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A Portage Shaw Joint Venture Company

OWNER: Environmental Monitoring	**PRS-ENM-2300**	**REV. NO. 0**
SUBJECT MATTER AREA: Engineering	**PREPARER: K. Holland**	**Page 1 of 18**
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REVISION LOG

Revision Number	Description of Changes	Pages Affected
0	Initial Release. Intent Change. Changed numbers and headings to define the beginning point of PRS. This document replaces BJC-ES-2300, *Collection of Soil Samples*, Rev. 0; GEO-TEC-015, *Subsurface Soil Sampling*, Rev. 0; GEO-TEC-020, *Surface Soil Sampling*, Rev. 2; W-157-PWOS, *Surface Soil Sampling*, Rev. 1; and W-158-PWOS, *Subsurface Soil Sampling*, Rev. 1.	All

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1.0 PURPOSE

This procedure describes the standard methods and equipment needed to collect environmental or geotechnical soil samples for description, physical and/or chemical analyses. The sampling methods as follows:

- Trier, spade, spoon, trowel or scoop;
- Stainless steel hand-operated auger;
- Thin-walled sampler; and
- Split-barrel sampler.

The task-specific WP will specify the type of soil sampler(s) that will be used to collect disturbed or undisturbed soil samples at the surface, from boreholes, or test pit/trench/excavation/trench sidewalls or bottoms. The manual or powered equipment and methods used to reach or access and sample soil at the surface and in the subsurface are dependent upon project objectives; soil conditions (i.e., degree of consolidation and moisture content; type; volume and depth of sample required; and the characteristics of the soil to be sampled) and should be specified in the WP. The method used can be either manual (e.g., drive hammer, hand auger, post-hole digger, and slide hammer) or powered (e.g., drill rig, direct push, pneumatic hammer, manually controlled mechanical or hydraulic earth drills, conventional excavation equipment).

2.0 SCOPE

This procedure shall be used for project characterization and cleanup verification activities performed by PRS.

3.0 PROCEDURE

NOTE: The PRS blue-sheeted BJC procedures referenced in this document are the active procedures as of the date of issuance of this procedure. Procedures noted in parentheses will become the reference procedures once these procedures are approved and implemented by PRS.

3.1 Quality Assurance/Quality Control

1. QC Samples

   The number and types of QC samples (e.g., duplicate, equipment rinsate, trip blank, etc.) shall be collected as specified in the task-specific WP and prepared in accordance with BJC-ES-2704, *Trip, Equipment and Field Blank Preparation* (PRS-ENM-2704, *Trip, Equipment and Field Blank Preparation*). Rinsate blanks are not required when disposable sampling equipment is used.

2. Control and Documentation of Deviations

   Any departures from the requirements specified in the approved,

task-specific WP or this procedure shall be authorized through the PRS Project Manager (or designee). Prior to deviating from those requirements, authorization and WP revision shall be in accordance with BJC-FS-1001, *Work Control Process* (PRS-WCE-0018, *Paducah Environmental Remediation Project Work Management Program*). Any deviations and one-time difficulties encountered in the field concerning sample collection or related activities shall be documented in the field logbook by the Sample Handler.

3.2 Field Preparations

1. PEMS is the data management system that supports sampling and measurement collection activities, the automatic transfer of laboratory SOW and COC information, and the receipt of analytical results in digital format.

   PEMS is the preferred approach for generating sample container labels and COC forms. The sampling team will pre-populate the PEMS database in accordance with the project-specific requirements.

2. The sample handler shall prepare field logbook(s) in accordance with BJC-ES-2700, *Field Logbooks* (PRS-ENM-2700, *Logbooks and Data Forms*).

3. The sampling team will assemble the necessary equipment, tools and supplies, and ensure that all required notifications, permits [e.g., RWP (if required), excavation and penetration permit, burn permit, hot-work permit] are active and in place, and that all pre-mobilization readiness activities are complete prior to field mobilization.

