U.S.EPA REGION 9 LABORATORY

RICHMOND, CALIFORNIA

FIELD SAMPLING GUIDANCE DOCUMENT #1205

SOIL SAMPLING

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the collection of representative soil samples. Analysis of soil may determine whether concentrations of specific contaminants exceed established threshold action levels, or if the concentrations present a risk to public health, welfare, or the environment.

The methodologies discussed in this procedure are applicable to the sampling of (dry) soil. Typically this term "soil" refers to samples which are not covered with an aqueous layer for more than 30% of the time. The descriptions and procedures are generic in nature and may be modified in whole or part to meet the handling and analytical requirements of the contaminants of concern, as well as the constraints presented by the sampling area. However, if modifications occur, they should be documented in the site logbook or report summarizing field activities.

2.0 METHOD SUMMARY

Soil samples may be recovered using a variety of methods and equipment, depending on the portion of the soil profile required (surface versus subsurface), and the type of sample required (disturbed versus undisturbed) and the soil type.

Soil is collected directly, using a hand-held device such as hand scoop, auger or a post hole digger, or indirectly using a power activated device such as power augers, back hoes, or drill rigs. Following collection, the soil can be homogenized in a container constructed of inert material and transferred to the appropriate sample containers.

NOTE: This SOP does not provide sufficient detail to describe the essential details for collecting samples for volatile organic compounds; e.g., total petroleum hydrocarbons-gasoline, BTEX, etc. There are many nuances for sampling soil VOCs, thus a separate SOP(#1210) is being drafted to explain specific sampling, sub-sampling, preservation and analytical preparations. The reader may also refer to EPA Method 5035, "Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples" (1996).

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

- Chemical preservation of solids is generally not recommended. Cooling is usually the best approach, supplemented by the appropriate holding time.

- Wide-mouth glass containers with Teflon-lined caps are utilized for soil samples. The sample volume is a function of the analytical requirements and will be specified in the work plan.

- Transfer soil from the sample collection device to an appropriate sample container using a stainless steel or plastic scoop or equivalent. If composite samples are collected, place the soil sample in a stainless steel, plastic or other appropriate composition (e.g.: Teflon) bucket, and mix

thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then aliquot the soil sample into labeled containers.

- Samples for volatile organic analysis must be collected directly from the bucket, before mixing the sample, to minimize loss due to volatilization of contaminants.

- All sampling devices should be decontaminated, then wrapped in aluminum foil. The sampler should remain in this wrapping until it is needed. Each sampler should be used for only one sample. Dedicated samplers for soil samples may be impractical due to the large number of soil samples which may be required and the cost of the sampler. In this case, samplers should be cleaned in the field using the decontamination procedure described in SOP #1230, *Sampling Equipment Decontamination*.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Substrate particle size and organic content are directly related to water velocity and flow characteristics of a body of water. Contaminants are more likely to be concentrated in soils typified by fine particle size and a high organic content. This type of soil is most likely to be collected from depositional zones. In contrast, coarse soils with low organic content do not typically concentrate pollutants and are found in erosional zones. The selection of a sampling location can, therefore, greatly influence the analytical results.

5.0 EQUIPMENT/APPARATUS

Equipment needed for collection of soil samples includes:

- maps/plot plan
- safety equipment--photoinjection detector, OVM
- compass
- tape measure
- survey stakes, flags, or buoys and anchors
- camera and film
- stainless steel, plastic, or other appropriate composition bucket
- 4-oz, 8-oz, and one-quart, wide-mouth jars w/Teflon-lined lids
- Ziploc plastic bags
- logbook
- sample jar labels
- chain of custody forms
- custody seals
- field data sheets
- cooler(s)
- ice
- decontamination supplies/equipment
- spade or shovel
- scoop

- bucket auger
- hand auger
- extension rods
- T-handle
- power augers
- backhoes
- drill rigs

6.0 REAGENTS

Reagents are not used for preservation of soil samples. Decontamination solutions are specified in SOP #1230, *Sampling Equipment Decontamination*.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and required equipment and supplies according to the sampling QA plans for the site.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or preclean equipment, and ensure that it is in working order.
4. Prepare schedules, and coordinate with staff, client, and regulatory agencies, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Use stakes, flags, or buoys to identify and mark all sampling locations. Specific site characteristics, including flow regime, basin morphometry, soil characteristics, depth of overlying aqueous layer, and extent and nature of contaminant should be considered when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

7.2 Sample Collection

Selection of a sampling device is most often contingent upon: (1) depth of water at the sampling location, and (2) the physical characteristics of the medium to be sampled.

7.2.1 <u>Sampling Surface Soils with a Trowel or Hand Scoop</u>

Collection of surface soil can be accomplished with tools such as spades, shovels, and scoops. Surface soil can be removed to the required depth with a garden spade, then use a stainless steel or plastic scoop to collect the sample.

Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A stainless steel or plastic scoop or lab spoon will

suffice in most applications. Care should be exercised to avoid the use of devices plated with chrome or other materials. Plating is particularly common with garden trowels.

