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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure describes the methods for collecting subsurface soil samples using Direct Push Technology (DPT).

1.2 Scope

This procedure applies to all types of subsurface soil sampling using DPT methods completed by the Deactivation & Remediation (D&R) Contractor or any D&R Contractor's subcontractors for the U.S. Department of Energy (DOE) at or near the DOE-owned Paducah Gaseous Diffusion Plant (PGDP).

This procedure applies to soil samples collected at depths equal to or greater than one foot below ground surface and extends to penetration limits of the DPT system employed for the sampling activity. Depth constraints are dependent on many variables including:

- The type of driving system used (e.g., the power and mass of the equipment used).
- The diameter of the down-hole tool and drive rod or casing being advanced.
- The resistance of subsurface materials against tool advance (which is controlled by formation density, degree of consolidation, and grain size).
- The soil friction acting on the down-hole tools, drive rod, or casing.

Any changes to or deviation from this procedure must be approved by the Project Manager (PM), prior to initiation of subsurface soil sampling using DPT methodologies.

2.0 REFERENCES

2.1 Use References

- CP3-OP-0025, Document Control Process
- CP3-RD-0010, Records Management Process
- CP3-WM-1037, Generation and Temporary Storage of Waste Materials
- CP3-WM-9503, Off-Site Shipments by Air Transport
- CP4-EN-0227, *Trenching, Excavation, and Penetration Permit*
- CP4-ES-0040, *Composite Sampling*
- CP4-ES-0043, *Temperature Control for Sample Storage*
- CP4-ES-2700, *Logbooks and Data Forms*
- CP4-ES-2702, *Decontamination of Sampling Equipment and Devices*
- CP4-ES-2704, *Trip, Equipment and Field Blank Preparation*
- CP4-ES-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*
- CP4-ES-5003, *Quality Assured Data*
- JHA-10905, *Soil Sample Collection For Characterization of Soil*

2.2 Source References

- CP2-HS-1000, *Integrated Safety Management System Description*
- CP3-SM-1101, *Activity Level Work Request, Planning, Scheduling and Release*
- McCall W., Nielsen D.M., Farrington S.P., and Christy T.M. "*Use of Direct-Push Technologies in Environmental Site Characterization and Ground-Water Monitoring*," Practical Handbook of Environmental Site Characterization and Ground –Water Monitoring, Second Edition. CRC press, 2006. P 345-471.
- U.S. Environmental Protection Agency (EPA), November 2007. Soil Sampling Operating Procedure, Number SESDPROC-300-R1, Science and Ecosystem Support Division, Athens, GA.

3.0 COMMITMENTS

None

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Precautions

4.1.1 The D&R Contractor policy is to maintain an effective program to control personnel exposure to chemical, radiological, and physical stress according to CP2-HS-1000, *Integrated Safety Management System Description.*

4.1.2 All field personnel will be required to wear personal protective equipment, as specified in the project-specific Health and Safety Plan, Radiation Work Permit (RWP), and Sampling and Analysis Plan (SAP).

4.1.3 This procedure is **NOT** for use in the collection of groundwater samples unless approved in a project-specific Sampling Analysis Plan (SAP).

4.2 Limitations

None

5.0 PREREQUISITES

5.1 Prior to performing any action steps identified in this procedure for the first time, Project Managers and Samplers, read this document in its entirety.

5.2 Use of this procedure as a work control document is defined in CP3-SM-1101, *Activity Level Work Request, Planning, Scheduling and Release.* **When** used in the field for Activity Level Work (ALW), keep a copy of the associated Job Hazard Analysis (JHA) with this procedure.

5.3 Prior to daily use, verify that the procedure and JHA are the current versions.

5.4 Review the applicable JHA prior to performing work using this procedure.

5.5 Prior to performing any action steps identified in this procedure, complete any required applicable training identified for the position according to CP4-TR-0102, *Conduct of Training,* **and** CP3-OP-0208, *Required Reading/Crew Briefing.*

6.0 INSTRUCTIONS

6.1 General Requirements

6.1.1 **While** still in the sampling casing, maintain the proper orientation of the sample according to Appendix B, *Summary of Sample Collection Methods*.

