APPENDIX A

STANDARD OPERATING PROCEDURES

This page intentionally left blank.

STANDARD OPERATING PROCEDURE 1

Headspace Field Screening

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Indelible black-ink pens and markers
- Site logbook
- Camera
- Ziploc® bags
- Photoionization detector (PID)

TYPICAL PROCEDURES

1. Calibrate PID in accordance with the manufacturer's specifications.
2. Label Ziploc® bag with the sample number.
3. Place soil in Ziploc® bag until bag is approximately one-half full. Shake Ziploc® bag to homogenize sample.
4. Place PID wand into Ziploc® bag, being careful not to contact soil with PID probe.
5. Record highest sustained reading in field logbook.

STANDARD OPERATING PROCEDURE 2

Hollow-Stem Auger Well Installation

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Site logbook, boring log, and well development forms
- Indelible black-ink pens and markers
- Camera
- Hollow-stem auger drill rig
- Tremie pipe
- Weighted tape or tag-line
- Assorted tools (e.g., shovels, wrenches, etc.)
- Annular materials including silica sand, bentonite pellets and chips, and bentonite grout
- Monitor well materials including flush-threaded Schedule 40 polyvinyl chloride (PVC) (2 inches) riser in accordance with Washington Administrative Code (WAC) 173-160 casing, Johnson pre-packed or standard well screen (0.010 slot, wire wrappped), and end caps
- 10 to 20 silica sand
- Bentonite chips or pellets
- Completion materials including steel monuments, concrete mix, 2-inch by 6-inch forms

TYPICAL PROCEDURES

Note: Monitor well installation will comply with Monitoring Well Construction: General, 690-240-100 through Well Seals, WAC 173-160.

Installation:

1. Remove the center plug and rods from the borehole. Depth measurements will be taken during the installation procedure and verified by the rig geologist. Record measurements on the Well Completion form, site logbook, and in the Monitoring Well Log by driller.
2. The borehole diameter will be at least 6 inches.

3. If boring was drilled deeper than the bottom of the well, backpull auger flights to 1 foot below planned well depth and allow the boring below to collapse.
4. Lower the decontaminated well casing string into the borehole through the hollow-stem augers. Well screen size will consist of either a pre-packed or standard wire-wrapped screen.
5. For standard well-screen wells, install the 10-20 silica sand filter pack from 1 foot below the screen to a maximum of 3 feet above the screen using the surging procedure. Use a tremie pipe, if possible, to install the filter pack.
6. For wells with factory pre-packed well screens, install additional 10-20 silica sand to bring the sand pack to 3 feet above the top of the screen.
7. Install a dry bentonite pellet plug (2-foot minimum) above the filter pack. Use a tremie pipe, if possible, to install the plug. If the tremie cannot be used due to bridging, then slowly gravity feed the pellets.
8. Install a bentonite chip or bentonite grout seal from the top of the bentonite plug to the frost line (approximately 6 inches below grade). Hydrate the bentonite chips with potable water prior to placement of the annular seal to prevent grout infiltration into the filter pack.
9. Cut PVC riser (for surface completions). Record cut length in site logbook.
10. Install concrete pad (minimum 3 feet by 3 feet by 6 inches) and locking protective monument (either flush-mount or stand-pipe as appropriate for the location). Install three bucking posts for standpipe completions.
11. A lockable cap will be attached to the top of the casing. A protective cover, level with the ground surface, will be installed with a waterproof seal to prevent the inflow of surface water.
12. The well identification number is the start card number that is stamped or engraved on the outer well casing or permanent protective well cover.
13. Decontaminate all equipment.
14. Document activities in the site logbook.
15. Note: If a WRD well construction variance has been obtained for a well, filter pack and plug/seal requirements will match the variance.

STANDARD OPERATING PROCEDURE 3

Well Development

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Site logbook
- Well development forms
- 2-inch diameter surge block
- Grundfos Redi-Flow submersible pump; Reel E-Z® system including control box; portable generator (5,000 watt minimum)
- Groundwater parameter multi-meter capable of measuring pH, reduction/oxidation (redox) potential, temperature, specific conductance, turbidity, and dissolved oxygen
- Flow-through cell
- Department of Transportation (DOT) approved drums
- Indelible black-ink pens and markers
- Camera
- Decontamination equipment

TYPICAL PROCEDURES

1. Calibrate field instrumentation for measurement of water parameters in accordance with the Manufacturer's specifications.
2. Insert hand-held or rig mounted 2-inch surge block into well.
3. Lower surge block to within 0.25 feet of the bottom of well.
4. Surge well by raising and lowering surge bock from 0.25 foot from the bottom of the well to 1 foot above top of screened interval for a minimum of 5 minutes to flush the sand pack of fine grained materials.
5. Lower submersible pump into well depth within 1 foot of the bottom of the screened interval. The well shall then be pumped at a rate sufficient to stress the sand pack and aquifer surrounding the well while not pumping the well dry.

