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# Vadose Zone Soil and Sediment Sampling (Excluding VOCs)

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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure describes various methods for sampling vadose zone (VZ) soil and sediment for chemical (excluding volatile organic compounds [VOCs]), radiochemical, and physical properties analysis and testing.

1.2 Scope

1.2.1 This procedure applies to Vadose Zone (VZ) Tank Farm Project personnel sampling soil and sediment for chemical (excluding VOCs), radiochemical, and physical properties analysis and testing.

1.2.2 This procedure is not applicable to sampling for VOCs. To sample VZ soil and sediment for volatile organic compound analysis, use procedure TO-080-901, Vadose Zone Soil and Sediment Sampling for VOC Analysis.

1.2.3 This procedure can be performed in multiple locations. A work area, location, and/or activity-specific hazard analysis must be performed prior to starting the activity per TFC-ESHQ-S_SAF-C-02, Job Hazard Analysis.

2.0 INFORMATION

2.1 Terms and Definitions

- **COC** Chain of Custody
- **EB** Equipment Blank
- **FB** Field Blank
- **QA/QC** Quality Assurance/Quality Control
- **SAF** Sample Authorization Form
- **SAP** Sampling and Analysis Plan
- **VOC** Volatile Organic Compound
- **VZ** Vadose Zone.
3.0 PRECAUTIONS AND LIMITATIONS

NOTE - Sampling equipment shall be decontaminated prior to use in accordance with the requirements of LO-080-157, Cleaning of Containers and Sample Collection Equipment.

- Commercially purchased, disposable sampling equipment that comes in direct contact with the sample media should be of laboratory quality and shall be packaged in a manner that prevents cross contamination.

- All personnel using this procedure will have completed the Vadose Zone Soil Sampling Certification (Course 351474).

3.1 Personnel Safety

WARNING Failure to use proper personal protective equipment (PPE) when handling pre-preserved sample containers can result in personal injury.

3.1.1 Job-specific protective equipment requirements should be addressed during the pre-job brief and be in accordance with TFC-ESHQ-S_IS-C-02, Personal Protective Equipment.

3.1.2 A job specific Job Hazard Analysis Checklist (A-6004-101) is required when chemicals and/or chemical products are used.

3.2 Equipment Safety

CAUTION - Failure to perform ground scan and Engineering review of drawings prior to removing any ground material below excavation grade or soil sampling may lead to damaged piping and equipment.

3.3 Radiation and Contamination Control

3.3.1 Work in radiological areas will be performed using a Radiation Work permit following review by Radiological Control per ALARA work planning procedure TFC-ESHQ-RP_RWP-C-03.

3.3.2 The outside of each sample container shall be wiped clean of any visible dirt, grime, or liquid after the sample has been placed in the container.

3.4 Environmental Compliance

3.4.1 All environmental controls for soil and sediment sampling will be identified in the activity-specific work package.
4.0 PREREQUISITES

4.1 Special Tools, Equipment, and Supplies

The following supplies may be needed to perform this procedure:

- Sample containers (extra containers should be available to accommodate breakage, loss, and other unforeseen complications that may arise)
- Pre-preserved sample containers
- Evidence tape
- Ice chest with wet ice or frozen cold packs (blue ice)
- Freezer and/or refrigerator units
- Sample collection equipment (see attachments)
- Field logbook
- Nitrile or latex gloves
- Eye protection
- Non-volatile organic compound style pen (i.e., ball point ink or gel) to mark sample containers
- Reagent grade de-ionized water and/or pre-certified silica sand.

4.2 Performance Documents

The following procedures may be needed to perform this procedure:

- TFC-BSM-IRM-DC-C-02, Records Management
- TFC-ESHQ-RP_RWP-C-03, ALARA Work Planning
- TFC-ESHQ-S_SAF-C-02, Job Hazard Analysis
- TFC-ESHQ-S-STD-30, Implementation of DOE-0344, Excavating, Trenching, and Shoring
- TFC-OPS-OPER-C-17, Operating Logbooks
- TFC-OPS-WM-C-22, Chain of Custody for Tank Farm Vadose Zone and Multi-Media Sampling
- TFC-OPS-WM-C-23, Control of Certificates of Analysis for Tank Farm Vadose Zone and Multi-Media Sampling.
- TO-080-900, Sample Packaging and Shipping
- TO-080-903, Use of Sample Storage Units
- TO-100-052, Perform Waste Generation, Segregation, Accumulation and Clean-up
4.3 Field Preparation

NOTE - Steps in this section may be performed in any logical order.