4. Sample technicians, sampling tools, and equipment will be obtained decontaminated and ready for use [see BJC-ES-2702, *Decontamination of Sampling Equipment and Devices* (PRS-ENM-2702, *Decontamination of Sampling Equipment and Devices*)] and shall be protected from sources of contamination during transport to the sampling location and between each individual sampling location during field sampling activities (e.g., wrapped in aluminum foil, sealed in plastic or other storage containers, placed on plastic sheeting in staging area).

5. Disposable sampling implements and supplies shall be new and unused and will not be decontaminated for reuse, but will be disposed of in accordance with WP and PRS waste handling procedures

6. Obtain new and certified clean sample containers from a commercial supplier or from the supporting analytical laboratory.

7. Enter the sample container lot number in the field logbook.

3.3 Equipment, Tools, and Supplies

The sample handler is accountable for preparing and gathering all needed logbooks, field instruments, samplers, equipment, tools and supplies to safely and successfully complete the soil sampling event. The items listed may be used as a guide, but may not be a complete list. Refer to the task-specific AHA(s) and WP, and the RWP (if one is required) to determine what instruments, supplies, materials, samplers and equipment are needed to safely execute the activities comprising the soil sampling event. Additional method specific requirements are included in the procedure methods of Section 3.4 through 3.6.

1. Field logbook(s)
2. PPE and other safety equipment specified by the AHA and RWP
3. Task-specific ES&H supplies needed to establish and control the work area
4. COC forms generated from PEMS database
5. Sample labels generated from PEMS database including extra labels
6. Custody seals
7. New sample containers appropriate for the samples to be collected with COA, or certificates of cleanliness
8. Survey pin flags, stakes or paint
9. Traffic control vests, cones and signs
10. Duct tape
11. Ruler and tape measure
12. Utility knife
13. Plastic bags and plastic wrap
14. Aluminum foil
15. Cooler chest(s) with ice or blue ice.
16. Decontamination supplies and equipment
17. Stainless steel or Teflon®-coated spade
18. Stainless steel, glass, Teflon®or disposable bowls
19. Stainless steel, Teflon®-coated or Teflon®trowels, scoops, scoopulas,

spoons, and/or spatulas

20. Teflon®sheet/film

21. Silicone tape or other U.S. EPA-approved sealing tape

22. Sample tubes and end caps

23. Indelible marking pens

24. Analytical balance

25. The following sampler types, with needed ancillary equipment and supplies as required by the sampling method specified in the WP:

- Spade, Spoon, or Scoop;
- Stainless steel hand-operated auger;
- Split-barrel sampler (with or without inserts);
- Thin-walled sampler and tubes;
- EnCore®or equivalent sampler and containers; and
- Trier

3.4 General Requirements

The sampling team members as assigned by the Project Manager (or designee) shall complete the following steps prior to initiating the soil sampling event.

1. Review the WP for the sampling method(s) and equipment to be used and reference to any photos, maps or figures that indicate or show proposed soil sampling locations, method(s) to be used, type(s), and number of soil samples to be collected (e.g., discrete or composite).

NOTE 1: Refer to the WP to determine whether the area where soil samples are to be collected is within a building, under slab or paved over. The slab or pavement will need to be penetrated prior to soil sample collection.

NOTE 2: Utility clearance will be required for all locations where excavation or penetration will be accomplished to a depth of greater than 1 foot below ground surface. Utility clearance activities will be completed in adherence to PRS procedures prior to excavating, driving, or drilling with the device to access and collect soil samples.

The area within a minimum 5-foot radius of a proposed

penetration (sampling location) will also be cleared for utilities. If a utility is identified within 3 feet of the proposed sampling location, the location will be moved and the clearance procedure will be repeated at the new location. If it is necessary for a penetration to be located in an area of known or suspected overhead and/or subsurface obstructions, special safety precautions will be implemented as required and all ES&H guidance and procedures that control penetrations shall be followed to prevent accidents.

If refusal is encountered [i.e., the manual or power driven/drilled sampling equipment can no longer be advanced (50 blows with a 140-pound hammer to advance sampler 6 inches)] before the required sample depth is reached, the location will be moved within the circumference of the cleared circle and reattempted. If refusal is encountered after 3-attempts, the location will be abandoned and will not be sampled.