6. Pump well initially until the turbidity of the well drops to below 700 nephelometric turbidity units (NTUs).
7. Each well will be surged and pumped a minimum of three times. During the final development pumping, the well shall be developed until the turbidity remains within a 10-NTU range for at least 30 minutes and the field parameter stabilization criteria shown below are met.

Field Parameter	Stabilization Criteria
Temperature	± 1°C
pH	± 0.1 pH units
Specific Conductance	± 5 percent
Dissolved Oxygen	± 10 percent
Redox Potential (Eh)	± 50 mV
Turbidity	± 10 NTUs

8. Remove development equipment and clean up site.
9. Decontaminate all equipment.
10. Document activities in the site logbook

STANDARD OPERATING PROCEDURE 4

Field Instrument Calibration

CALIBRATION FREQUENCY FOR FIELD EQUIPMENT

Field equipment used for on-site measurements will be calibrated in accordance with the manufacturer's specification before and after field use each day, or at a frequency recommended by the equipment manufacturer or industry practice. If any screening or test device requiring calibration cannot immediately be removed from service, the Field Operations Lead (FOL) may extend the calibration cycle, providing a review of the equipment's history warrants the issuance of an extension. No equipment will be extended more than twice per calibration cycle, nor will the extension exceed one-half the prescribed calibration cycle.

All calibration information will be recorded in the site logbook. This includes the instrument's make, model, serial number, condition, and all adjustments made during calibration of the instrument.

STANDARD OPERATING PROCEDURE 5

Groundwater Sampling

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Site logbook
- Indelible black-ink pens and markers
- Sample tags/labels and appropriate documentation
- Appropriate laboratory glassware
- Oil/water interface probe
- Water level meter
- Groundwater parameter multi-meter capable of measuring pH, reduction/oxidation (redox) potential, temperature, specific conductance, turbidity, and dissolved oxygen
- Flow-through cell
- Field alkalinity test kit
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags
- Sample containers, coolers, and blue ice or equivalent
- Sampling equipment: Grundfos Redi-Flow submersible pump; Reel E-Z® system including control box; portable generator (5,000 watt minimum)
- Water Sampling Log Forms
- Decontamination equipment

TYPICAL PROCEDURES

Preparation:

1. Record necessary data in site logbook.
2. Prepare sampling equipment including calibration of field meters prior to use (SOP 4).
3. Move equipment and supplies to sampling location.
4. Decontaminate equipment according to SOP 7.

Purging:

1. Remove well cap.
2. Measure light nonaqueous phase liquid (LNAPL) thickness (if present), measure static water level and total depth of well.
3. Remove the pump from the pump holder and rinse the pump off with distilled water. After consulting the well log to determine depth to the middle of the well screen, slowly lower the pump into the well. Position the pump at the middle of the well screen.
4. Connect the discharge hose and cable for the control box to the Reel E-Z® system. Start the generator and set it to 120 volts. Make sure the generator is kept down-wind from the sampling system.
5. Place the discharge hose in the flow-through box. Place the probes for the calibrated field meters into the flow-through box. Place a bucket beneath the flow-through box to catch purged water.
6. Turn on the pump and adjust flow rate to approximately 2 liters per minute.
7. After approximately 4 liters of water have been purged from the well, adjust the flow rate to 1 liter per minute.
8. Start recording field parameters every 4 liters of water purged. Purging should continue at a constant rate until the selected parameters shown below have stabilized for three consecutive measurements.

Field Parameter	Stabilization Criteria
Temperature	± 1°C
pH	± 0.1 pH units
Specific Conductance	± 5 percent
Dissolved Oxygen	± 10 percent
Redox Potential (Eh)	± 50 mV
Turbidity	± 10 nephelometric turbidity units (NTUs)

Sampling:

1. After specified parameters have stabilized, turn down flow rate on control box so pressure is maintained in the system to stop water from entering well and minimize or stop water from exiting the well.
2. Disconnect discharge hose from Reel E-Z® system.
3. Connect Teflon® sampling tube to Reel E-Z® system. Place bucket beneath sampling tube to catch unsampled water.

