WORKING COPY

VERIF. DATE: _____

INTIALS: _____

CP4-ES-2300 **FRev. 1**	**TITLE**: Collection of Soil Samples	Page 1 of 16

DOCUMENT CATEGORY: ☐ Administrative ☒ Technical

LEVEL OF USE: ☐ Information Level ☒ Reference Level ☐ Continuous Use

FUNCTIONAL AREA: Environmental Services **SUBJECT MATTER AREA:** Environmental Sampling	**SUBJECT MATTER EXPERT**: Jeff Bennett, Sampling Operations FLM
NUCLEAR SAFETY REVIEW DOCUMENTATION: FRNP-18-0020-D	**APPROVED BY/DATE** (Signature on file): Pam Baird, Characterization Manager, 1/17/18
REQUIRED REVIEW DATE (or expiration date for temporary change): 1/17/2021	**EFFECTIVE DATE**:

REVISION/CHANGE LOG

Revision/Change Letter	Description of Changes	Pages Affected	Date of Revision/Change
FR0	Initial FRNP release	All	10/20/17
FR1	General Revision	All	1/17/18

TABLE OF CONTENTS

1.0 PURPOSE AND SCOPE 3
1.1 Purpose 3
1.2 Scope 3
2.0 REFERENCES 3
2.1 Use References 3
2.2 Source References 4
3.0 COMMITMENTS 4
4.0 PRECAUTIONS AND LIMITATIONS 4
4.1 Precautions 4
4.2 Limitations 4
5.0 PREREQUISITES 5
6.0 INSTRUCTIONS 5
6.1 General Sampling Requirements 5
6.2 Soil Sample Site Preparation 6
6.3 VOC Sampling Requirements 7
6.4 Soil Sampling with a Trier, Spoon, Trowel, or Scoop 7
6.5 Manual Sampling Using an Auger 8
6.6 Sampling Using a Thin-Walled Tube Sampler 9
6.7 Sampling Using a Split-Barrel or MacroCore® Sampler 10
6.8 Soil Sample Processing 11
7.0 ACCEPTANCE CRITERIA 12
8.0 POST PERFORMANCE WORK ACTIVITIES 12
9.0 RECORDS 13
9.1 Records Generated 13
9.2 Records Disposition 13
APPENDIX A – ACRONYMS/DEFINITIONS 14

1.0 PURPOSE AND SCOPE

1.1 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 described include:

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

A sampling and analysis plan or sampling and analysis event plan (SAP/SAEP) or task-specific Work Package (WP) will specify the type of soil sampler(s) to 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 (for example, degree of consolidation and moisture content; type; volume and depth of sample required; and the characteristics of the soil to be sampled). The methods used may be either manual (such as, drive hammer, hand auger, post-hole digger, and slide hammer) or powered (such as, drill rig, direct push, pneumatic hammer, manually controlled mechanical or hydraulic earth drills, conventional excavation equipment).

1.2 Scope

This procedure applies to the Deactivation & Remediation (D&R) contractor personnel, and subcontractor personnel that perform soil sampling at the U.S. Department of Energy (DOE)-owned Paducah site.

2.0 REFERENCES

2.1 Use References

- CP3-EN-0227, *Trenching, Excavation and Penetration Permit*
- CP3-RD-0010, *Records Management Process*
- CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*
- CP4-ER-2701, *Large Equipment Decontamination*
- CP4-ES-2303, *Borehole Logging*
- 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*
- Job Hazard Analysis (JHA) 10905

2.2 Source References

- U.S. Environmental Protection Agency, November 2001, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*. Region 4, Environmental Compliance Branch, Athens, GA.
- American Society for Testing and Materials (ASTM) D 1452 – 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.*

3.0 COMMITMENTS

None

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Precautions

4.1.1 An Excavation or Penetration Permit is required for all sample locations where penetration is required to a depth greater than six inches below ground surface.

4.1.2 **If** refusal to advance the sampling device is encountered before the required sample depth is reached, **then** the location will be moved and reattempted.

4.1.3 **If** refusal to advance the sampling device is encountered after three attempts, **then** the location will be abandoned and will **NOT** be sampled.

