COVERSHEET
STANDARD OPERATING PROCEDURE

Operation Title: **PROTOCOL FOR COLLECTING SOIL SAMPLES**

Originator: **Becky Blais**
Quality Assurance Coordinator
Division of Remediation
Bureau of Remediation and Waste Management

APPROVALS:

Division of Remediation Director:

Carla J. Hopkins		Dec 20, 2021
Print name	*Signature*	*Date*

Bureau of Remediation and Waste Management Director:

Susanne Miller		Dec 22, 2021
Print name	*Signature*	*Date*

QMSC Chair:

Kevin Martin		Dec 23, 2021
Print name	*Signature*	*Date*

Department Commissioner:

Melanie Loyzim		Dec 23, 2021
Print name	*Signature*	*Date*

DISTRIBUTION;

( ) Division of Remediation……...By:_____Date:_____

1.0 APPLICABILITY

This Standard Operating Procedure (SOP) applies to all programs in the Maine Department of Environmental Protection's (MEDEP) Division of Remediation (DR). It is also applicable to all parties that may submit data that will be used by the MEDEP/DR.

This SOP is not a rule and is not intended to have the force of law, nor does it create or affect any legal rights of any individual, all of which are determined by applicable statutes and law. This SOP does not supersede statutes or rules.

2.0 PURPOSE

The purpose of this document is to describe the MEDEP/DR procedure for collecting soil samples for evaluating soil contamination.

3.0 RESPONSIBILITIES

All MEDEP/DR Staff must follow this procedure when performing this task. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this procedure. MEDEP/DR staff reviewing data by outside parties are responsible for assuring that the procedure (or an equivalent) was utilized appropriately.

4.0 DEFINITIONS

4.1 SOIL AUGER – A device that is stainless steel in construction and consists of a t-handle, extension piece, and a screw-like cutting blade. Used to collect soil samples from various depths. Soil conditions permitting, a depth of up to 10 feet can be adequately sampled using a hand auger. Power augers allow for even further depths to be sampled.

4.2 SOIL BORER – A device, such as a Geoprobe® Systems Large Bore Soil Sampler or a Split Spoon Sampler, which allows the collection of Soil from discrete levels below grade.

4.3 GRAB SAMPLE - A single portion of material from a point source sample location.

4.4 COMPOSITE SAMPLE - Two or more portions of material from different depths and/or different sample point locations mixed together to yield a single sample for analysis.

4.5 TRENCH - a narrow excavation (at least four feet in depth according to OSHA standards) made below the surface of the ground in which the depth is greater than the width--the width not exceeding 15 feet.

4.6 EXCAVATION - is any man-made cut, cavity, trench, test pit or depression in the earth's surface formed by earth removal.

4.7 CONTAINERIZATION – the act of collecting the appropriate amount of soil for a specific analysis, and placing it in the appropriate jar or vessel with any required preservation.

5.0 GUIDELINES AND PROCEDURES

5.1 INTRODUCTION

Soil sample collection is one of the most basic aspects of the investigation of hazardous substances and petroleum discharges into the environment. Most hazardous substance and petroleum releases are into a site's soil. Hazardous substances and petroleum can be discharged to the ground surface from a variety of sources (i.e. poorly stored containers, spills), or below grade, from sources such as buried drums, leaking underground storage tanks, or dry wells and other sub-surface waste collection systems. This contaminated soil thereby becomes a source of contamination, which can migrate, contaminating additional soil and underlying groundwater. Understanding the extent and chemical characteristics of soil contamination is paramount, and can be determined through effective soil sampling.

Soil sample collection has two steps. The first is obtaining the soil from the desired spatial location. The second is containerizing the soil obtained as appropriate for the specific analysis. Shovels, trowels, borers, and excavators are all tools that can be used to obtain the soil from the desired location. Staff then utilize syringes, gloved hands, trowels and other tools to containerize the appropriate amount of soil in appropriate jars or other sample vessels with required preservation, as specified by the analysis methodology.