4. Turn up flow rate slightly and fill necessary sample bottles. If sampling for volatile organic compounds (VOCs), flow rate should be just enough to create a trickle of water. If sampling for other analytes, adjust flow rate to 1 liter per minute.
5. Samples collected for dissolved metals shall be field filtered by connecting a 0.45 micron in-line filter to the sampling tube. Dispose of filter after each sample.
6. Label and manage sample containers in accordance with SOP 11 for shipping and handling of samples.

Documentation:

1. Fill out one Water Sampling Log Form for each sample collected with all necessary information recorded in the site logbook.

STANDARD OPERATING PROCEDURE 6

Slug Tests

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Field logbook
- Indelible black-ink pens
- Decontamination equipment
- Slug(s): solid polyvinyl chloride (PVC) cylinder(s) (or, alternately, PVC pipe filled with sand or other weighting and capped with waterproof end caps). Slug has eye bolt at one end to allow attachment of cord to raise and lower. Diameter of slug is less than inner diameter of wells to be tested, with clearance for transducer cable and for unimpeded vertical movement of slug. Length of slug is less than the minimum length of well casing and/or screen below water table, with clearance for pressure transducer below slug when completely immersed in well. Multiple slugs may be used at a site to be used in wells with different diameters or lengths.
- Cord or string to attach to slug and allow raising and lowering in well: strength must be sufficient to lift slug rapidly out of water. Kite cord is commonly used, often with a kite reel to allow easy deployment of cord.
- Pressure transducer with sufficient range to measure expected instantaneous rise of water due to insertion of slug: note that 1 pound per square inch (psi) = 2.3 feet of water, so a 5-psi transducer can measure up to about 11 feet of water, with an accuracy of about 1 percent of the range, or 0.11 foot. Transducer is connected to surface via a cable of sufficient length to clear slug and length of well above water table.
- Data logger: one channel, with logging capacity for intervals of one second or less, and for logarithmically increasing logging intervals. This SOP describes operation of the Aquistar DL-1, but other data loggers can be used with only minor adjustments to the procedure.
- Electrical tape or similar water level measuring device.
- Laptop computer with appropriate software to communicate with data loggers, compile data, and view results (Note: should have Excel or similar spreadsheet program, data logger communication software, and serial interface with cables and connectors).

TYPICAL PROCEDURES

1. Select wells to perform test, obtain equipment, and mobilize for field operations. Set up equipment at well to be tested. Record diameter and length of slug being used.
2. Using e-tape, measure depth to water table and depth to bottom of well. Record measurements and diameter of well. From measurements, confirm that slug will fit into water in well without disturbing transducer.
3. Install transducer in well at a point that is at least slug's length below water table and where water level will never rise beyond pressure range of transducer. Take water level measurements via transducer until water level stabilizes after insertion of transducer.
4. Program data logger to take variable (logarithmically increasing) interval readings. Set up to start immediately after a single button press.
5. Measure and mark length of cord that will place slug just above water table. Measure additional length to depth where slug is fully immersed.
6. Lower slug down well until slug is just above water table. Secure end of extra cord at a point that will suspend slug fully immersed in water at static level but above transducer.
7. Start data logger and immediately drop slug into water.
8. Observe water levels via data logger (if possible), via e-tape, or based on previous tests, until water level has returned to within 0.01 foot (or less) of static level. Stop data logger.
9. Prepare data logger to start logging with new logarithmically-increasing interval schedule.
10. Start data logger logging and immediately pull slug up out of water to at least above static water level. Maintain slug above water table until water level recovers to within 0.01 foot of static level.
11. Repeat steps 7 through 10 to get two complete recordings each of well responses to slug insertions and withdrawals.
12. Download data logger and view data. Data can be manipulated in spreadsheet program by subtracting static water level value to produce residual rise (during insertion test, or drawdown during withdrawal test) of water in well. Plotting this residual rise (logarithmic scale) against time (linear scale) should show a downward sloped straight line section of curve followed by curved, gradually flattening section.
13. Remove slug and transducer from well. Decontaminate according to SOP 7 before proceeding to another well to test. Follow steps 2 through 14 to perform slug test in each additional well.