4.2 Limitations

4.2.1 Soil samples collected for Volatile Organic Compounds (VOC) analysis will always be collected first, regardless of the sampler used, to minimize loss of volatiles due to disturbance and off-gassing.

4.2.2 **If** the VOC soil sample is **NOT** collected, labeled, and shipped in the sampler (such as, thin-walled tube or insert), **then** the preferred collection method is to use an EnCore® or equivalent sampler.

5.0 PREREQUISITES

5.1 Review the SAP/SAEP or WP for the sampling methods and equipment to be used, and reference to any photos, maps or figures that indicate or show proposed soil sampling locations, methods to be used, type, and number of soil samples to be collected.

5.2 Notify Radiological Control (RADCON) and Safety & Health personnel before initiating sampling to determine required surveys and monitoring requirements for Radiological Work Permit (RWP) and Industrial Hygiene Work Plan (IHWP).

5.3 Obtain chain-of-custody forms, field sample logs, sample labels, and custody seals as necessary from Sample Management Office (SMO).

5.4 Request removal of concrete, pavement, or any other overlay before soil sample collection.

5.5 Review JHA-10905, *Soil Sample Collection for Characterization*.

5.6 Ensure the site is clear of vegetation to ensure worker safety by minimizing trip hazards.

5.7 Obtain an Excavation or Penetration Permit according to CP3-EN-0227, *Trenching, Excavation and Penetration Permit*, for all sample locations where penetration is required to a depth greater than six inches below ground surface.

5.8 Label sample containers with known information before collection of the sample according to CP4-ES-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals.*

6.0 INSTRUCTIONS

6.1 General Sampling Requirements

<u>Sampler</u>

6.1.1 Ensure assigned project personnel record all observations and operations according to CP4-ES-2700, *Logbooks and Data Forms*.

6.1.2 Manage waste according to CP3-WM-1037, Generation and Temporary Storage of Waste Materials.

NOTE:
Rinsate blanks are **NOT** required when using disposable sampling equipment.

6.1.3 Collect the number and type of Quality Control (QC) samples as specified in the SAP/SAEP or WP.

6.1.4 Prepare QC samples according to CP4-ES-2704, *Trip, Equipment and Field Blank Preparation*.

6.1.5 Prepare field logbooks, data forms, and other records according to CP4-ES-2700.

6.1.6 Ensure sampling tools and equipment are decontaminated and ready for use according to CP4-ES-2702, *Decontamination of Sampling Equipment and Devices*.

6.1.7 Ensure sampling tools and equipment are protected from sources of contamination by wrapping in aluminum foil, sealing in plastic or other storage containers, or placing on plastic sheeting in staging area.

6.1.8 Ensure disposable sampling equipment is new and unused.

6.1.9 Ensure only new and certified precleaned sample containers are used for each sampling event.

6.2 Soil Sample Site Preparation

6.2.1 **If** decontamination of equipment will be necessary during the sampling event, **then** prepare a decontamination area in proximity to the area to be sampled.

NOTE:

In general, proposed environmental soil sampling locations are designated before the sampling event and approximately located using a Global Positioning System (GPS) device or other suitable method, or civil surveyed and temporarily marked with a labeled survey pin flag, survey stake, or survey paint.

RADCON and/or Safety personnel survey sample locations as necessary before sampling.

6.2.2 Locate proposed sample points using photos, maps, or figures from the SAP/SAEP or WP for guidance before sample collection.

NOTE:

Protective groundcover may be required when powered equipment such as drill rigs, direct push rigs, pneumatic hammers, and manually controlled mechanical or hydraulic earth drills are used to reach the required sample depth and collect the soil samples.

6.2.3 Prepare the area around the proposed sample location by laying down plastic sheeting or an equivalent material as groundcover to contain Investigation-Derived Waste (IDW) and prevent contact with potentially transferable contaminants.

6.2.4 Cut a hole in the plastic sheeting of sufficient size to access the sample point.

6.2.5 Remove surface vegetation and debris from the sample point if necessary with a stainless steel or Teflon® coated spade.