5.2 PLANNING

A well-developed conceptual site model (CSM) is imperative for effective soil sampling. Prior to conducting any sampling event, a sampling and analysis plan (SAP) should be developed (see MEDEP/DR SOP# RWM-DR-014 - Development of a Sampling and Analysis Plan). Included in the SAP should be specifics regarding the anticipated substances of concern, data quality objectives, the laboratory conducting analysis, method of sample collection, and Quality Assurance/Quality Control (QA/QC).

A well thought out CSM, and a statement of specific goals for a sampling project, will make any sampling event more efficient and provide meaningful data for making sound decisions.

5.2.1 SPECIAL CONSIDERATIONS REGARDING CONTAINERIZATION

Many analytical procedures require specific containerization and preservation protocols. Many samples collected for volatile organic analysis, depending on the specific method, may require a set of three or more containers for conducting the complete analysis. Many methods for the analysis of volatile organic compounds (VOCs) require multiple glass vial containers with varying types and amounts of preservatives, including deionized water and methanol. MEDEP/DR expects requirements for soil sample containerization to change as analysis methodology and sample preservation techniques evolve. Therefore, container and preservation requirements for the specific analysis methodology must be obtained from the laboratory conducting the analysis, and outlined in the SAP. Field staff must be trained and familiar with these protocols.

5.3 EQUIPMENT

Depending on the objectives of the sampling event and site characteristics, there is a range of equipment available for sample collection purposes. Equipment choice will generally be dictated by the depth of the soil samples to be taken and the type of subsurface materials expected to be encountered:

- Surficial soil 0 – 6 inches in depth;
- Shallow soil samples – 6 inches - 2 feet in depth; and
- Deep soils greater than 2 feet in depth.

In addition to the tool(s) and its associated paraphernalia for obtaining the soil sample, additional required equipment for a soil sampling event would include:

- Containers – As indicated by the laboratory conducting the analysis, including sample preservative;
- Personal Protective Equipment (PPE) – As required for expected contamination, and stated in the SAP/HASP (Health and Safety Plan);
- Decontamination Equipment – As outlined in MEDEP/DR SOP# RWM-DR-017 – Equipment Decontamination Protocol, and specified in the HASP;
- Sample Containerization tools – Certain analytical methods have specific sample size and preservation requirements. A number of tools can be utilized for meeting these requirements. A sample collection syringe, such as a disposable open barrel (without Luer-tip end) plastic syringe for sampling or a Terra Core™ sampler, is useful for collecting a specific amount of soil and extruding it into the containers. As sample requirements are based on mass, a field scale is useful to assure the appropriate amount of soil is collected. To make containerization easier and minimize soil disturbance, syringes used for collection should be smaller than the mouth of the jar. Syringes having rubber or other elastomer seals are not acceptable, and must have the rubber seal removed prior to use. As stated earlier, specific tools for sample containerization must be outlined in the SAP.

The sampling equipment's composition may vary with analytical needs. Depending on the media collected and anticipated analysis, some containers and/or tools may be incompatible with the analytical methods. For example, If sampling for PFAS, then

equipment must be stainless steel or an approved plastic (i.e. HDPE), and Teflon and other PFAS containing materials must be avoided throughout the sampling event.

5.3.1 EQUIPMENT FOR SURFICIAL SOIL SAMPLE COLLECTION

Surficial soil sampling is generally conducted utilizing common hand tools, such as shovels, trowels, etc. An appropriately gloved hand can also be used.

5.3.2 EQUIPMENT FOR SHALLOW SOIL SAMPLE COLLECTION

Shallow soil sampling can be conducted utilizing common hand tools, such as shovels, trowels, etc. Additionally, augers and borers may also be useful for sampling below a depth of one foot. Soil characteristics, such as grain size and saturation will also dictate tool selection. For example, a collapsing soil, such as sand or gravel, may not be suitable to collect with a shovel at depth, making a borer a better option. Below is a list of tools and equipment available to MEDEP/DR staff for shallow soil sampling:

- Shovels
- Trowels
- Lab spatulas, scoops
- Soil Augers - bucket, screw and push
- Geoprobe® soil borer

This list is by no means complete, as any type of tool capable of “digging” can be used for soil sampling, as long as it has been properly decontaminated and is made of appropriate material considering the contaminants in question. Use of shovels, trowels, and augers are for the most part intuitive. For use of the Geoprobe® soil borer or other boring device, please refer to manufacturer’s operation manual.

