampling log and chain of custody (COC) form. Assign sample identification on canister ID tag, and record on the sample collection log (Attachment B), and COC form.

4. Remove the brass dust cap from the SUMMA® canister. Attach the flow controller with in-line particulate filter and vacuum gauge to the SUMMA® canister with the appropriate-sized wrench. Tighten with fingers first, then gently with the wrench. Use caution not to over tighten fittings.

5. Open the SUMMA® canister valve to initiate sample collection. Record the date and local time (24-hour basis) of valve opening on the sample collection log, and COC form. Collection of duplicate samples will include collecting two samples side by side at the same time.

6. Record the initial vacuum pressure in the SUMMA® canister on the sample log and COC form. If the initial vacuum pressure registers less than -25 inches of Hg, then the SUMMA® canister is not appropriate for use and another canister should be used.

7. Take a photograph of the SUMMA® canister and surrounding area, if possible.

8. Check the SUMMA canister approximately half way through the sample duration and note progress on sample logs.

Termination of Sample Collection

1. Arrive at the SUMMA® canister location at least 1-2 hours prior to the end of the sampling interval (e.g., 8-hour, 24-hour).

2. Stop collecting the sample when the canister vacuum reaches approximately 7 inches of Hg (leaving some vacuum in the canister provides a way to verify if the canister leaks before it reaches the laboratory) or when the desired sample time has elapsed.

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

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

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

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

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

VII. Waste Management

No specific waste management procedures are required.

VIII. Data Recording and Management

Notes taken during the initial building survey will be recorded on the sample log, with notations of project name, sample date, sample time, and sample location (e.g., description and GPS coordinates if available) sample start and finish times, canister serial number, flow controller number, initial vacuum reading, and final vacuum reading. Sample logs and COC records will be transmitted to the Task Manager or Project Manager. A building survey form and product inventory form (Attachment A) may also be completed for each building within the facility being sampled during each sampling event as applicable.

IX. Quality Assurance

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

Duplicate samples should be collected in the field as a quality assurance step. Generally, duplicates are taken of 10% of samples, but project specific requirements should take precedence.

Building Survey and Product Inventory Form

Directions: This form must be completed for each residence or area involved in indoor air testing.

Preparer's Name: ______________________________

Date/Time Prepared: ______________________________

Preparer's Affiliation: ______________________________

Phone No.: ______________________________

Purpose of Investigation: ______________________________

1. OCCUPANT:

Interviewed: Y / N

Last Name: ____________________ First Name: ____________________

Address: ______________________________

County: ______________________________

Home Phone: ____________________ Office Phone: ____________________

Number of Occupants/Persons at this Location: ______________

Age of Occupants: ______________

2. OWNER OR LANDLORD: (Check if Same as Occupant ___)

Interviewed: Y / N

Last Name: ____________________ First Name: ____________________

Address: ______________________________

County: ______________________________

Home Phone: ____________________ Office Phone: ____________________

3. BUILDING CHARACTERISTICS:

Type of Building: (circle appropriate response)

Residential	School	Commercial/Multi-use
Industrial	Church	Other: ________________

If the Property is Residential, Type? (circle appropriate response)

Ranch		2-Family 3-Family
Raised Ranch	Split Level	Colonial
Cape Cod	Contemporary	Mobile Home
Duplex	Apartment House	Townhouses/Condos
Modular	Log Home	Other:______________

If Multiple Units, How Many? ___________

If the Property is Commercial, Type?

Business Type(s) ____________________________________

Does it include residences (i.e., multi-use)? Y / N If yes, how many? _________

Other Characteristics:

Number of Floors______ Building Age______

Is the Building Insulated? Y / N How Air-Tight? Tight / Average / Not Tight

4. AIRFLOW:

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow Between Floors

____

____

____

Airflow Near Source

____

____

____

Outdoor Air Infiltration

____

____

____

Infiltration Into Air Ducts

____

____

____

5. **BASEMENT AND CONSTRUCTION CHARACTERISTICS:** (circle all that apply)

a.	**Above grade construction:**	wood frame	concrete	stone brick	
b.	**Basement type:**	full	crawlspace	slab other ________	
c.	**Basement floor:**	concrete	dirt	stone other ________	
d.	**Basement floor:**	uncovered	covered	covered with ________________	
e.	**Concrete floor:**	unsealed	sealed	sealed with ________________	
f.	**Foundation walls:**	poured	block stone	other ________________	
g.	**Foundation walls:**	unsealed	sealed	sealed with ________________	
h.	**The basement is:**	wet	damp	dry	moldy
i.	**The basement is:**	finished	unfinished	partially finished	

j. **Sump present?** Y / N

k. **Water in sump?** Y / N / NA

Basement/lowest level depth below grade: ________(feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