14. When field work is complete, or sooner if storage capacity of data logger is becoming exceeded, download all data to laptop computer and convert to spreadsheet.
15. In office after field work is complete, analyze test using Bouwer and Rice Method (incorporated into Aqtesolve analysis program).

STANDARD OPERATING PROCEDURE 7

Hand-held Sampling Equipment Decontamination

REQUIRED EQUIPMENT

- Tap water
- Deionized water
- Laboratory-grade detergent (i.e., Alconox® or equivalent)
- 5-gallon buckets, or other appropriate container
- Scrub brushes
- Plastic garbage can
- 4-foot length of 2-inch polyvinyl chloride (PVC)
- Methanol
- Dilute nitric acid (if metals analysis will be conducted)
- Hexane (if pesticide or PCB analysis will be conducted)
- Plastic sheeting
- Sprayers (garden or hand)

TYPICAL PROCEDURE:

Preparation:

1. Set up decontamination area on plastic sheeting.
2. Set up "clean" area upwind of decontamination area for air drying of equipment.
3. Fill one 5-gallon "wash" bucket with detergent and tap water.
4. Fill spray bottles with tap water, deionized water, and applicable solvents.

Decontamination of Sampling Equipment:

1. Remove gross contamination from sampling equipment.
2. Wash equipment with tap water/detergent solution.
3. Rinse equipment twice with tap water.

Rinse equipment with the appropriate solvent or combination of solvents as listed below:

1. For sampling equipment used for metals analysis, rinse with dilute nitric acid (sprayer).
2. For sampling equipment used for PCB or pesticide analysis, rinse with hexane (sprayer).
3. For sampling equipment used for all other analyses, rinse with methanol (sprayer).
4. Rinse with deionized water (sprayer).
5. Air dry.
6. Place disposable items (sampling gloves, paper towels, etc.) in garbage bag.

Sample Pump Decontamination:

1. Place the pump in a first 5-gallon bucket containing tap water and a small amount of Alconox or equivalent. Place discharge hose into same bucket.
2. Standby with additional tap water.
3. Turn on system and pump water through the sampling system. Add more water as needed and pump for 3 minutes.
4. Place the pump into a second 5-gallon bucket of tap water and turn on system. Pump until the soapy water has filled the first bucket. Place the discharge hose into the second 5-gallon bucket of water and pump for 1 minute.
5. Turn off system and place the pump into the 4-foot section of 2-inch ID PVC fitted with an end cap. Pour organic-free water into the decontamination tube. Standby with additional water.
6. Turn on the pump and pull organic-free water through the system. Add more water until at least 3 liters of organic-free water are pulled through the system.
7. Remove the pump from the decontamination tube and place the pump in its holder on the Reel E-ZTM system.
8. Containerize solvent bearing solutions in accordance with the Waste Management Plan.
9. Document activities in the site logbook.

STANDARD OPERATING PROCEDURE 8

Surface Soil Sampling

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Indelible black-ink pens
- Site logbook
- Camera
- Stainless-steel or plastic bowls and spoons
- Sample containers
- Chain-of-custody forms, custody seals, sample labels
- Ziploc® bags
- Insulated cooler
- Decontamination equipment

TYPICAL PROCEDURES

1. Review SAP for sample locations and analysis.
2. Record necessary data in site logbook.
3. Obtain photograph(s) of the material before sampling.
4. Move equipment and supplies to sampling location.
5. If soil sample is to be a discrete sample, collect soil using a clean/decontaminated stainless-steel (organic analyses) or plastic (inorganic analyses) spoon.
6. If soil sample is to be a composite, collect soil from all locations to be sampled into one stainless-steel (organic analyses) or plastic (inorganic analyses) bowl and homogenize the soil. (Volatiles samples should not be composited.)
7. Note: If collecting volatile organic compound (VOC) samples, preserve samples in accordance with SOP 14 (Methanol Field Preservation).
8. Use stainless-steel or plastic spoon to transfer soil sample into sample container.
9. Label and manage sample containers in accordance with SOP 11 for shipping and handling of samples.
10. Decontaminate sampling equipment in accordance with SOP for decontamination (SOP 7).
11. Document activities in the site logbook.