5.4 EQUIPMENT FOR DEEP SOIL SAMPLE COLLECTION

Tools for deep soil sample collection are used to obtain the soil from the depth desired and bring it to the surface upon which it is containerized. Sampling equipment for obtaining deep soil samples includes augers, direct push boring machinery, such as Geoprobe® Systems manual boring equipment and rigs, rotary auger rigs with split spoon samplers, and earthmoving equipment, such as backhoes and excavators. A standard shovel can also be used. Use of Augers and shovels is intuitive, drill rigs and earthmoving equipment should only be used by staff trained specifically for the use of that piece of equipment.

5.5 SAMPLING PROCEDURE

5.5.1 SITE MOBILIZATION/ RECONNAISSANCE

Upon arrival at the work area, note conditions around the sample site. If sampling pre-determined locations stated in the SAP, reconnoiter each location to determine whether in fact the sample location is appropriate to meet the goals of the activity stated in the SAP, if this has not been done previously. If sampling based on field conditions, conduct

a walkover of the entire area in question and observe the conditions of the site. Look for visual indicators such as stained soil and stressed vegetation, which may be indicative of a spill. Low-lying areas are more likely to receive contaminants discharge to the ground surface. Note the general condition of the landscape (i.e., has it been disturbed or does it appear to be in a natural condition). Designate site boundaries, work zones and establish a secure perimeter to keep out unauthorized persons.

5.6 SAMPLING PROCEDURE

5.6.1 SAMPLING PROCEDURE FOR SURFICIAL SOIL SAMPLING

1) Don appropriate Personal Protective Equipment (PPE) for sampling.

2) Use a Scoop, spatula, trowel, syringe, or other appropriate tool to collect sample. The goal of the sample collection is to collect the soil with minimal disturbance and limit the amount of handling and tooling contact. For those soils more densely packed or rocky, a more robust tool, such as a shovel can be used. Remove debris, twigs, rocks, vegetation, and organisms (such as bugs and worms) from the extracted material to gain a representative sample.

Depending on the SAP and the data quality objectives (DQOs) of the project, an attempt should be made to keep site-wide sampling as consistent as possible. Choose sample locations that have the same or similar soil type, organic matter content, and depth if possible.

Depending on the containerization requirements, the tool will be used to expose the soil desired, and the soil will then be containerized directly from the soil formation. The tool may also be used to remove the soil from the formation and the soil may be containerized directly from the tool. The specific procedure selected should allow sample collection with the minimal amount of soil disturbance. Care should be taken to ensure that the soil sample containerized is representative of the specific depth to be sampled and not from hand tool “smearing” from an alternate depth interval or “cave in” of materials from an unrepresentative depth.

An example:

Samples for VOC analysis are generally collected utilizing a plastic syringe inserted into the soil to collect a specific amount of soil. This “plug” of soil is then extruded from the syringe into the container, which may be pre-served with the appropriate volume of preservation fluid. In some cases, preservation fluid might need to be added after the fact. Metals are generally collected by placing soil in a plastic “whirlpak” style bag. In this example, an appropriate procedure to collect a surficial sample for VOC and metals analysis would be to: a) use trowel to scrape off vegetation, duff, and the top 1 - 2 inches of soil; b) use appropriately gloved hands to pick out large rocks, stones, sticks and bugs; c) push the syringe directly into the undisturbed soil to collect the sample for VOC analysis, thereby minimizing the soils’ handling, and then extrude into the container; d) use the trowel, or gloved fingers, to remove soil from the sample location, and place soil into whirlpak container for metals analysis.