____

____

Are the basement walls or floor sealed with waterproof paint or epoxy coatings? Y / N

6. HEATING, VENTILATING, AND AIR CONDITIONING: (circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

Hot air circulation	Heat pump	Hot water baseboard
Space heaters	Stream radiation	Radiant floor
Electric baseboard	Wood stove	Outdoor wood boiler
Other __________		

The primary type of fuel used is:

Natural base	Fuel oil	Kerosene
Electric	Propane	Solar
Wood coal		

Domestic hot water tank fueled by: ______________________________

Boiler/furnace located in: Basement Outdoors Main Floor Other___________

Air conditioning: Central Air Window Units Open Windows None

Are there air distribution ducts present? Y / N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

____

____

____

7. OCCUPANCY:

Is basement/lowest level occupied? Full-time Occasionally Seldom Almost Never

General Use of Each Floor (e.g., family room, bedroom, laundry, workshop, storage):

Basement ______________________________

1st Floor ______________________________

2nd Floor ______________________________

3rd Floor ______________________________

4th Floor ______________________________

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY:

a. Is there an attached garage? Y / N

b. Does the garage have a separate heating unit? Y / N / NA

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, ATV, car)?

Y / N / NA Please specify: ______________________________

d. Has the building ever had a fire? Y / N When? ____________________

e. Is a kerosene or unvented gas space heater present? Y / N Where? ____________

f. Is there a workshop or hobby/craft area? Y / N Where & Type? ____________

g. Is there smoking in the building? Y / N How frequently? ____________

h. Have cleaning products been used recently? Y / N When & Type? ____________

i. Have cosmetic products been used recently? Y / N When & Type? ____________

j. Has painting/staining been done in the last 6 months? Y / N Where & When? ________

k. Is there new carpet, drapes or other textiles? Y / N Where & When? ____________

l. Have air fresheners been used recently? Y / N When & Type? ____________

m. Is there a kitchen exhaust fan? Y / N If yes, where ____________

n. Is there a bathroom exhaust fan? Y / N If yes, where vented?____________

o. Is there a clothes dryer? Y / N If yes, is it vented outside? Y / N

p. **Has there been a pesticide application?** Y / N When & Type?____________________

q. **Are there odors in the building?** Y / N

If yes, please describe: ____

Do any of the building occupants use solvents (e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist) at work? Y / N

If yes, what types of solvents are used? ____

If yes, are their clothes washed at work? Y / N

Do any of the building occupants regularly use or work at a dry-cleaning service? (circle appropriate response)

Yes, use dry-cleaning regularly (weekly) No

Yes, use dry-cleaning infrequently (monthly or less) Unknown

Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Y / N

Date of Installation: ____________________

Is the system active or passive? Active/Passive

Are there any Outside Contaminant Sources? (circle appropriate responses)

Contaminated site with 1000-foot radius? Y / N Specify ______________________________

Other stationary sources nearby (e.g., gas stations, emission stacks, etc.): __________________

____

Heavy vehicle traffic nearby (or other mobile sources): ________________________________

9. **WATER AND SEWAGE:**

Water Supply:	Public Water	Drilled Well	Driven Well	Dug Well	Other: _______
Sewage Disposal:	Public Sewer	Septic Tank	Leach Field	Dry Well	Other: _______

10. RELOCATION INFORMATION: (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: ________________________________

____

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N

11. FLOOR PLANS:

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Basement:

First Floor:

12. OUTDOOR PLOT:

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s), and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.

13. PRODUCT INVENTORY FORM:

Make and Model of field instrument used: ______________________________

List specific products found in the residence or area that have the potential to affect indoor air quality (e.g., gasoline or kerosene storage cans, glues, paints, cleaning solvents/products, polishes/waxes, new furniture/ carpet, nail polish/hairspray/cologne).