6.2.6 Collect the sample using the method and sample equipment specified in the SAP/SAEP or WP, while controlling the spread of IDW.

6.3 VOC Sampling Requirements

6.3.1 Reference the associated SAP/SAEP or WP for specific VOC sampling methods.

NOTE:

When the EnCore® sampler piston is fully deployed, the winged stem is turned using the slot found in the handle to lock the piston in place.

Three EnCore® or equivalent samples are collected to represent one sampling point. Any deviation is recorded in the field logbook or data form, and on the Chain-of-Custody (COC) form.

6.3.2 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.

NOTE:

Record any deviation in the field logbook or data form, and on the COC form.

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

6.3.4 Minimize the headspace by completely filling the VOC sample container with soil.

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

6.4.1 For soil sample collection at grade, along test pit, trench, excavation sidewalls, or bottom, 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.

6.4.2 Place soil IDW on groundcover when sampling at grade.

NOTE:

A trowel may be used to cut a block of soil sample if the SAP/SAEP or WP requires a description and sampling of an undisturbed soil profile.

6.4.3 Describe the undisturbed sample according to CP4-ES-2303, *Borehole Logging,* before sample processing for analysis.

NOTE:

A trier sampler may be used to collect a core of soil that is fine-grained and cohesive.

A trier sampler is well suited for collecting soil samples from a test pit, trench, or excavation sidewalls and bottoms when the test pit, trench, or excavation can be safely entered and exited for sample collection or when the sample points can be safely accessed without entry by using an extension rod connected to the trier sampler.

6.4.4 Use a decontaminated stainless steel trier or 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.

6.4.5 Process each sample according to Section **6.8**.

6.4.6 **Before** backfilling each sample point, record the depth from which the sample was taken.

NOTE:

Use of soil generated during sample collection for backfill is only permitted when the Regional Gravel Aquifer (RGA) has **NOT** been penetrated.

6.4.7 Backfill the sample location to grade, if appropriate, using soil IDW generated during sample collection as specified in the SAP/SAEP or WP.

6.4.8 **If** the location is to be civil surveyed, **then** label **and** stake the location using a survey pin flag, survey stake, or survey paint, **and** record the information.

6.4.9 Repeat Steps 6.4.1 through 6.4.8 until all soil samples have been collected at the sample site.

6.5 Manual Sampling Using an Auger

NOTE:

It may be necessary to auger down several times and remove soil from the borehole to reach the desired sample depth.

6.5.1 Use a manual auger or a manually controlled mechanical or hydraulic earth drill to advance the auger to the desired depth.

6.5.2 Carefully stage excess IDW soil from the auger bucket or solid auger flights on the plastic sheeting to prevent the spread of contaminants.

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

6.5.4 Avoid hitting the borehole wall while inserting the auger bucket to minimize sidewall sloughing and the possibility of cross contamination.

6.5.5 Mark sampler insertion equipment for a reference point.

6.5.6 Rotate the auger to collect the sample **and** carefully retrieve the full bucket.

6.5.7 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.

6.5.8 Process sample according to Section **6.8**.

NOTE:

Use of soil generated during sample collection for backfill is only permitted when the RGA has **NOT** been penetrated.

6.5.9 Backfill the borehole to grade using soil IDW generated during sample collection or other approved material as specified in the SAP/SAEP or WP.

6.5.10 **If** the location is to be civil surveyed, **then** label **and** stake the location using a survey pin flag, survey stake, or survey paint, **and** record the information.

6.5.11 Repeat Steps **6.5.1** through **6.5.10** until all soil samples have been collected at the sample location.

6.6 Sampling Using a Thin-Walled Tube Sampler

NOTES:

A drill or direct push rig or hand operated auger may be used to reach the top of the interval to be sampled at the location.

The thin-walled sampler is pushed through the bottom of the borehole to collect the sample and the core is extracted from the borehole.

The undisturbed sample is normally described according to CP4-ES-2303, before soil sample collection.

6.6.1 Advance the borehole to the desired sample depth using the method specified in the SAP/SAEP or WP before collecting the sample.

NOTE:

Depending on the method used, it may be necessary to clear and remove soil from the borehole several times to reach the desired sample depth.