Pushing the syringe directly into the formation minimizes the disturbance of the soil collected for VOC analysis. If it is not possible to push the syringe directly into the soil formation, it is acceptable to collect the soil with a tool, and push the syringe into the soil collected by tool. Containers for VOC analysis should be filled first and quickly sealed to minimize off-gassing of any volatile substances potentially present.

3) Add preservative (if necessary) and tightly close containers. Be sure to remove any dirt from the threads of the jar to ensure a tight fit. Wipe or wash off any large soil particles adhering to the jar lid or threads.

5.6.2 SAMPLING PROCEDURE FOR SHALLOW SOIL SAMPLING

1) Don appropriate PPE for sampling

2) Using appropriate tool, expose the soil to be sampled. As stated earlier, the goal of the sample collection is to collect the soil with minimal disturbance of the soil and limiting the amount of handling and tooling contact to the sample collected. If using a shovel, then the shovel can be used to dig a hole to the specific depth, and the sample then collected from the side wall using a trowel, gloved hand, syringe, or even the container itself (but be careful using the container if it contains preservative). If using an auger or borer, the soil to be sampled is brought up to the surface, and soil is removed from the tool and placed in the container(s). If utilizing a syringe to collect a specific amount of soil, the syringe should be pushed into the soil in the tool as soon as possible to minimize handling of soil.

3) Collect and containerize sample. Care should be taken to make sure that the soil sample containerized is from the specific depth to be sampled, not from soil smeared from a shallower depth by tools, or “caved in” soil having fallen into the excavated hole from a shallower depth.

An Example:
Using a shovel, dig a hole to a little beyond the desired sample depth. Then, using a trowel or gloved hand, scrape the sidewall at the desired depth to remove any possible smeared soil from the shovel. For VOC analysis, push a syringe directly into the sidewall, and then extrude the soil into the container. For metals analysis, use the trowel to obtain the appropriate amount of soil from the desired sample depth and containerize, removing any large roots, stones, organic matter, etc.

Another Example
Using a bucket auger, advance the auger to the desired sample depth. Upon reaching an inch or two above the desired depth, remove the bucket auger and empty out soil next to the hole. Remove any soil that might have collapsed into the hole with bucket auger. It may be necessary to decontaminate the auger to minimize cross-contamination from the upper layer of soil. Reinsert auger, and advance to desired depth. Remove bucket auger, and containerize soil samples from soil at end of bucket auger, trying to

minimize handling as much as possible. If syringes are used, push syringe directly into soil in auger.

3) Add preservative (if necessary) and tightly close containers. Be sure to remove any dirt from the threads of the jar to assure a tight fit. Wipe or wash off any large soil particles adhering to the jar lab.

5.6.3 SAMPLING PROCEDURE FOR DEEP SOIL SAMPLING

1) Don appropriate PPE for sampling.

2) Using appropriate tool or machinery, obtain soil for containerization. With the exception of very large excavations, sampling tools will be used to bring the soil up to the surface for containerization. This will be with the use of an auger, borer, or heavy mechanical equipment, such as an excavator or backhoe. Soil boring/drilling equipment should be operated per manufacturers' instructions. Heavy machinery is to be used by trained operators.

For samples requiring the use of heavy equipment (i.e. back-hoe, loader) to excavate, samplers should not enter the pit/trench. All observations and samples can generally be taken from the excavated material at the ground surface. "Trenching and excavation work presents serious risks to all workers involved. Strict compliance, however with all sections of the OSHA standard will prevent or greatly reduce the risk of cave-ins as well as other excavation-related accidents."(OSHA Subpart P-Excavation, Trenching, and Shoring-1926.650 et seq.). Particularly with excavators and backhoes, be careful to obtain the sample from depth of the formation, and not from slough or caved in material from a shallower depth. As with shallow sampling, it may be appropriate for the excavator to dig to the desired depth, scrape the side or bottom wall of the pit to remove slough and smeared material, then obtain soil for sampling. When collecting from the excavator bucket, care should be taken to ensure that samples are collected from an area that did not come into contact with the bucket itself, since the bucket cannot be decontaminated after touching other layers of soil.