6.1.2 **If** necessary, **then** obtain multiple samples, representing different depths, from a single retracted casing.

6.1.3 For volatile organic compound (VOC) investigations, **if** biased sampling is called for in the Sampling and Analysis Plan (SAP), **then** use a field photo-ionization detector (PID) to pinpoint depth of contamination from a single extracted casing

NOTES:

When powered equipment is used to collect the sample, care must be taken that exhaust fumes, gasoline, and/or oil do **NOT** contaminate the borehole or the sample.

When re-fueling or servicing powered equipment within a 25 foot radius of the sample location, caution should be used to prevent cross contamination of samples.

6.1.4 Use powered equipment to acquire soil samples from any depth (surface, shallow subsurface and deep subsurface).

6.2 Pre-Performance Activities

Project Manager

6.2.1 Issue appropriate notifications for sampling activity to be conducted at PGDP and associated areas.

NOTE:

Regulatory Compliance will review and approve the excavation permit to determine if notification requirements have been met.

6.2.2 Obtain an excavation/penetration permit according to CP4-EN-0227, *Trenching, Excavation, and Penetration Permit*, and any other required permits (i.e., Radiological Work Permit).

NOTES:

A DPT system generally consists of a sampling tool [composed of a drive tool body, tip (for some tools), a sample liner or chamber], a drive rod or casing extending from the sampling zone to the surface, and the equipment used to advance the tool or logging device and rod or casing.

A brief summary of subsurface soil collection methods using DPT technology is included as Appendix B.

Steps in the next subsection are numbered for reference only. The numbers do **NOT** indicate that the steps are to be performed in order or sequentially.

Field Team Personnel/Sampler

6.2.3 Inspect threads on drill rods for wear.

6.2.4 Prior to equipment use, make sure the DPT percussion hammer is properly charged with nitrogen.

6.2.5 Survey **and** stake sampling locations, as required, **and** determine appropriate sampling requirements.

6.2.6 **If** necessary as determined by the field project manager, **then** decontaminate drill rods and equipment according to CP4-ES-2702, *Decontamination of Sampling Equipment and Devices*, as applicable.

6.2.7 Place clean plastic sheeting on a flat and level surface near the sampling area, if possible.

NOTE:

Drive rods may be stored in the rod trays on DPT rig, if provided.

6.2.8 Place decontaminated equipment to be used on plastic.

6.2.9 **When NOT** in use, cover all sampling equipment **and** supplies with clean plastic sheeting.

NOTE:

The decontamination line should be staged on plastic sheeting.

6.2.10 **If** required by the site-specific SAP, establish decontamination line.

6.2.11 Document the sampling events by recording the information in the designated field logbook according to CP4-ES-2700, *Logbooks and Data Forms*.

6.2.12 Follow applicable sampling requirements related to data quality according to CP4-ES-5003, *Quality Assured Data*.

6.2.13 Enter necessary information on the sample label [e.g., date and time (24-hour clock)] according to CP4-ES-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*.

6.2.14 Complete chain of custody forms according to CP4-ES-2708.

6.2.15 **If** applicable, **then** prepare quality control samples that will collect the soil material according to CP4-ES-2704, *Trip, Equipment and Field Blank Preparation*.

6.3 Collection of Soil Samples/Volatile Organic Compound Analysis

NOTE:

The requirements for collecting grab samples of subsurface soil for VOCs or other samples degraded by aeration are found in Steps **6.3.1** through **6.3.5.**

<u>Sampler</u>

6.3.1 Collect soil samples for VOC analysis first to minimize loss of volatiles due to disturbance and off gassing.

NOTES:

VOC samples are to be collected with minimum amount of disturbance as possible.

The selected method of collection may vary depending upon site conditions, data quality objectives, and the degree of known or suspected contaminant(s).

6.3.2 Collect VOC samples as undisturbed grab samples to minimize the potential loss of VOCs due to volatilization using one of the following:

- Method or sampling device with Teflon or stainless steel sample liners, or other approved material
- Method and equipment specified in the project-specific SAP

6.3.3 Complete any necessary health and safety field screening for volatiles and radionuclides using the instruments specified in the site-specific documents, including the Radiation Work Permit.