Location	Product Description	Size (units)	Condition*	Chemical Ingredients	Field Instrument Reading (units)	Photo** Y/N

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Indoor Air/Ambient Air Sample Collection Log

		Sample ID:	
Client:		Outdoor/Indoor:	
Project:		Sample Intake Height:	
Location:		Tubing Information:	
Project #:		Miscellaneous Equipment:	
Samplers:		Time On/Off:	
Sample Point Location:		Subcontractor:	

Instrument Readings:

Date	Time	Canister Vacuum (a) (inches of Hg)	Temperature (°F)	Relative Humidity (%)	Air Speed (mph)	Barometric Pressure (inches of Hg)	PID (ppb)

(a) Record canister information at a minimum at the beginning and end of sampling

SUMMA Canister Information:

Size (circle one):	1 L 6 L
Canister ID:	
Flow Controller ID:	
Notes:	

General Observations/Notes:

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Appendix L

Project Management Plan

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Project Management Plan

USEPA RCRA 3013(a)
Administrative Order
EPA ID No. MSD 008 182 081
Docket No. RCRA-04-2011-4251
MDEQ AI No. 2022

14 July 2011

ARCADIS

John Ellis, P.G.
Principal Scientist/Hydrogeologist

James L. Reid
Principal in Charge

Project Management Plan

USEPA RCRA 3013(a)
Administrative Order
Hattiesburg, Mississippi

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Our Ref.:
LA002999.0003.00300

Date:
14 July 2011

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1. Project Organization and Responsibilities

This Project Management Plan (PMP) has been prepared to support the Phase 1 Sampling and Analysis Work Plan (Work Plan) by documenting mechanisms that will be implemented to ensure the investigation undertaken by Hercules Incorporated (Hercules), in Hattiesburg, Mississippi, pursuant to the May 9, 2011, Administrative Order (AO) issued by Region 4 of the U.S. Environmental Protection Agency (USEPA) pursuant to Section 3013(a) of the Resource Conservation and Recovery Act (RCRA), 42 United States Code (USC) §6934(a), is performed in accordance with the requirements of the AO.

Hercules will review this PMP periodically to ensure its continued applicability. Laboratory control limits will be updated annually or as re-calculated by the analytical laboratory. The Project Manager (PM) will be responsible for initiating the review and update. If the review indicates additions or changes are required, the PMP will be updated by preparing changes to specific sections.

The information presented in this PMP covers general procedures for implementing applicable USEPA guidance and Mississippi Department of Environmental Quality (MDEQ) requirements to ensure that data of verifiable quality are generated. This is necessary to ensure the validity of the results of the investigation. Hercules' Subcontractors will also be contracted to perform activities in accordance with this PMP. The analytical laboratory will perform analyses in accordance with USEPA-approved methods and as further defined by the laboratory standard operating procedures, as well as the project's Quality Assurance Project Plan (QAPP) and the Work Plan requirements.

This PMP addresses the general activities that may be performed in accordance with the AO to achieve the project objectives. The investigation is being performed under the direction of the USEPA to assess the presence, magnitude, extent, direction, and rate of movement of any of the constituents to be monitored under the AO (the "Constituents").

An environmental contractor will be selected to perform and oversee the field operations as well as compile and submit the final report on behalf of Hercules. Accredited contract laboratories will be selected to provide analytical support. Geotechnical work will be performed by a water well driller licensed in the state of Mississippi.

FINAL

The PM and Field Operations Manager are primarily responsible for the implementation of the PMP and quality assurance and quality control (QA/QC) programs on the project. The specific QA responsibilities of the key project personnel are described in the QAPP. The organizational chart for the project is provided as Attachment A.

1.1 Project Manager

The selected contractor will identify a PM for the project. The PM will oversee the implementation of all schedules and budgets. He will establish and interpret all contract policies and procedures and access appropriate resources in order to maintain technical quality. The PM will work with the Field Operations Manager and QA Manager to resolve any QA/QC issues during the implementation of the site activities.