It may be possible to use a remote sampling device to collect samples at the desired depth from the sidewall or bottom of the pit. The face of the pit/trench should first be scraped to remove the smeared zone that has contacted the backhoe bucket by the remote sampler. Utilize the remote sampler to obtain soil for containerization.

If the excavation is large enough to allow safe and acceptable entry, obtain sample using the protocol for surface or shallow soil samples.

3) Containerize the sample. After using the borer, excavator or remote sampler to obtain the soil from the appropriate depth, containerize the sample, following laboratory protocol. Soil samples should be collected and containerized with minimal handling and disturbance. Wipe or wash off any large soil particles adhering to the jar lid or threads.

4) Add preservative (if necessary) and tightly close containers. Be sure to remove any dirt from the threads of the jar to assure a tight fit. Wipe or wash off any large soil particles adhering to the jar lid.

5.7 GENERAL CONSIDERATIONS

The sampler should remove gloves after completion of sample collection and don new, clean gloves for each sampling point. All sampling equipment must be decontaminated before use at each sampling point, or new, dedicated equipment for each point must be used. This includes changing gloves and using clean equipment when sampling for different depths at the same point. In general, if the label on the container changes, then it should be treated as a completely different sample.

If sampling for any volatile compounds, then special care should be taken to minimize disturbance of the soil and exposure of the sample material to the air. This will help to prevent off-gassing of any volatile compounds potentially present.

If resampling is expected, mark the sample location by placing a marker in the hole such as a stake with flagging. After completing sampling activities, close (fill in) the excavation to ground level to reduce tripping hazards. Sample locations should also be located using global positioning (GPS) or swing tie measurements collected from permanent or semi-permanent site features to ensure sample locations can be identified and located in the future.

If possible, background samples or samples from areas of lower expected concentrations should be collected first. After this, samples should progress from lesser to more contaminated locations to minimize the potential for cross-contamination.

Preservation for most samples, even if preservative is used, includes the cooling of samples to 4° Celsius. All samples should be placed in iced cooler for storage and transported soon after collection to ensure laboratory hold times are met.

5.8 COMPOSITE SAMPLES

Depending on the DQOs of the project, it may be necessary to collect composite samples. Composite samples are often collected for disposal characterization. The SAP will outline any specific composite requirements. The same procedure for obtaining soil from surficial, shallow or deep locations would be followed. However, instead of directly containerizing the sample, the soil is placed in a dish, bucket, tray or other suitable vessel for mixing. Samples should be mixed thoroughly, while taking care to remove cobbles, organic material and other unlike materials non-indicative of the desired soil interval. This mixed sample material is then transferred into the final sample containers, following laboratory protocol for containerization and preservation. Use an equal amount of soil from each sample location.

If a composite sample is desired from a test pit, several depths or locations within the pit/trench should be selected and a bucket is filled from each area. The SAP will outline

composite sample requirements. Material from each bucket is then placed into an appropriate container where the material is mixed.

Unless specifically stated in the SAP, samples for compounds considered volatile, such as VOCs and Volatile Petroleum Hydrocarbon (VPH) analysis, should not be composited in the field.

5.9 DECONTAMINATION

All equipment should be decontaminated between sampling points, and at the end of the day, following the procedure outlined in MEDEP/DR SOP# RWM-DR-017 – Equipment Decontamination Protocol, and as outlined in the project specific SAP.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

Data quality objectives should be stated in the sampling plan. Quality Assurance/Quality Control (QA/QC) samples may be required to meet your data quality objectives. The following typical types of QA/QC samples may be collected as part of the QA/QC program for soil sample collection. For an additional discussion of QA/QC, please refer to the MEDEP/DR Quality Assurance Plan, Sections 4 and 8.

6.1 EQUIPMENT BLANKS

Equipment blanks may be collected at a rate of 5%, one equipment blank every twenty samples collected.

6.2 DUPLICATE SAMPLES

It is recommended that duplicate samples be collected at a rate of 5% to assess sample location variability.

6.3 BACKGROUND SAMPLES

Background samples may be collected as part of the soil evaluation, depending on the goals of the sampling event, and the DQOs of the project. Background sample requirements should be outlined in the SAP.