The area where the test pit/trench/excavation will be dug shall be cleared for utilities prior to beginning soil sampling. The test pit/trench location will be relocated (if possible) and cleared for utilities if any overhead or subsurface obstructions are located or suspected. Special safety precautions will be implemented as required and all ES&H guidance and procedures that control digging or excavating in areas where overhead or subsurface obstructions are known or suspected shall be followed to prevent accidents.

Deviations encountered in the field concerning sample location, sample collection, or related activities shall be documented in the field logbook by the Sample Handler.

NOTE 3: Soil samples collected for VOC analysis always will be collected first, regardless of the sampler used, to minimize loss of volatiles due to disturbance and offgassing. The preferred collection method, if the VOC soil sample isn't collected, labeled, and shipped in the sampler (i.e., thin-walled tube or insert), is to use an EnCore® or equivalent sampler.

Use the EnCore® or equivalent sampler and sample container to collect the VOC sample(s) following the current EnCore® or equivalent sample collection and sampling procedure. Standard practice is to collect three EnCore® or equivalent samples to represent one sampling point. Deviation shall be recorded in the field logbook and on the COC in the remarks column.

If coarse-grained soil precludes the use of the EnCore® or equivalent sampler for VOC soil sample collection, then use a clean spoon or spatula and directly transfer the sample into a

sample container. Minimize the headspace by completely filling the container with soil. Note the deviation in the field logbook and on the COC in the remarks column.

2. Initiate the sampling event after completing all required notifications and entering required information in the field logbook prior to mobilizing to the field.

3. Record the area that will be sampled in the field logbook and mobilize to that area.

4. Prepare a decontamination area (if required).

5. Pre-locate proposed sampling point(s) using photos and maps (figures) from the WP for guidance prior to sample collection.

NOTE 4: In most cases, proposed environmental soil sampling locations are chosen prior to the actual sampling event and approximately located using a GPS device or other suitable method, or civil surveyed and temporally marked (e.g., a labeled survey pin flag, survey stake or survey paint). Use the pre-marked location(s) to guide the sampling effort.

6. The RCT and/or ES&H Technician will screen all sampling location(s) prior to sampling and inform the sampling team that it is safe to begin soil sampling.

7. Begin work by preparing the area around the proposed soil sampling location by laying down plastic sheeting or an equivalent material as groundcover to prevent contact with potentially transferable contaminants, spread of IDW, and possible cross contamination.

NOTE 5: Protective groundcover may also be required when powered equipment (e.g., drill rig, direct push rig, pneumatic hammer, manually controlled mechanical or hydraulic earth drills) is the method used to penetrate and reach the required sampling depth and collect the soil samples. Consult the WP for direction.

8. Cut a hole in the plastic sheeting of sufficient size to access the sampling point.

9. Use a stainless steel or Teflon®-coated spade to remove surface vegetation and debris from the sampling location if necessary.

10. Perform the sampling using the method and sampler type specified in the WP, while controlling the spread of IDW.

3.5 Soil Sampling Methods

3.5.1 Soil Sampling with a Trier, Spoon, Trowel, or Scoop

1. For soil sample collection at grade, along test pit/trench/excavation sidewalls or bottoms, use a Stainless steel, Teflon®-coated or Teflon® spoon or scoop to remove the layer of soil that may have been disturbed and in contact with the spade, heavy equipment bucket, or grader blade (reference WP).

2. Stage soil IDW on plastic sheeting when sampling at grade.

NOTE 1: A trowel may be used to cut a block of soil (sample) if the WP requires description and sampling of an undisturbed soil profile. The undisturbed sample will be described in accordance with BJC-ES-2303, *Borehole Logging* (PRS-ENM-2303, *Borehole Logging*) prior to preservation for laboratory testing or disruption and soil sample processing for analysis.

3. Use a decontaminated stainless steel trier [go to Step (4)], or use a Teflon®-coated or stainless steel trowel, scoop, scoopula, spoon, or spatula to collect the soil sample and place in a stainless steel, glass, Teflon® or disposable bowl [go to Step (5)].