Follow these procedures to collect soil samples with a scoop or trowel:

1. Using a precleaned stainless steel scoop or trowel remove vegetation and top layer of soil, then loosen the desired volume of soil from the sampling area.
2. Transfer the discrete grab sample into an appropriate samples container.
3. For composite sample, homogenize grab samples in a stainless steel or glass mixing container using the appropriate tool (stainless steel spoon, trowel, or pestle).
4. Secure the cap tightly. Chemical preservation of solids is generally not recommended.
5. Label and tag sample containers, and record appropriate data on soil sample data sheets (depth, location, color, other observations).
6. Place glass sample containers in sealable plastic bags, if required, and place containers into an iced shipping container. Samples should be cooled to 4°C as soon as possible.
7. Complete chain of custody forms and ship as soon as possible to minimize sample holding time. Scheduled arrival time at the analytical laboratory should give as much much of a holding time as possible for scheduling of sample analysis.
8. Follow required decontamination and disposal procedures (see SOP #1230).

7.2.2 Sampling Surface Soils with a Hand Auger

This system uses an auger, a series of extension rods, a "T" handle, and a thin-wall tube sampler. The auger bores a hole to a desired sampling depth and then is withdrawn. The auger tip is then replaced with a tube core sampler, lowered down the borehole, and driven into the soil at the completion depth. The core is then withdrawn and the sample collected. Posthole augers have limited utility for sample collection, as they are designed more for their ability to cut through fibrous, rooted areas. Bucket augers are better for direct sample recovery, are fast, and provide a large volume of sample.

Use the following procedure to collect soil samples with a hand auger:

1. Insert the auger into the material to be sampled at a 0^{o} to 45^{o} angle from vertical. This orientation minimizes spillage of the sample from the sampler. Extraction of samples may require tilting of the sampler.
2. Rotate the auger once or twice to cut a core of material.
3. Slowly withdraw the auger, making sure that the slot is facing upward.
4. An acetate core may be inserted into the auger prior to sampling, if characteristics of the soils or body of water warrant. By using this technique, an intact core can be extracted.
5. Transfer the sample into an appropriate sample or homogenization container.

OR

Follow these procedures to collect soil samples with a hand auger:

1. Attach the auger bit to a drill extension rod, then attach the "T" handle to the drill extension rod.

2. Clear the area to be sampled of any surface debris.
3. Begin augering, periodically removing any accumulated soil from the auger bucket.
4. After reaching the desired depth, slowly and carefully remove the auger from boring. (When sampling directly from the auger, collect sample after the auger is removed from boring and proceed to Step 10.)
5. Remove auger tip from drill rods and replace with a precleaned thin-wall tube sampler. Install proper cutting tip.
6. Carefully lower tube sampler down borehole. Gradually force tube sampler into soil. Care should be taken to avoid scraping the borehole sides. Also **avoid hammering** of the drill rods to facilitate coring, since the vibrations may cause the boring walls to collapse.
7. Remove tube sampler and unscrew drill rods.
8. Remove cutting tip and remove core from device.
9. Discard top of core (approximately 1 inch), as this represents material collected by the tube sampler before penetration of the layer of concern.
10. Transfer sample into an appropriate sample or homogenization container.

7.2.4 Sampling Surface Soils From Power augers etc.

Samples for volatile organic analysis must be collected by sub-sampling directly from the bucket before mixing the sample to minimize volatilization of contaminants.

7.2.5 Sampling Subsurface Soils with a drill rig

Follow these procedures when using a sample coring device to collect subsurface soils. It consists of a coring device, handle, and acetate core utilized in the following procedure:

1. Assemble the coring device by inserting the acetate core into the sampling tube.This sampling device works best in medium to fine-grained cohesive sediments.
2. For loose sandy materials place an “eggshell” check valve mechanisms into the tip of the sampling tube with the convex surface positioned inside the acetate core.
3. Screw the coring point onto the tip of the sampling tube.
4. Screw the handle onto the upper end of the sampling tube and add extension rods as needed.
5. Place the sampler in a perpendicular position on the material to be sampled.
6. This sampler may be used with either a drive hammer for firm consolidated soils, or a “T” handle for soft soils. If the “T” handle is used, place downward pressure on the device until the desired depth is reached. Rotate the sample to shear off the core of the bottom, retrieve the device and proceed to Step 15.
7. If the drive hammer is selected, insert the tapered handle (drive head) of the drive hammer through the drive head.
8. With left hand holding the tube, drive the sampler into the material to the desired depth. Do not drive the tube further than the tip of the hammer’s guide.
9. Record the length of the tube that penetrated the sample material, and the number of blows required to obtain this depth.
10. Remove the drive hammer and fit the keyhole-like opening on the flat side of the hammer onto

the drive head. In this position, the hammer serves as a handle for the sampler.

11. Rotate the sampler at least two revolutions to shear off the sample at the bottom.
12. Lower the sampler handle (hammer) until it just clears the two ear-like protrusions on the drive head, and rotate about 90º
13. Withdraw the sampler by puling the handle (hammer) upwards and dislodging the hammer from the sampler.
14. Unscrew the coring point and remove the "eggshell" check valve.
15. Slide the acetate core out of the sampler tube. The acetate core may be capped at both ends. The sample may be used in this fashion, or the contents transferred to a stainless steel or plastic bucket and mixed thoroughly to obtain a homogeneous sample representative of the entire sampling interval.
16. Samples for volatile organic analysis must be collected directly from the bucket before mixing the sample to minimize volatilization of contaminants.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following QA/QC procedures apply:

1. All data must be documented on field data sheets or within site logbooks.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures.

More specifically, when sampling soil from areas containing known or suspected hazardous substances, adequate precautions must be taken to ensure the sampler's safety. The team member collecting the sample should not climb into trenches where bank failure may cause him or her to lose their balance. To prevent this, the person performing the sampling should be completed via augers with extensions or from directly from the backhoe immediately after removal from the ambient ground area.