6.4 TRIP BLANK

When collecting samples for VOC or PFAS analysis, trip blanks may be collected.

7.0 DOCUMENTATION

Documentation is one of the most important aspects of any sampling event, but particularly so with a soil sampling event. Documentation should be completed with the idea that someone not present during the actual event may need to repeat the event exactly as was conducted originally. During the sampling event or immediately upon the

completion of the event, create a map of the area and locate the sampling points on the map. Refer to the MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report. It is very important that all information regarding a sampling event (or any events/activities) be accurately recorded. A trip report package should also be completed for the event, as outlined in MEDEP/DR SOP# RWM-DR-013.

Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol.

8.0 HEALTH AND SAFETY

As part of the SAP, a HASP must be developed for site work. Additional safety considerations are required for working with heavy equipment. Note the conditions of the sample area, be aware of the potential physical hazards (i.e., trench, open excavation, loose uneven footing, overhead power lines, etc.). With each of these unique situations take a common sense approach that will yield a representative sample in the safest manner possible. Establish alternative means of communication other than verbal for situations when hearing is hampered or impaired. Samplers must read the HASP and acknowledge that they have read it and understand it before work can begin.

For information on buried utilities that may be impacted by the excavations occurring on site call the DIG SAFE HOTLINE, toll free at 1-800-225-4977. This is required by law!

006-soil-sampling-Final-2021 - B Blais

Final Audit Report 2021-12-23

Created:	2021-12-18
By:	Lindsay Caron (LINDSAY.ER.CARON@MAINE.GOV)
Status:	Signed
Transaction ID:	CBJCHBCAABAA01WqJtu3B8KTOkZ-BHM3DP7WCoHW9vyU

"006-soil-sampling-Final-2021 - B Blais" History

Document created by Lindsay Caron (LINDSAY.ER.CARON@MAINE.GOV)
2021-12-18 - 3:40:14 AM GMT- IP address: 198.182.163.115

Document emailed to Carla J. Hopkins (carla.j.hopkins@maine.gov) for signature
2021-12-18 - 3:41:34 AM GMT

Email viewed by Carla J. Hopkins (carla.j.hopkins@maine.gov)
2021-12-20 - 1:02:39 PM GMT- IP address: 104.47.64.254

Document e-signed by Carla J. Hopkins (carla.j.hopkins@maine.gov)
Signature Date: 2021-12-20 - 1:08:43 PM GMT - Time Source: server- IP address: 67.253.120.113

Document emailed to Susanne Miller (susanne.miller@maine.gov) for signature
2021-12-20 - 1:08:45 PM GMT

Email viewed by Susanne Miller (susanne.miller@maine.gov)
2021-12-22 - 6:13:10 PM GMT- IP address: 104.47.65.254

Document e-signed by Susanne Miller (susanne.miller@maine.gov)
Signature Date: 2021-12-22 - 6:17:41 PM GMT - Time Source: server- IP address: 184.153.146.117

Document emailed to Kevin Martin (kevin.martin@maine.gov) for signature
2021-12-22 - 6:17:42 PM GMT

Email viewed by Kevin Martin (kevin.martin@maine.gov)
2021-12-23 - 6:00:17 PM GMT- IP address: 104.47.65.254

Document e-signed by Kevin Martin (kevin.martin@maine.gov)
Signature Date: 2021-12-23 - 6:01:54 PM GMT - Time Source: server- IP address: 73.16.27.248

Document emailed to Melanie Loyzim (melanie.loyzim@maine.gov) for signature
2021-12-23 - 6:01:56 PM GMT

Email viewed by Melanie Loyzim (melanie.loyzim@maine.gov)

2021-12-23 - 7:08:33 PM GMT- IP address: 104.47.65.254

Document e-signed by Melanie Loyzim (melanie.loyzim@maine.gov)

Signature Date: 2021-12-23 - 7:08:45 PM GMT - Time Source: server- IP address: 198.182.163.121

Agreement completed.

2021-12-23 - 7:08:45 PM GMT