The PM is responsible for all field activities. The PM will also be responsible for reviewing any new work not currently defined to determine whether the PMP will require amendments or modifications. In addition, the PM is responsible for distributing all site-specific plans and related documents to the Field Operations Manager and the Laboratory PM, who in turn distribute it to the appropriate technical staff. Specific PM responsibilities include:

- Overseeing day-to-day task performance including all technical and administrative operations;
- Coordinating with the Hercules PM;
- Tracking schedules and budgets and management of mobilization and contract closeout activities;
- Performing assessment and oversight duties as described in the Work Plan;
- Selecting and monitoring technical staff;
- Reviewing and approving all final reports and other work products; and
- Distributing the QA/QC Plan and the site Health and Safety Plan to the technical staff and subcontractors.

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1.2 Field Coordinator/Field Operations Manager

The contractor will provide a Field Coordinator/Field Operations Manager for the project. As Field Coordinator, the selected individual will interface between the PM and subcontractors to ensure that all personnel, supplies, and equipment necessary for completion of field activities are available. In the role of Field Operations Manager, the selected individual will coordinate and be present during all sampling activities and will ensure the availability and maintenance of all sampling materials/equipment. The Field Operations Manager will be responsible for the completion of all sampling and chain-of-custody documentation and the overall quality of work performed during the investigation at the site as it relates to the following specific responsibilities:

- Implementation of the field activities in accordance with the Work Plan;
- Management of field staff during the investigation, including health and safety procedures; and
- Coordination of site work including subcontractor access to and work at the site.

1.3 QA Manager

The Project QA Manager will be responsible for oversight of all site QA/QC activities. The QA Manager will remain independent of day-to-day direct project involvement, but will have the responsibility for ensuring that all project and task-specific QA/QC requirements are met. The QA Manager's specific duties include:

- Reviewing and approving the QA/QC Plan;
- Reviewing and approving substantive changes to the QA/QC Plan;
- Reviewing any new work orders with the PM to determine if the QA/QC Plan requires modification;
- Providing external review of field and analytical activities by performance of assessment and oversight duties; and
- Conducting field audits and keeping written records of those audits.

1.4 Project Health & Safety Manager and Site Safety Officer

The Project Health and Safety Manager (PHSM), or designee, is responsible for overseeing all aspects of the site safety program and preparing any site-specific health and safety guidance documents or addenda to this plan. The PHSM does not report to the PM and is separately accountable to the contractor's senior management for site health and safety.

1.5 Task Manager and Technical Staff

The Task Manager and technical staff for this program will be specified in advance by the contractor. The technical staff will implement project and site tasks, analyze data, and prepare reports/support materials as directed by the Task Manager. All personnel assigned will be experienced professionals who possess the degree of specialization and technical competence required to perform the required work effectively and efficiently. Project personnel will hold current certifications documenting appropriate training for assigned tasks, as required.

1.6 Analytical Laboratory

The analytical laboratories providing analytical services will be chosen as appropriate for the project requirements. The analytical laboratory shall be accredited for the analytical parameters required for the project and covered under the scope of the certification programs. The laboratory QA programs will be reviewed by the QA Manager. The laboratory must provide an experienced PM to coordinate between the QA Manager and the laboratory. The laboratory staff shall include a QA Officer/Coordinator who is independent of the day-to-day operations of the laboratory. The specific duties of each Laboratory PM and Laboratory QA Officer on the project include:

- Reviewing the QA/QC Plan to verify that analytical operations will meet project requirements;
- Documenting and implementing site-specific QA/QC requirements in the laboratory and reviewing analytical data to verify the requirements were met;
- Reviewing receipt of all sample shipments and notifying the Field Operations Manager of any discrepancies in a timely fashion;

FINAL

- Conducting internal laboratory audits to assess implementation of the QA/QC Plan and providing written records of those audits;

- Providing rapid notification to the contractor's PM regarding laboratory nonconformance with the QA/QC Plan or analytical QA/QC problems affecting samples; and

- Coordinating with the project and laboratory management to implement corrective actions as required by the QA/QC Plan or laboratory Quality Assurance Manual.

1.7 Other Subcontractors

The drilling, probing, surveying, and/or other subcontractors are responsible for implementing the subcontracts and applicable portions of this PMP as provided in the subcontract package. Subcontractors are responsible for rapidly notifying the Field Operations Manager regarding nonconformance with the PMP or QAPP problems affecting the project. Subcontractors must coordinate with the Field Operations Manager to implement corrective actions required by the contractor.

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Attachment A

Organizational Chart

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Organizational Chart
Phase I Sampling and Analysis Work Plan