6.3.4 **If** the sampling method itself does **NOT** already seal the material in a container, **then** place the soil in each of the designated containers.

6.3.5 Seal the container **and** ensure that no headspace is left in the container.

6.4 Collecting Samples for Nonvolatile or inorganic Compound Analysis

NOTE:

The requirements for collecting samples of subsurface soil for nonvolatile organic or inorganic analyses are found in Steps **6.4.1** through **6.4.7**.

Sampler

6.4.1 Collect the required sample volume using the sampling device specified in the site-specific SAP.

6.4.2 Complete any necessary health and safety field screening for volatiles and radionuclides using the instruments specified in the site-specific documents, including the Radiation Work Permit.

6.4.3 **If** sample being collected is a grab sample, **then** advance to Step **6.4.6**.

6.4.4 **If** sample being collected is a composite sample, **then** transfer each aliquot (sub sample) directly into a clean stainless steel or Teflon lined tray or bowl according to CP4-ES-0040, *Composite Sampling*.

6.4.5 Homogenize the sample, if applicable, by thoroughly mixing the total sample volume using a decontaminated stainless steel or Teflon-lined spoon, spatula, or trowel according to CP4-ES-0040.

6.4.6 Distribute the sample volume into the appropriate sample containers (including the required quality control samples).

6.4.7 Secure the appropriate cap on each container immediately after filling.

6.5 Sample Location Changes

Field Team Personnel

6.5.1 **If** sampling locations defined in the SAP, including sample depth cannot be sampled due to a physical obstruction, **then** contact the PM.

6.5.2 **If** the project manager approves a change, **then** move the sampling location.

6.5.3 Document the change in the field logbook **and** notify the data manager.

7.0 ACCEPTANCE CRITERIA

None

8.0 POST PERFORMANCE WORK ACTIVITIES

Field Team Personnel/Sampler

8.1 Wipe sample containers clean with a Kimwipe or paper towel.

8.2 DISPOSE of non-fissile waste or material generated during the sampling activity according to CP3-WM-1037.

8.3 Record required information such as sample collection time and date on sample label, field custody form, logbook, and other data collection forms.

8.4 Place samples in a sample cooler containing ice bags or “blue ice” to maintain a preservation temperature of 4°C, as required.

8.5 Ensure that the temperature of the sample(s) is maintained according to CP4-ES-0043, *Temperature Control for Sample Storage.*

8.6 **If** samples are to be shipped off-site, **then** ship according to CP3-WM-9503, *Off-Site Shipments by Air Transport*

8.7 Decontaminate equipment according to the SAP and/or CP4-ES-2702.

8.8 Copy **and** submit field data forms (including all automatic data recording media, such as print-outs, logs, disks or tapes, and activity-specific data collection forms) according to CP3-RD-0010, *Records Management Process*, **and** CP3-OP-0025, *Document Control Process*.

8.9 Complete logbook according to CP4-ES-2700.

8.10 Record Global Positioning System readings, if required, **and** transfer the data to the Sample Management Office for inclusion in PGDP databases (e.g., Paducah Environmental Measurements System).

8.11 Clean up work area, remove trash, debris, restore site to original state.

8.12 Dispose of the excess sample media, personnel protective equipment, plastic, and other waste materials as specified by the Waste Management Plan, Statement of Work, or other applicable documents.

9.0 RECORDS

9.1 Records Generated

None.

9.2 Records Disposition

The records are to be maintained in accordance with CP3-RD-0010, *Records Management Process*.

Appendix A – Acronyms/Definitions

ACRONYMS

ALW – Activity Level Work

CAB – cellulose acetate butyrate

D&R – Deactivation & Remediation

DOE – United States Department of Energy

DPT – Direct Push Technology

JHA – Job Hazard Analysis

PGDP – Paducah Gaseous Diffusion Plant

PID – photo-ionization detector

PM – Project Manager

RWP – Radiation Work Permit

SAP – Sampling and Analysis Plan

VOC – volatile organic compound

DEFINITIONS

Composite Sample - A sample collected at a given point in time consisting of a series of discrete samples (aliquots) that have been mixed together.