STANDARD OPERATING PROCEDURE 9

Hand Auger Sampling

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Indelible black-ink pens
- Site logbook
- Camera
- Hand auger, drive sampler, or equivalent
- Plastic sheeting
- Sample containers
- Sample labels
- Ziploc® bags
- Cooler
- Decontamination equipment

TYPICAL PROCEDURES

1. Review SAP for sample locations and analysis.
2. Record necessary data in site logbook.
3. Obtain photograph(s) of the material before sampling.
4. Place plastic sheeting at sampling location to collect hand-auger cuttings.
5. Move equipment and supplies to sampling location.
6. Use hand auger/drive sampler to bore into subsurface soil.
7. Place hand-auger cuttings on the plastic sheeting.
8. Describe soils in the site logbook.
9. If soil sample is to be a discrete sample, collect soil using a clean/decontaminated stainless-steel (organic analyses) or plastic (inorganic analyses) spoon.

10. If soil sample is to be a composite, collect soil from all locations to be sampled into one stainless-steel (organic analyses) or plastic (inorganic analyses) bowl and homogenize the soil. (Volatiles samples should not be composited.)

    Note: If collecting volatile organic compound (VOC) samples, preserve samples in accordance with SOP 14 (Methanol Field Preservation).

11. Label and manage sample containers in accordance with SOP 11 for shipping and handling of samples.
12. Backfill sampling hole with hand auger cuttings.
13. Decontaminate sampling equipment in accordance with SOP for decontamination (SOP 7).
14. Document activities in site logbook.

STANDARD OPERATING PROCEDURE 10

Site Logbook

PURPOSE

This guideline describes the process for keeping site logbook(s).

SCOPE

The site logbook is a controlled document which records all major on-site activities. At a minimum, the following activities/events should be recorded in the site logbook:

- Arrival/departure of site visitors.
- Arrival/departure of major site equipment (e.g., drill rigs).
- Sample and waste shipment information (i.e., shipping manifests, chain-of-custody form numbers, carrier, air bill numbers, time).
- A summary of activities and logsheet numbers.
- Start or completion time of individual activities.

The site logbook is initiated at the start of the first on-site activity (e.g., initial reconnaissance survey). Entries are made each day that on-site activities take place. The site logbook becomes part of the permanent project file. Because information contained in the site logbook may be admitted as evidence in legal proceedings, it is critical that this document be properly maintained.

DEFINITIONS

Site Logbook—The logbook is a bound notebook with consecutively numbered pages that cannot be removed. Upon entry of data, the logbook requires the signature at the bottom of each page of the person making the entry.

RESPONSIBILITIES

The site logbook is issued by the Project Manager (or designee) to the appropriate site personnel for the direction of on-site activities (e.g., Reconnaissance Survey Team Leader, Sampling Team Leader). It is the responsibility of this person (or designee) to keep the site logbook current while in his or her possession, and return it to the Project Manager or turn it over to another field team. Following the completion of all fieldwork, the site logbook is returned to the Project Manager for inclusion in the permanent site files.

GUIDELINES

The cover of each site logbook shall contain the following information:

- Project name
- Responsible parties name
- Sequential book number
- Start date
- End date

Daily entries into the logbook may contain a variety of information. At the beginning of each day, the following information must be recorded:

- Date
- Start time
- Weather conditions
- All field personnel present
- Any visitors present

During the day, a summary of all site activities and level of personal protective equipment should be recorded in the logbook. The information need not duplicate anything recorded in other field notebooks (e.g., Site Health and Safety Officer's notebook, calibration logbook, etc.), but should summarize the contents of the other notebooks and refer to the page locations in these notebooks for detailed information.

If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the notebook and page number(s) on which they are recorded. All maintenance and calibration records for equipment should be traceable through field records to the person using the instrument and to the specific piece of instrumentation itself.

All entries should be made in black pen. No erasures are permitted. If an incorrect entry is made, the data should be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook must be signed.

PHOTOGRAPHS

The record of photographs taken at a site for the purpose of project documentation must be recorded in the site logbook or a field notebook. When movies, slides, or photographs are taken of a site or any monitoring location, they are numbered to correspond to logbook entries. The name of the photographer, date, time, site location, site description, and weather conditions are entered in the logbook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record

the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook. If possible, such techniques should be avoided because they can adversely affect the admissibility of photographs as evidence. Chain-of-custody procedures depend upon the subject matter, type of film, and the processing methods. Film used for aerial photography, confidential information, or criminal investigations require chain-of-custody procedures. Adequate logbook notations and receipts may be used to account for routine film processing. Once processed, the slides of photographic prints shall be serially numbered and labeled according to the logbook descriptions.