Preparation for Field Sampling

4.3.1 CONFRM personnel assigned to this activity have completed the Vadose Zone Soil Sampling Certification (Course 351474).

4.3.2 ENSURE a work area and/or location-specific hazard analysis per TFC-ESHQ-S_SAF-C-02 has been performed.

4.3.3 CONFRM that all required sampling documentation (e.g., Chains of Custody [COCs] forms, sample labels, Sample Authorization Forms [SAF] and any other project information that provide direction for or assistance with meeting project requirements) has been provided.

4.3.4 PERFORM the following:

4.3.4.1 READ and become familiar with all applicable project specific documents (e.g., sampling and analysis plan [SAP]).

4.3.4.2 REVIEW sampling paperwork for sampling event to ensure information and requirements are correct.

4.3.5 IF there is a conflict between any sampling document and the COC form regarding container type or size, DO NOT PROCEED AND NOTIFY the VZ Sampling Lead or designee.

4.3.6 IF using decontaminated sampling equipment, CONFRM the LABCORE Completed Batch Report is included in the field logbook.

4.3.7 CONFRM that appropriate sample containers are prepared and staged for the sampling to be performed (e.g., certified clean sample containers; new clean split spoon liners), and Certificates of Analysis are available for containers and preservatives, per TFC-OPS-WM-C-23.
4.3 Field Preparation (Cont.)

4.3.8 STAGE AND ASSEMBLE the equipment required for sampling and field data collection.

NOTE - Logbook entries should be concise and chronological, enabling anyone to reconstruct events as they occurred for legal defensibility.

4.3.9 INITIATE field logbook entry in accordance with TFC-OPS-OPER-C-17.

4.3.10 IF work is performed in a radiological area, ENSURE sampling site has been prepared with the controls and postings specified in the work package prior to commencement of sampling activities.
5.0 PROCEDURE

5.1 Sampling

5.1.1 IF any unexpected conditions are encountered during the sampling event, CONTACT the VZ Sampling Lead or designee for the project.

5.1.2 IF minimal media volume is anticipated, CONTACT the VZ Sampling Lead or designee for collection priority.

5.1.3 IF performing quality assurance/quality control (QA/QC) sampling, GO TO Section 5.2.

5.1.4 IDENTIFY the Attachment 1 through Attachment 3 sampling method that corresponds to the sampling method to be used AND

COLLECT sample per the steps in that attachment.

5.1.5 MAINTAIN samples under COC in accordance with TFC-OPS-WM-C-22, Chain of Custody for Tank Farm Vadose Zone and Multi-Media Sampling.
Vadose Zone Soil and Sediment Sampling (Excluding VOCs)

5.2 QA/QC Sampling

WARNING

Failure to use proper PPE when handling pre-preserved sample containers can result in personal injury.

NOTE - QA/QC samples may be specified in the project-specific Sampling and Analysis Plan (SAP) or other applicable sampling documentation. The instructions below are the sampling directions for several different types of QA/QC samples. Specific sample requirements will vary depending on the project. The person collecting the sample will be provided sampling paperwork for the specific type and quantity of QA/QC sample to be collected.

5.2.1 DON proper PPE as follows:
- Nitrile or latex gloves
- Eye protection.

Field Duplicates

5.2.2 IF collecting a duplicate soil sample, COLLECT the soil samples as close as possible to the same point in time and space as the primary field sample.

Split Samples

5.2.3 IF collecting a split surface soil sample, PERFORM the following:

5.2.3.1 COLLECT the sample material.

5.2.3.2 IF appropriate for the sampling method, HOMOGENIZE the sample material.

5.2.3.3 DIVIDE the homogenized sample into two samples in the field.

5.2.4 IF collecting split subsurface soil samples, COLLECT the soil samples as close as possible to the same point in time and space.
5.2 QA/QC Sampling (Cont.)