NOTE 2: A trier sampler may be used to collect a core of soil that is fine-grained and cohesive. This sampler also is well suited for collecting soil samples from a test pit, trench, or excavation sidewalls and bottoms (at 0^0 to 90^0 angle from horizontal) when the test pit, trench, or excavation can be safely entered/exited for sample collection or when the sampling point(s) can be safely accessed remotely, without entry using an extension rod(s) connected to the trier sampler.

CAUTION

Follow all applicable ES&H requirements, guidance, and procedures before entering a test pit, trench or excavation.

4. For soil sampling with a trier proceed as follows:

- Insert the trier approximately perpendicular to the surface of the soil and rotate (one or two times) to cut a core,

- Pull the core out of the hole slowly to minimize sample loss, and

- Place sample in a stainless steel, glass, Teflon, or disposable bowl.

Process sample (Section 3.6 Sample Processing).

5. Before leaving or filling the sampling location, use a ruler or tape measure to measure the depth from which the sample was taken and record sample number and depth in the field logbook.

6. Decontaminate the ruler or tape before use at the next sampling location.

7. Backfill sampled location to grade, if appropriate, using soil IDW generated during sample collection as specified in the WP. Use of soil generated during sample collection for backfill is only permitted when sampling has not penetrated the RGA.

8. **IF** the location is to be civil surveyed (reference WP), **THEN** label and stake location using a survey pin flag, survey stake or survey paint, and record in the field logbook.

9. Pickup and bag any plastic sheeting, trash and other disposable supplies before moving to the next sampling location.

10. Repeat Steps 1 though 10 until all soil samples have been collected at the sampling location.

11. Remove all rope, barriers, placards, etc., that were used to secure the area.

3.5.2 Manual Sampling Using an Auger

1. Use a manual auger or a manually controlled mechanical or hydraulic earth drill to advance the auger to the desired depth (reference the WP).

2. Carefully stage excess IDW (soil) from the auger bucket or solid auger flight(s) on the plastic sheeting to prevent the spread of contaminants.

NOTE 1: It may be necessary to auger down, clear and remove soil from the borehole several times to reach the desired sampling depth.

3. Attach a decontaminated auger bucket on the sampler insertion equipment and insert into the borehole.

NOTE 2: Avoid hitting the borehole wall while inserting the auger bucket to mitigate sidewall sloughing and the possibility of cross contamination.

4. Mark sampler insertion equipment for a reference point.

5. Rotate the auger to collect the sample and carefully retrieve

the full bucket.

NOTE 3: Reference WP for required VOC sampling method. Also refer to Section 3.4 General Requirements, Note 3.

6. Remove the soil sample from the auger bucket using a stainless steel, Teflon®-coated or Teflon® spoon or spatula to collect the required sample and place in a stainless steel, glass, Teflon® or a disposable bowl for mixing.

7. Process sample (Section 3.6 Sample Processing).

8. Repeat Steps 1 though 7 until all soil samples have been collected at the sampling location.

9. Backfill the borehole to grade using soil IDW generated during sample collection or other approved material as specified in the WP. Use of soil generated during sample collection for backfill is only permitted when sampling has not penetrated the RGA.

10. If the location is to be civil surveyed (reference WP), label and stake location using a survey pin flag, survey stake or survey paint, and record in the field logbook.

11. Pickup and bag any plastic sheeting, trash, and other disposable supplies before moving to the next sampling location.

12. Remove all rope, barriers, placards, etc. that were used to secure the area.

3.5.3 Sampling Using a Thin-Walled Tube Sampler

A thin-walled sampler is used to collect undisturbed sample cores. A drill/direct push rig or hand operated auger may be used to reach the top of the interval to be sampled at the location (refer to WP for requirements). The thin-walled sampler then is pushed through the bottom of the borehole to collect the sample and the core is extracted from the borehole. The undisturbed sample normally is described in accordance with BJC-ES-2303, *Borehole Logging* (PRS-ENM-2303, *Borehole Logging*) prior to soil sample collection.