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

6.6.3 Assemble the thin-walled sampler **and** attach to sampler insertion equipment (reference SAP/SAEP or WP).

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

6.6.5 Avoid hitting the borehole wall while inserting the sampler to minimize sidewall sloughing and the possibility of cross contamination.

6.6.6 Mark manual sampler insertion equipment for a reference point.

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

6.6.8 Position a drive device on the sampling rods.

6.6.9 Shove, twist, push, or pound the tube holder into the soil using the specified method in the SAP/SAEP or WP until the tube is full or refusal to advance the sampler is met.

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

6.6.11 **If** the collection tube will be used as the sample container, **then** immediately cover both ends of the tube with Teflon® film or microcrystalline wax **and** cap.

6.6.12 **If** the tube will **NOT** be used as the sample container, **then** proceed to Step **6.6.15**.

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

NOTE:

Do **NOT** use electrical tape to tape end caps.

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

6.6.15 Process sample according to Section **6.8**.

NOTE:

Use of soil generated during sample collection for backfill is only permitted when sampling has **NOT** penetrated the RGA.

6.6.16 Backfill the borehole to grade using soil IDW generated during sample collection or other acceptable material as specified in the SAP/SAEP or WP.

6.6.17 **If** the location is to be civil surveyed, **then** label **and** stake the location using a survey pin flag, survey stake, or survey paint, **and** record the information.

6.6.18 Repeat Steps 6.6.1 through 6.6.17 until all soil samples have been collected at the sampling location.

6.7 Sampling Using a Split-Barrel or MacroCore® Sampler

6.7.1 Advance the borehole to the desired sampling depth using the method specified in the SAP/SAEP or WP.

6.7.2 Stage excess soil IDW on the plastic sheeting to prevent spread of contamination.

NOTE:

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

6.7.3 Carefully remove the drilling or penetration device from the borehole **and** stage excess IDW soil on the plastic sheeting to prevent cross contamination.

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

6.7.5 Avoid hitting the borehole wall while reinserting to minimize sidewall sloughing and the possibility of cross contamination.

6.7.6 Mark sampler insertion equipment for a reference point.

6.7.7 Position the driving device on the sample insertion equipment.

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

6.7.9 Power or manually drive the sampler into the soil.

6.7.10 **When** using standard penetration test equipment to drive the sampler, mark the drill rods in successive 6-inch increments to observe advancement of the sampler.

6.7.11 Advance the split-barrel sampler the required distance (generally 18 inches) with blows from the 140-pound hammer.

NOTE:

Generally, refusal to advance is indicated if more than 50 blows are required to advance the sampler 6 inches.

6.7.12 Count **and** record the number of blows applied for each 6-inch increment of sampler advancement.

6.7.13 Carefully retrieve **and** open the sampler **and** remove tube, if used, from the borehole.

6.7.14 Remove disturbed material in the upper end of the sample tube using a stainless steel or Teflon®-coated spatula or spoon **and if** the collection tube will be used as the sample container, **then immediately** cover both ends of the tube with Teflon® film **and** cap.

6.7.15 **If** the tube will **NOT** be used as the sample container, **then** process the sample according to Section **6.8**.

NOTE:

Use of soil generated during sample collection for backfill is only permitted when sampling has **not** penetrated the RGA.

6.7.16 Backfill the borehole to grade using soil IDW generated during sample collection or another acceptable material as specified in the SAP/SAEP or WP.

6.7.17 **If** the location is to be civil surveyed, **then** label **and** stake the location using a survey pin flag, survey stake, or survey paint, **and** record the information.

6.7.18 Repeat Steps 6.7.1 through 6.7.17 until all soil core samples have been collected at the sampling location.

6.8 Soil Sample Processing

NOTES:

The type of soil sample collected may be a discrete sample or a composite sample. Each of these sample types are processed to ensure a sample is collected that is representative of the source material and meets data quality objectives given in the SAP/SAEP or WP.

Compositing of samples is **NOT** an acceptable means of collecting samples to be analyzed for VOCs.