**Equipment Blanks**

5.2.5 IF collecting an Equipment Blank (EB), **PERFORM** the following:

5.2.5.1 **PASS** reagent grade de-ionized water or pre-certified silica sand through or over the new or decontaminated (or lab cleaned) equipment.

5.2.5.2 **COLLECT** the rinsate/silica sand in a certified clean container **AND**

**TRANSFER** into sample container(s)

**OR**

**COLLECT** the rinsate/silica sand directly into the sample container(s).

5.2.5.3 **AFFIX** the sample label(s) to the sample container(s).

**NOTE** - If no temperature range for preservation of a sample is specified, cooling to 0 °C - 6 °C with containers requiring cooling is acceptable.

5.2.5.4 **MAINTAIN** EB sample(s) within temperature range specified in sampling document(s).
5.2 QA/QC Sampling (Cont.)

Field Blank

5.2.6 IF collecting a Field Blank (FB), PERFORM the following:

5.2.6.1 PRIOR to going to the field, FILL a certified clean amber glass bottles with reagent grade de-ionized water or pre-certified silica sand.

5.2.6.2 TRANSPORT the bottle(s) of reagent-grade de-ionized water or pre-certified silica sand to the field.

5.2.6.3 PRIOR to collecting regular soil/sediment samples, COLLECT FB sample by pouring the reagent-grade de-ionized water or pre-certified silica sand into the sample containers identified on the COC form.

5.2.6.4 AFFIX the sample label(s) to the sample containers.

5.2.6.5 MAINTAIN the FB in the same manner as the other samples collected during the sampling event.

5.2.6.6 IF conditions change from when the FB was collected and the regular sample is collected (e.g., change in wind blows exhaust fumes from the truck over the sampling area.), RECORD the change in the logbook and on the COC form.
5.3 Post Sampling Activities

5.3.1 **AFTER** the sample has been collected, **ENSURE** the outside of the sample container is wiped clean of any visible dirt, grime, or liquid.

5.3.2 **ENSURE** sample label is affixed to the sample container and includes the following information:
- Sample identification number
- Date collected
- Time collected
- Media
- Preservative (if required)
- Analysis Required
- Collector’s initials, Printed Name or Signature.

5.3.3 **COMPLETE** the COC form and field logbook.

5.3.4 **REQUEST** independent review of COC forms and sample labels after completion (one-over-one check).

5.3.5 **CONFIRM** samples are packaged in accordance with TO-080-900, Sample Packaging and Shipping.

5.3.6 **PLACE** sample(s) in a secure location for transportation.

5.3.7 **AS** soon as possible, **DELIVER** sample(s) and COC form(s) to shipping personnel or appropriate laboratory for analysis.

5.3.8 **IF** samples(s) cannot be delivered the same day (due to time constraints or radiological laboratory screening), **STORE** sample(s) according to TO-080-903, Use of Sample Storage Units **AND**

**NOTIFY** the Field Work Supervisor (FWS) and VZ Sampling Lead, or designee, for the project.

5.3.9 **MANAGE** solid waste sampling materials (e.g., used gloves, paper towels, etc.) in accordance with TO-100-052, Perform Waste Generation, Segregation, Accumulation and Clean-up.
5.4 Restoration

None

5.5 Records

The performance of this procedure generates no records.

The record custodian identified in the Company Level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.
Attachment 1 – Surface Sampling Methods

A. APPLICABILITY

The devices described in this method are used to obtain surface soil/sediment samples. Each method is best suited to particular conditions and should be chosen based on field conditions and project needs. The following descriptions of sampling methods and techniques are guidelines based on industry standards and general manufacturers’ instructions. Specific manufacturers’ instructions and varying field conditions may necessitate deviations from these methods. Check the sampling planning documents (e.g., SAP) for specific equipment, methods, and techniques to use. Document any deviations in the field logbook.

B. SAMPLING EQUIPMENT

Equipment may include, but is not limited to, scoops, spade, shovel, hand corer, soil/sediment punch, or hand auger.

C. PROCEDURE

The soil/sediments to be sampled must be exposed prior to sample acquisition. If the upper 6 inches of soil/sediment is to be sampled, the surface vegetation should be removed with a trowel or scoop. If the sample is to represent a discrete interval depth of 6 inches or greater, the overlying soil/sediments may be removed with a shovel or hand auger. Samples may then be collected using the most suitable method described below. A surface sample is considered to be from 0-1 feet, unless specified differently in the SAP.