1. Advance the borehole to the desired sampling depth using the method specified in the WP prior to collecting the sample.

2. Stage excess soil IDW on the plastic sheeting to prevent the spread of contaminants and/or cross contamination.

NOTE 1: It may be necessary to clear and remove soil from the borehole several times to reach the desired sampling depth.

This will be dependent on the method used to drill/penetrate to the sampling depth.

3. Assemble the thin-walled sampler and attach to sampler insertion equipment (reference WP).

4. Carefully lower the thin-walled sampler and insertion equipment to the bottom of the borehole.

NOTE 2: Avoid hitting the borehole wall while inserting the sampler to mitigate sidewall sloughing and the possibility of cross contamination.

NOTE 3: Mark manual sampler insertion equipment for a reference point.

5. Rest the dead weight of the rods and sampler on the bottom of the borehole.

6. Position a drive device on the sampling rods (reference WP).

7. Shove, twist, push, or pound the tube holder into the soil using the specified method in the WP until the tube is full or refusal is met.

8. Carefully retract sampler and sample insertion equipment from the borehole to minimize loss of soil from the thin-walled tube and disassemble.

9. Immediately cover both ends of the tube with Teflon® film or microcrystalline wax (see WP for detail) and cap if the collection tube will be used as the sample container.
IF the tube will not be used as the sample container, **THEN** proceed to Step 12.

10. Label the top and bottom end of the tube and indicate which end is to be opened at the laboratory.

11. Use silicone tape to tape both end caps to ensure retention before shipping tube to the laboratory.

NOTE 4: Electrical tape shall never be used to tape end caps.

NOTE 5: Reference WP for required VOC sampling method. Also refer to Section 3.4 General Requirements, Note 3.

12. Process sample (Section 3.6 Sample Processing).

13. Repeat Steps 1 though 12 until all soil samples have been collected at the sampling location.

14. Backfill the borehole to grade using soil IDW generated during

sample collection or other acceptable material as specified in the WP. Use of soil generated during sample collection for backfill is only permitted when sampling has not penetrated the RGA.

15. **IF** the location is to be civil surveyed (reference WP), **THEN** label and stake location using a survey pin flag, survey stake or survey paint, and record in the field logbook.

16. Pickup and bag any plastic sheeting, trash, and other disposable supplies before moving to the next sampling location.

17. Remove all rope, barriers, placards, etc., that were used to secure the area.

3.5.4 Sampling Using a Split-Barrel or MacroCore Sampler

1. Advance the borehole to the desired sampling depth using the method specified in the WP.

2. Stage excess soil IDW on the plastic sheeting to prevent the spread of contaminants and/or cross contamination.

NOTE 1: It may be necessary to clear and remove soil from the borehole several times to reach the desired sampling depth.

3. Carefully remove the drilling or penetration device from the borehole and stage excess IDW (soil) on the plastic sheeting to prevent the spread of contaminants and/or cross contamination.

4. After reaching the sampling depth, install the split spoon or MacroCore sampler (with or without liner/insert) on the drill rods (consult WP) and reinsert into the borehole when ready to sample.

NOTE 2: Avoid hitting the borehole wall while reinserting to mitigate sidewall sloughing and the possibility of cross contamination.

5. Mark sampler insertion equipment for a reference point.

6. Position the driving device on the sample insertion equipment (consult WP).

7. Rest the dead weight of the sampler, sample insertion rod, and hammer on the bottom of the borehole.

8. Power or manually drive the sampler into the soil.

NOTE 3: When using standard penetration test equipment to drive the sampler mark the drill rods in successive 6-inch increments so

that advance of the sampler can be easily observed. Advance the split-barrel sampler the required distance (generally 18 inches) with blows from the 140-pound hammer. Count the number of blows applied for each 6-inch increment of sampler advance and record blow count in the field logbook. Refusal generally is indicated if more than 50 blows are required to advance the sampler 6 inches.