STANDARD OPERATING PROCEDURE 11

Sample Packing and Shipping

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Indelible black-ink pens
- Site logbook
- Ziploc® bags
- Coolers
- Blue Ice® (or equivalent)
- Strapping tape or duct tape
- Vermiculite (or equivalent)
- Sample Logs
- Sample labels
- Chain-of-custody forms
- Custody seals

TYPICAL PROCEDURES

Note: Before packing, all samples will be individually labeled and noted in the site logbook by Field Operations Lead (FOL) or designee. Labels will be completed with all required information. The samples will be assigned individual numbers. The sample numbers will be used to complete the chain-of-custody forms.

Samples to be hand-delivered to the laboratory:

1. Attach sampling label and custody seals (if necessary) on each sample jar.
2. Place each sample in a Ziploc® bag and align the label so it can be easily read. Seal the bag.
3. Place individual samples into the cooler lined with a larger heavy duty plastic garbage bag so that each container is safely secured.
4. Include three or more (sufficient) Blue Ice® packs (or equivalent) to maintain a low temperature environment (approximately 4°C or less). Blue Ice® packs should not be in contact with the sample containers.

5. Complete a chain-of-custody form for the containers and seal in a Ziploc® bag. Place the chain-of-custody form in the cooler. Always transport the cooler with its accompanying chain-of-custody form together.
6. Samples to be shipped to the Laboratory:
7. Place each sample in a Ziploc® bag and align the label so it can be easily read. Seal the bag.
8. Place individual samples into the cooler so that each container has some clearance on all sides.
9. Fill void space with vermiculite or equivalent low-density packing material.
10. Cover the head space inside the cooler with frozen Blue Ice® packs (or equivalent).
11. Place the chain-of-custody form in a sealed Ziploc® bag and place it in the cooler.
12. Close and latch the cooler. Wrap the cooler and lid with at least two turns of strapping or duct tape. Affix signed custody seals over the edge of the lid and the top of the cooler body at front and rear.
13. Label coolers with up arrows and information to comply with Department of Transportation (DOT) requirements.
14. The FOL or designee will notify the laboratory approximately when and how many samples will arrive. The samples must be kept under refrigeration (or packed with Blue Ice® or equivalent) between sampling and analysis processing. The sample containers will be checked on arrival at the laboratory for breakage.

STANDARD OPERATING PROCEDURE 12

Utilities Clearance

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Site maps
- Utilities clearance forms
- Site logbook

TYPICAL PROCEDURES

1. Review SAP for sample locations.
2. Locate subsurface soil sampling locations on site maps.
3. Call to set up commercial utilities location.
4. Obtain utilities clearance forms before utilities location.
5. Escort utility personnel to locations requiring clearance and fill out utilities clearance forms as required.
6. Document activities in site logbook.

STANDARD OPERATING PROCEDURE 13

Hollow-Stem Auger Drilling/Soil Sampling

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Site logbook and boring log
- Indelible black-ink pens and markers
- Camera
- Hollow-stem auger drill rig
- Split-spoon samplers
- Photoionization detector (PID)
- Plastic sheeting
- 55-gallon drums
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags
- Sample labels and appropriate documentation
- Assorted geology supplies (e.g., hand lens, grain size card, scales, etc.)
- Decontamination equipment

TYPICAL PROCEDURES

Preparation:

1. Conduct site activity/health and safety briefing.
2. Calibrate field instrumentation.
3. Record necessary data in field logbook.
4. Obtain photograph(s) of site before drilling.
5. Place plastic sheeting and drums at drilling location to collect cuttings.
6. Move equipment and supplies to drilling location.
7. Set up decontamination and sampling stations.

Construction:

1. Obtain surface soil samples, if required.
2. Drill to first sampling depth, as described in the SAP.
3. Place decontaminated split-spoon sampler on center rods.
4. Drive split-spoon sampler as described in American Society for Testing and Materials (ASTM) Method D-1586. Drive sampler to 18 inches or to refusal (no progress for 50 blows). Record blow counts on boring log form. Retrieve sampler.
5. Screen sampler with PID.
6. Describe soil in accordance with ASTM C2488-69 on the boring log form.
7. Collect soil samples as necessary. If volatile organic compound (VOC) samples are to be collected, collect sample prior to describing soil.
8. Note: If collecting VOC samples, preserve samples in accordance with SOP 14 (Methanol Field Preservation).
9. Continue drilling to next sample location. Collect samples as outlined above.