**Scoop/Spade/Shovel**

Use of a scoop, spade, or shovel is the simplest, most direct method of collecting soil/sediment samples. This method can be used for most soil/sediment types. However, it is limited somewhat to sampling near the surface.

1. **CAREFULLY REMOVE** the top layer of soil/sediment to the desired sample depth with a shovel.

2. **REMOVE AND DISCARD** the thin layer of soil/sediment from the area that comes in contact with the shovel using a pre-cleaned scoop or trowel.

   NOTE - If approved by SAP, a sieve may be placed over stainless steel bowl.

3. **PLACE** a quantity of soil/sediment sufficient to fill all required sample containers into a pre-cleaned bowl using a pre-cleaned spatula, spoon, or equivalent.

4. **HOMOGENIZE** the material.

(Continued on Next Page)
Attachment 1 – Surface Sampling Methods (Cont.)

Scoop/Spade/Shovel (Cont.)

NOTE - The pre-cleaned spatula, spoon, or equivalent used to homogenize the soil/sediment may be used to place that same soil/sediment into sample containers.

5. COLLECT the sample by placing the soil/sediment in the required sample container(s) using a pre-cleaned spatula, spoon, or equivalent.

Hand Corer

Hand corers may be used in many situations and with many materials. Most corers can be adapted to hold liners generally available in brass, polycarbonate plastic, and Teflon.

1. FORCE the corer into the soil/sediment with a smooth, continuous motion.
2. TWIST the corer and withdraw in a single smooth motion.
3. REMOVE the nose piece AND TRANSFER the sample into a pre-cleaned bowl.
4. HOMOGENIZE the material.
5. COLLECT the material into an appropriate sample bottle using a pre-cleaned spatula, spoon, or equivalent.

Soil/Sediment Punch

The soil/sediment punch applies to many situations, but may not be useful in rocky or very wet soil/sediment.

1. DRIVE the tube into the soil/sediment to the desired depth.
2. EXTRACT the tube and the core.
3. PUSH the soil/sediment out of the tube into a pre-cleaned bowl.
4. HOMOGENIZE the material.
5. COLLECT the material into an appropriate sample bottle using a pre-cleaned spatula, spoon, or equivalent.
Vadose Zone Soil and Sediment Sampling (Excluding VOCs)

Attachment 1 – Surface Sampling Methods (Cont.)

Hand Auger

1. **ATTACH** the auger bit to a drill rod extension **AND**
   **ATTACH** the "T" handle to the drill rod.
2. **BEGIN** drilling, periodically removing accumulated soil/sediment. This prevents accidentally brushing loose material back into the borehole when removing the auger to add drill rods.
3. **AFTER** reaching the desired depth, **SLOWLY AND CAREFULLY REMOVE** the auger from the borehole.
4. **REMOVE** the auger tip from the drill rods and replace with a pre-cleaned, thin-walled tube sampler **AND**
   **INSTALL** the proper cutting tip.
5. **CAREFULLY LOWER** the corer down the borehole.
   - Gradually force the corer into the soil/sediment. Take care to avoid scraping the borehole sides
   - A fence post driver may be used to push the core
   - If the wall above the corer collapses, another hole may be dug for the next deeper sampling interval.
6. **REMOVE** the corer **AND**
   **UNSCREW** the drill rods.
7. **REMOVE** the cutting tip.
8. **TRANSFER** the material from the device to a pre-cleaned bowl or surface.
9. **DISCARD** the top of the core (approximately 1 inch if possible), which represents any material collected by the corer before penetration of the layer sampled.
10. **HOMOGENIZE** the material.
11. **COLLECT** the material into an appropriate sample bottle using a pre-cleaned spatula, spoon, or equivalent.
Attachment 2 - Cable Tool Drilling / Drive Barrel Sampling

A. APPLICABILITY

The following descriptions of sampling methods and techniques are guidelines based on industry standards and general manufacturers' instructions. Specific manufacturers' instructions and varying field conditions may necessitate deviations from these methods. Document any deviations in the field logbook.