9. Carefully retrieve and open the sampler and remove tube, if used, from the borehole. Remove disturbed material in the upper end of the sample tube using a stainless steel or Teflon®-coated spatula or spoon and immediately cover both ends of the tube with Teflon® film and cap if the collection tube will be used as the sample container. **IF** the tube will not be used as the sample container, **THEN** proceed to Step 11.

10. Use of tubes/inserts/liners for the collection of soil samples for VOC analysis is preferable (refer to WP). For VOC samples, seal, label, and ship the tube intact or use an EnCore® or equivalent sampler and associated sample container to collect the VOC samples.

NOTE 4: Reference WP for required VOC sampling method. Also refer to Section 3.4 General Requirements, Note 3.

11. Process sample in accordance with the WP and as indicated in Section 3.6, Soil Sample Processing, of this procedure.

12. Repeat Steps 1 though 11 until all soil core samples have been collected at the sampling location.

13. **IF** the location is to be civil surveyed (reference WP), **THEN** label and stake location using a survey pin flag, survey stake, or survey paint, and record in the field logbook.

14. Backfill the borehole to grade using soil IDW generated during sample collection or another acceptable material as specified in the WP. Use of soil generated during sample collection for backfill is only permitted when sampling has not penetrated the RGA.

15. **IF** the location is to be civil surveyed (reference WP), **THEN** label and stake location using a survey pin flag, survey stake or survey paint, and record in the field logbook.

16. Pickup and bag any plastic sheeting, trash, and other disposable supplies before moving to the next sampling location.

17. Remove all rope, barriers, placards, etc., that were used to secure the area.

3.6 Soil Sample Processing

The type of soil sample collected may be a discrete sample or a composite sample. Each of these sample types must be processed to ensure that a homogeneous sample is collected that is representative and meets data quality objectives given in the task-specific WP.

1. Composite the soil in a stainless-steel or glass bowl as follows unless directed otherwise by governing plans and procedures. Composite samples normally are not an acceptable means of collecting samples to be analyzed for volatile organic compounds (VOC)s, semivolatile organic compound (SVOC)s, and dissolved gases.

    - Collect soil aliquots in the same manner and of generally equal proportion.

    - Ensure aliquots are well mixed to ensure that composite sample is homogeneous.

      A stainless-steel or glass bowl and stainless-steel spoon serve well for mixing purposes. It is important that waste, soil, and sediment samples be mixed thoroughly to ensure that the sample is as representative of the sample media. The most common method of mixing is referred to as quartering. The quartering procedure should be performed as follows:

    a. The material in the sample pan is divided into quarters and each quarter is mixed individually.

    b. Two quarters are mixed together to form halves.

    c. The two halves are mixed to form a homogenous matrix.

    d. This procedure should be repeated several times until the sample is adequately mixed. If round bowls are used for sample mixing, adequate mixing is achieved by stirring the material in a circular fashion, reversing direction, and occasionally turning the material over.

2. Transfer homogenized soil samples into sample container(s), using appropriate equipment (i.e., stainless-steel or Teflon® spoon, spatula, or disposable scoop) until completely full and securely tighten lid.

3. Seal sample containers and affix custody seals in accordance with BJC-ES-2708, Chain of Custody Protocol for Environmental Sampling (Chain-of-Custody forms, Field Sample Logs, Sample Labels, and Custody Seals)..

4. Sample containers should be labeled prior to collection of the sample.

Enter any remaining information on the sample label [e.g., date and time (24-hour clock)] at the time of sample collection. See BJC-ES-2708, *Chain of Custody Protocol for Environmental Sampling* (PRS-ENM-2708, *Chain-of-Custody forms, Field Sample Logs, Sample Labels, and Custody Seals*).

5. Place the sample container in a cooler with ice or blue ice to maintain a preservation temperature of 4^0C as required in the WP. Cooling normally is the only preservation method required for soil samples collected in the field.

6. Repeat Steps 1 through 5 until all soils samples are collected.

7. Complete the field logbook entries in accordance with BJC-ES-2700, *Field Logbooks* (PRS-ENM-2700, *Logbooks and Data Forms*). Logbook entries shall be made at the time of sample collection and before leaving the sampling location.