Grab Sample – An individual sample or aliquot collected from a single location at a specific time or period of time.

Spoon/Scoop – A small stainless steel or Teflon-lined utensil approximately 6 to 8 in. in length with a stem-like handle.

Subsurface Soil – The soil that exists 1 ft. (30 cm) or more below ground surface.

Trowel – A small stainless steel shovel approximately 6 in. to 8 in. in length with a slight (~140º) curve and a stem-like handle.

Appendix B – Summary of Sample Collection Methods

DPT technology includes a variety of methods for collecting samples of environmental media. Soil samples are obtained using DPT machines that advance a sampling tool by pushing (using hydraulic rams and the static weight of the machine), driving (using hydraulic or mechanical percussion hammers), or vibrating (using a vibratory drive head). The DPT machines typically used range from small hand tools, lightweight all-terrain or tracked vehicles, to cargo vans and pickup trucks. The tools typically are advanced using either one string or two concentric strings of small-diameter rods or drive casing. Rotary drilling action generally is not used to advance the rods or tools and essentially no drill cuttings are generated from the DPT soil sampling process. Some small diameter sampling tools can even be advanced manually, using "slam bars" or hand-held percussion hammers.

Geoprobe® Soil Samplers

Geoprobe® is the brand name of widely used DPT equipment specifically designed for the environmental industry and offers several tools for soil sample collection. Among these are the Macro-Core® Soil Sampler and the Large Bore® and Dual Tube® soil sampling systems.

The Macro-Core MC5 sampler is a solid barrel, direct push device commonly used as an open-tube sampler to collect continuous core samples of unconsolidated materials at depth. Standard Macro-Core sample tubes come in lengths of 48 inches and 60 inches with outside diameters of 2.25 inches. Samples are collected inside a removable liner.

The Large Bore sampler is a solid barrel, piston sealed, direct push device for collecting discrete interval samples of unconsolidated materials at depth. The sampler is approximately 30-inches long and has a 1.5-inch outside diameter. The Large Bore sampler is capable of recovering a discrete sample core 22 inches x 1.0 inches contained inside a removable liner. The liner is a 24-inch long by 1.15-inch outside diameter removable/replaceable thin-walled tube that fits inside the Large Bore sample tube. Liners facilitate retrieval of the sample and may be used for storage, when applicable. The Large Bore soil sampler is pushed with 1.25-inch diameter probe rod.

The Dual Tube 22 sampler is a direct push system for collecting continuous core sample of unconsolidated materials from within a sealed casing of 2.25-inch probe rods. Samples are collected and retrieved within a liner that is threaded onto the leading end of a string of center rods. The center rods hold the liner in place as the outer casing is driven to fill the liner with soil. The inner rods are then retracted to retrieve the full liner. This system eliminates the generation of side slough in the sample and prevents cross-contamination. Thin-walled polyvinyl chloride (PVC) sample tubes, with a 1.375-inch outside diameter, typically are used to contain and retrieve the core samples. Common sample tube lengths are 36 inches, 1 meter, 48 inches, and 60 inches.

Liner Use and Material Selection

Due to the mode of operation, the Geoprobe soil samplers are commonly used with a liner. Liners are available in the following materials: stainless steel, brass, cellulose acetate butyrate (CAB), PVC, and Teflon®. If samples are collected for organic compound analyses, stainless steel or Teflon® liners commonly are required. CAB liners may be used if metals or other inorganic constituents are the object of the investigation.

Appendix B – Summary of Sample Collection Methods (Cont'd)

Sample Orientation

When the liners and associated sample are removed from the sample tubes, it is important to maintain the proper orientation of the sample. This is particularly important when multiple sample depths are collected from the same push. It also is important to maintain proper orientation to define precisely the depth from which an aliquot was collected. Maintaining proper orientation typically is accomplished using vinyl end caps. Convention is to place red caps on the top of liner and black caps on the bottom to maintain the proper sample orientation. Orientation also can be indicated by marking on the exterior of the liner with a permanent marker.