B. SAMPLING EQUIPMENT

Sampling equipment includes, but may not be limited to, stainless steel bowl, scoop, spatula, and sample collection containers.

C. PROCEDURE

Drive Barrel Sampling

NOTE - The driller and the sampler work together to accomplish these tasks.

1. ADVISE the driller of the desired sampling depth.
2. POSITION a pre-cleaned stainless mixing bowl beneath the drive barrel to collect retrieved soil/sediment sample material as the drive barrel is emptied, taking care not to collect material that has come in direct contact with the drive barrel.
3. HOMOGENIZE the sample material AND COLLECT the sample by transferring the sample material to an appropriate sample container(s) using a pre-cleaned spatula, spoon, or equivalent.
4. REPEAT steps 1 through 3 as required.
Attachment 3 - Direct Push and Split Spoon Sampling

A. APPLICABILITY

Direct push sampling is accomplished through the use of equipment that applies a force to sample tubing to drive soil/sediment (a sample) into the sampler. This force may be applied through the use of a weighted rig with a continuous hydraulic push (cone penetrometer) or a surface-mounted driving device such as a drop hammer, casing type hammer, hydraulic hammer or diesel fired hammer. There are also a number of sampler designs that may be used, but all are designed to drive a sample up into a sleeve or set of liners and then retrieve the sampler assembly and sample to surface. The following descriptions of sampling methods and techniques are guidelines based on industry standards and general manufacturers' instructions. Specific manufacturers' instructions and varying field conditions may necessitate deviations from these methods. Document any deviations in the field logbook.

B. SAMPLING EQUIPMENT

Sampling equipment may include, but is not limited to, bowls, scoops, jars, liners, liner caps, and tape or aluminum foil.

C. PROCEDURE

NOTE - The driller and sampler work together to accomplish these tasks.

1. ADVISE driller of sample depth.

2. CONFIRM the sampler assembly has been completely and correctly assembled (e.g., pre-cleansed liner[s] inserted into pre-cleansed assembly, head and shoe secured).

3. HAND sampler assembly to the drilling personnel.

4. RECEIVE sampling assembly from drilling personnel following sample collection.

5. OPEN sampler assembly by unscrewing the drive shoe and drive head.

6. PLACE sample media from the drive shoe in the sample container identified on the COC unless otherwise directed by the SAP.

7. IMMEDIATELY after the sample media is put into the sample container, SEAL the sample container in a manner that minimizes moisture loss (e.g., electrical tape, stretch tape).

8. REMOVE the sample liners (if used) and place end caps over the ends of the liners. If sample liners were not used or a homogenized sample is to be collected, go to Step 11.

9. LETTER the liners sequentially (starting with an A), beginning at the shoe end of the sampler (the deepest sample material received) and progressing to the head end of the sampler (liner A is closest to the shoe and liner C is farthest away from the shoe) THEN LABEL each liner with TOP and BOTTOM (BOTTOM being closest to the shoe).
10. **SEAL** the liner caps with tape or wrap the entire assembly in foil to make sure the end caps remain secure.

11. **IF** sample liner(s) were not used or a homogenized sample is to be collected, **PERFORM** the following:
   a. **FREE** the sample from the drive tube or liner(s) by holding an open end over the pre-cleaned bowl and tapping as necessary.
   b. **HOMOGENIZE** the material.
   c. **PLACE** the sample material into appropriate sample containers.

12. **RECORD** date, time, and sampler signature on sample label.

13. **AFFIX** sample label to sample container/liner.

14. **RECORD** the collection date **AND** **INITIAL** on the custody seals.

15. **AFFIX** the custody seals to each sample container/liner after sample collection in a manner that could detect tampering.

16. **AS QUICKLY** as possible, **STORE** sample containers/liners that require cooling in appropriate storage location/container.

17. **IF** samples are collected in hazardous exclusion zones or radiological zones, and it is not possible to seal the sample containers until exiting the zone, **KEEP** possession of the sample until the container can be sealed.

18. **IF** the sample material is for chemical analysis, **COOL** containers/liners on ice to 0 °C to 6 °C immediately after capping, labeling, sealing, and bagging the containers/liners.

**NOTE** - Pre-cleaned utensils may be required for removing compacted materials.

19. **REPEAT** Steps 1 through 19 as required.