4.0 POST-PERFORMANCE ACTIONS

1. Complete COC forms in accordance with BJC-ES-2708, *Chain of Custody Protocol for Environmental Sampling* (PRS-ENM-2708, *Chain-of-Custody forms, Field Sample Logs, Sample Labels, and Custody*).

2. Sample containers shall undergo radiation surveys to be performed by a RCT in accordance with applicable radcon procedures.

3. In coordination with the RCT, release the sample(s) and related COC documentation to the transportation specialist, or designee, for shipment to an off-site laboratory or deliver the sample(s) to the on-site laboratory.

4. Any sampling equipment, tools, or supplies that are contaminated as a result of their use during sample collection and not otherwise intended to be disposed of will be packaged or containerized for removal from the sampling location and decontaminated in accordance with BJC-ES-2702, *Decontamination of Sampling Equipment an Devices* (PRS-ENM-2702, *Decontamination of Sampling Equipment and Devices*). Prior to transporting contaminated equipment, tools, or supplies, contact the transportation specialist.

5. Any IDW generated during soil sampling activities shall be collected, segregated into appropriate containers, labeled, and disposed of (or treated prior to disposal) in accordance with the requirements in the WP. Prior to transporting IDW, contact the transportation specialist.

5.0 RECORDS

The field logbook, sample container COA or certificates of cleanliness, and COC Form(s) are project records and shall be maintained according

to BJC-OS-1001, *Records Management, Including Document Control* (PRS-DOC-1009, *Records Management, Administrative Records, and Document Control*).

6.0 SOURCE DOCUMENTS

- U.S. Environmental Protection Agency. November 2001. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*. Region 4, Environmental Compliance Branch, Athens, GA.
- ASTM D 1452 (American Society for Testing and Materials)– 80 (Reapproved 2000). *Practice for Soil Investigation and Sampling by Auger Borings.*
- ASTM D 1587 – 00. *Method for Thin-Walled Tube Geotechnical Sampling of Soils.*
- ASTM D 2937 – 04. *Density of Soil in Place by the Drive-Cylinder Method.*
- ASTM D 3550 - 01. *Practice for Ring-Lined Barrel Sampling of Soils.*
- ASTM D 4700 – 91 (Reapproved 1998). *Soil Sampling from the Vadose Zone.*
- ASTM D 5451 – 93 (Reapproved 2004). *Standard Practice for Sampling Using a Trier Sampler.*
- ASTM D 5633 – 04. *Practice for Sampling with a Scoop.*
- ASTM D 5784 – 95. *Guide for Use of Hollow-Stem Augers for Geo-environmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices.*
- ASTM D 6169 – 98 (Reapproved 2005). *Guide for Selection of Soil and Rock Sampling Devices with Drill Rigs for Environmental Investigations.*

ATTACHMENT A
DEFINITIONS/ACRONYMS
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DEFINITIONS

COMPOSITE SOIL SAMPLE – A soil sample that consists of a number of discrete soil samples collected from a body of material and homogenized prior to analysis. The objective of soil sample compositing is to represent the average condition of the sampled soil.

DISCRETE SOIL SAMPLE – A soil sample collected from one specific horizon and vertical interval (usually 6 inches).

DIRECT PUSH – Direct push sampling involves pushing a small-diameter hollow steel rod into the ground to a selected depth and extracting a soil or groundwater sample, and can be used in most materials that can be augured or sampled with a split spoon. It can be attached to cone penetrometer rods and driven into the soil with hydraulic rams.

HOLLOW-STEM AUGER DRILL RIG - The hollow-stem auger column rotates as it drills into the ground and is designed to push soil up and out of the borehole along the outside of the auger. The auger itself is driven either mechanically or by a hydraulically-powered drill rig. A plug is placed through the auger to prevent soil from rising through the hollow portion of the stem. Samples are retrieved by retracting the plug and lowering the sampler (e.g., split spoon w/ tube insert, thin-walled tube collection tube through the auger and driving or pushing the sampler to capture the sample).