6.8.1 Handle soil samples for VOC analysis according to Section **6.3**.

6.8.2 **Except** for VOC samples, collect the soil in a stainless steel or glass bowl as follows unless directed otherwise by the SAP/SAEP or WP.

NOTE:

Plastic may be used instead of stainless steel or glass for sampling if samples are being analyzed by field laboratory (such as, polychlorinated biphenyl (PCB) test kits, X-ray fluorescence (XRF)).

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

NOTES:

A stainless steel or glass bowl and stainless steel spoon function well for compositing purposes.

The most common method of compositing is referred to as quartering.

Quartering is repeated several times until the sample is adequately mixed.

If round bowls are used for sample mixing, **then** adequate mixing is achieved by stirring the material in a circular fashion, reversing direction, and occasionally turning the material over.

6.8.4 Ensure aliquots are well mixed to ensure the sample is representative of the source material:

- Divide the sample material into quarters **and** mix each quarter individually.
- Mix two quarters together thoroughly to form halves.
- Mix the two halves together thoroughly to form a representative composite sample.

6.8.5 Transfer soil samples into sample containers, using appropriate equipment (i.e., stainless steel or Teflon® spoon, spatula, or disposable scoop) **and** securely tighten lid.

6.8.6 Record any remaining information on the sample label.

6.8.7 Seal sample containers **and** affix custody seals according to CP4-ES-2708.

6.8.8 Store sample containers in a cooler with ice or blue ice to maintain the preservation temperature as required.

6.8.9 Record all field observations and sampling methods according to CP4-ES-2700.

7.0 ACCEPTANCE CRITERIA

None

8.0 POST PERFORMANCE WORK ACTIVITIES

8.1 Pickup **and** bag any plastic sheeting, trash, and other disposable supplies before moving to the next sample location.

8.2 Remove all rope, barriers, placards, etc. used to secure the area.

8.3 As necessary, request survey of sample containers from radiological areas.

8.4 Contact the transportation specialist for guidance before transporting samples, contaminated equipment, tools, and supplies on public roads.

8.5 Ensure all equipment is decontaminated according to CP4-ER-2701, *Large Equipment Decontamination,* or CP4-ES-2702, before radiological survey out and demobilization from the site.

8.6 Manage waste generated during soil sampling activities according to CP3-WM-1037.

8.7 Complete COC forms according to CP4-ES-2708.

8.8 Release samples and related COC documentation for shipment to an off-site laboratory **or** deliver to the on-site laboratory.

8.9 Handle **and** decontaminate reusable sampling equipment, tools, or supplies according to CP4-ES-2702.

9.0 RECORDS

9.1 Records Generated

The following records may be generated by this procedure:

- Field Logbook Entries
- Data Form Entries

9.2 Records Disposition

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

Appendix A – Acronyms/Definitions

ACRONYMS

ASTM – American Society for Testing and Materials

COC – Chain of Custody

D&R- Deactivation & Remediation

DOE - U.S. Department of Energy

GPS - Global Positioning System

IDW - Investigation-Derived Waste

IHWP – Industrial Hygiene Work Plan

JHA – Job Hazard Analysis

PCB - Polychlorinated Biphenyl

QC – Quality Control

RGA – Regional Gravel Aquifer

RADCON – Radiological Control

RWP – Radiological Work Permit

SAP/SAEP - Sampling and Analysis Plan or Sampling and Analysis Even Plan

SMO – Sample Management Office

VOC – Volatile Organic Compounds

WP – Work Package

XRF – X-ray Fluorescence

DEFINITIONS

Composite Sample – A sample that consists of a number of discrete soil samples collected from a body of material and mixed before analysis. The objective of soil sample compositing is to represent the average condition of the sampled soil.

Discrete Sample – A sample collected from one specific horizon and vertical interval (usually 6 inches) that is not mixed with soil aliquots from other locations.

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.

Appendix A – Acronyms/Definitions (Continued)

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 be used as the soil sample. Alternately, augers can be used to bore to the desired sampling depth, and a tube sampler used for collection. Auger diameters typically range between 1 and 4 inches. Augers normally are used in conjunction with metal shafts 3 to 4 feet in length 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.

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.

Appendix A – Acronyms/Definitions (Continued)

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.