STANDARD OPERATING PROCEDURE 14

Methanol Field Preservation

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Site logbook
- Indelible black-ink pens and markers
- Scale
- Pre-weighed sample containers
- 25-milliliter (ml) vials of methanol
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags
- Sample labels and appropriate documentation

TYPICAL PROCEDURES

1. Place pre-weighed sample containers on scale.
2. Place 25 grams of soil into sample container.
3. Place 25 ml of methanol into jar.
4. Confirm that soil is completely saturated with methanol and that free methanol is present above the soil.
5. If no free methanol is present add an additional 25 ml of methanol to container.
6. Record amount of methanol used for each container on chain-of-custody form.
7. Place samples in Ziploc® bag.
8. Place samples in insulated cooler.
9. Record all information in field logbook.

Note: In order to achieve project-required detection limits, the ratio of methanol to soil may need to be adjusted.

STANDARD OPERATING PROCEDURE 15

Investigation-Derived Waste Handling

REQUIRED EQUIPMENT

- 55-gallon drums
- Paint markers
- Tools
- Ziploc® bag
- Drum labels

SOLID WASTE HANDLING

1. Solid wastes needing to be containerized will be placed in 55-gallon drums or other approved containers. Solid residues known to be from a contaminated area should not be combined with other residues.
2. After proper decontamination, protective clothing and used disposable sampling equipment should be drummed together and separated from other waste types. Protective clothing and disposable sampling equipment should be collected daily and placed in a dedicated drum for this waste type. Personal protective equipment that does not come in contact with contaminated media can be disposed of (except footwear) along with domestic waste. However, disposable footwear should always be containerized in drums for proper disposal.
3. All filled or partially filled drums must be properly closed, sealed, labeled, and staged before demobilization. If storage is anticipated in excess of 2 weeks, the drums should be covered with a wind/rain resistant cover, such as a plastic or polyethylene tarp.

STANDARD OPERATING PROCEDURE 16

Wastewater Sampling

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Site logbook
- Indelible black-ink pens and markers
- Sample tags/labels and appropriate documentation
- Insulated cooler(s), chain-of-custody seals, Ziploc® bags
- Sample containers
- Disposable bailers
- Decontamination equipment

TYPICAL PROCEDURES

Wastewater Storage:

1. Place 55-gallon drums or Baker® tanks at an approved storage area.

Wastewater Sampling

Preparation:

1. Record necessary data in site logbook.
2. Prepare sampling equipment.
3. Move equipment and supplies to sampling location.

Procedure:

1. Slowly lower the bailer into the 55-gallon drum. Through the top, lower the bailer to a minimum of 2/3 depth into the tank and remove.
2. Collect volatile organic compound (VOC) samples first by filling the 40-ml vials. Check to ensure that no air bubbles are contained in the vials after capping.
3. Collect remaining samples in appropriate glassware from the bailer.
4. Label and manage sample containers in accordance with SOP 11.
5. Decontaminate all equipment in accordance with SOP 7.
6. Document activities in the site logbook.

STANDARD OPERATING PROCEDURE 17

Biota Sampling [Plants]

REQUIRED EQUIPMENT

- Sampling and Analysis Plan (SAP)
- Indelible black-ink pens
- Site logbook
- Camera
- Aluminum foil
- Chain-of-custody forms, custody seals, sample labels
- Ziploc® bags
- Insulated cooler

PLANT SAMPLING PROCEDURE

1. Search for occurrence of flora in the vicinity of the sample locations.
2. Based upon environmental characteristics of known site contaminants, select plant tissues (i.e., roots, stems, leaves, etc.) of a single species or multiple species.
3. Select plants of same or similar species and similar size at the sample locations and reference location.
4. Collect sufficient quantity of plant tissue for analytical requirements.
5. Record species collected and numerical quantity by sample.
6. Wrap sample in aluminum foil (shiny side out). Weigh composited sample mass. Place sample in plastic bag and freeze with dry ice to preserve sample.
7. Collect replicates at each sampling location (as necessary) following above steps.
8. Complete sample logs, labels, custody seals, and chain-of-custody forms. Record sample information in the field notebook.
9. Analyze for selected contaminants based upon the SAP.

This page intentionally left blank.