MANUALLY CONTROLLED MECHANICAL OR HYDRAULIC EARTH DRILLS - A mechanically or hydraulically powered portable drilling unit whose position, orientation, location, and direction is controlled by one or more operators.

MANUALLY OPERATED AUGER – Manually operated augers consist of an auger bit, a solid or tubular drill rod, and a "T" handle. When the drill rod is threaded, extensions can be added or auger bits interchanged. The auger tip drills into the ground as the handle is rotated, and soil retained on the auger tip is brought to the surface and may used as the soil sample. Alternately, augers can be used to bore to the desired sampling depth, and a tube sampler used for collection. Diameters typically range between 2.54 and 10.16 cm (1 and 4 in.). Augers normally are used in conjunction with 0.9-1.2 m (3-4 ft) metal shafts and T-handles.

PNEUMATIC HAMMER - A pneumatic hammer (jackhammer) is a portable percussive-drill, operated by compressed air and can be used to drive samplers, install drive points, drill rock, break up pavement, etc. It works in the manner of a hammer by jabbing but not by rotating.

PUSH OR DRIVE SAMPLERS - Pushed or driven samplers penetrate into the soil without rotation and may be used for obtaining disturbed samples of most soils.

SAMPLE HANDLER - The person (or designee) responsible for ensuring that sampling activities are performed in accordance with the current, approved task-specific WP and associated procedures, and approving (or coordinating the approval of) deviations there from. Specific position titles with these responsibilities may be designated as these: project technical lead, sampling manager, lead engineer, sampling team leader, or task leader.

ATTACHMENT A
DEFINITIONS/ACRONYMS
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SPLIT SPOONS - Split spoons are tubes constructed of high strength alloy steel with a tongue and groove arrangement running the length of the tube, allowing it to be split in half. The two halves are held together by a threaded drive head assembly at the top, and a hardened shoe at the bottom, with a beveled cutting tip. The sampler can be driven manually or by a 140-pound weight dropped through a 30-inch interval.

TEST PITS - Test pits are used for exposing and sampling the subsurface soil section. The test pit must be large enough to allow detailed description of the material in situ and allow soil sampling for undisturbed samples. In plan view the test pit will be square, rectangular, or circular.

TEST TRENCHES - Test trenches are used to perform a function similar to test pits, but offer the distinct advantage of a continuous exposure of the continuity and character of the subsurface soil section. Test trenches may be excavated with backhoes, trackhoes, or bulldozers depending upon the required size and depth of the trench.

THIN-WALLED SAMPLERS - The thin-walled open sampler consists of a tube affixed to a sampler head assembly, which may or may not be equipped with a check valve. Thin-walled tubes are sharpened on one end and, therefore, may be easily damaged by buckling or by blunting or tearing of the cutting edge as they are driven into stiff or coarse soils. To reduce the potential for damage, the tube should be pushed rather than driven. The basic principle of operation of the thin-walled sampler is to force the cylindrical tube into the soil in one continuous push without rotation.

THIN-WALLED TUBES - Tubes are similar to augers except that a tube with a cutting tip is attached to the drill rod. Instead of being rotated, the tube is pushed into the soil. Often, augers are used to drill the hole and tubes are used to collect the sample. Sample collection procedures are similar to split-spoon sampling except that the tube is pushed into the soil, using the weight of the drill rig, rather than driven.

TRIER - A hand-operated trier consists of a tube that has been cut in half, a solid or tubular drill rod, and a "T" handle. When the drill rod is threaded, extensions can be added for extended reach. The tip of the trier is sharpened which allows the sampler to cut into soil.

ACRONYMS

AHA - Activity Hazards Analysis
COA - Certificate of Analysis
COC - chain of custody
IDW - investigation-derived waste
PEMS - Project Environmental Measurements System database
PPE - personal protective equipment
PRS- Paducah Remediation Services, LLC
RADCON - Radiological Controls
RCT- radiological controls technician
RWP - radiological work permit
VOC- volatile organic compound
WP - work package