COVER SHEET
STANDARD OPERATING PROCEDURE

Operation Title: **SURFACE WATER AND SEDIMENT SAMPLING**

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1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Site Remediation (MEDEP/DR) standard operating procedure (SOP) for collecting surface water and sediment samples from streams, rivers, ponds, lakes, lagoons, surface impoundment's and other surface water bodies throughout the State of Maine.

2.0 APPLICABILITY

MEDEP/DR is responsible for the investigation and remediation of hazardous substance, petroleum, and landfill sites throughout Maine. In the course of these investigations, samples are sometimes taken to determine the extent of contamination within the surface water bodies of Maine. This standard operating procedure (SOP) is designed to be a guideline for MEDEP/DR staff for collecting samples of surface water and sediment chemical analysis. This procedure is based on current methodology guidelines and field experience of MEDEP personnel.

3.0 RESPONSIBLITIES

All MEDEP/DR staff must follow this procedure when performing surface water and sampling activities. Generally, the field staff (OHMS positions) in MEDEP/DR conduct this type of sampling, although project managers may collect these types of samples in specific instances if accompanied by, or once appropriately trained in, this methodology when use of powered water craft are not required. The respective managers and supervisors for MEDEP/DR are responsible for ensuring that their staff receive adequate training, are familiar with, and adhere to these procedures.

4.0 INTRODUCTION

Collecting a representative surface water and/or sediment samples is often difficult because of many factors associated with water bodies. In moving surface water systems, for example, mixing and flow rate may effect the sample. In standing surface water systems, stratification and lack of significant currents play a major role in the type of sampling to be proposed. This SOP identifies sampling protocols to be followed when collecting representative surface water samples. Sediment sampling presents the same challenges, given the changing depositional characteristics in rivers, streams, lakes and other surface water bodies. This SOP shall provide a guideline in to assure that environmental samples collected from surface water bodies are as representative as possible of the actual conditions within the surface water body itself.

5.0 EQUIPMENT

The following standard equipment for surface water collection is available to MEDEP/DR staff for collecting sediment samples.

5.1 EQUIPMENT FOR SURFACE WATER

5.1.1 Kemmerer sampler

A messenger activated water sampling device which is able to sample water at discrete Locations in a column of water. The Kemmerer sampler is a vertically oriented sampler, and is applicable for collecting stratified water column samples.

5.1.2 Beta sampler

A messenger activated water sampling device that is horizontally oriented. The Beta sampler is applicable for collecting samples from the bottom of a surface water column, as well as being able to collect discrete samples at different depths of the water column.

5.1.3 Peristaltic Pump

A peristaltic pump can be used to collect a water sample by attaching the intake of the hose to a stick or pipe, or weighing the end of the intake pipe, and lowering it to the desired depth.

5.1.4 Other Samplers

Additional collection devices can also be used for obtaining samples of water (such as a sample container itself, or a container tied to a clean rope, or other "container" type device); any custom made tool must be described in either the sampling plan or trip report for the particular sampling event.

5.2 EQUIPMENT FOR SEDIMENT SAMPLING

The following standard equipment is available to MEDEP/DR staff for collecting sediment samples.

5.2.1 Ponar grab

A self closing center pivot benthic grab sampler used for taking samples of hard bottoms such as sand, gravel, rocky, or clay.

5.2.2 Ekman Grab

A center pivot benthic grab sampler used for obtaining samples in soft, finely divided littoral bottoms.

5.2.3 Geoprobe Systems Large Bore sampler

A soil boring device used usually for boring in soil, but can also be used in sediment sampling with a manual slide hammer and manual removal jack. Specific use of the Large Bore sampler can be found in the Geoprobe System's operators manual.

5.3.4 Shovel

A general garden type spade.

5.3.5 Other Tools

Additional "digging" type tools can also be used for obtaining samples of sediment; any custom made tool must be described in either the sampling plan or trip report for the particular sampling event.

6.0 GUIDELINES/PROCEDURES FOR SURFACE WATER AND SEDIMENT SAMPLING

6.1 PREPARATION

Before undertaking any surface water or sediment sampling at a site, a site and event specific Sampling and Analysis Plan (SAP) should be developed (see SOP DR#014 - Development of a Sampling and Analysis Plan, as well as a Health and Safety Plan (HASP). As with all sampling, a well developed Site conceptual model is imperative for effective surface water and sediment sampling. Special considerations should be made to determine the presence of preferential pathways for contamination into the building, and appropriate locations and methodology to assure proper sampling locations are selected. A SAP for a surface water sampling event should specify the sample collection tools and means of accessing the sample points.

There are 3 means of accessing surface water for collection of water column and sediment samples: 1) Dipping from shore or surface water crossing; 2) Wading into the surface water body; and 3) Boat access. The .size and flow of the water body will generally dictate the means of accessing the sampling points. Means of access generally dictates the equipment for collecting samples as well. In instances of sampling a shallow stream, it is possible to obtain the desired samples by dipping the containers directly into the water body from shore. At larger streams or ponds, entering the surface water with boots or waders may be the safest and easiest way to collect a representative sample, provided depth of water and strength of the current are not prohibitive. In such instances, a safety line should be attached to the sampler entering the surface. The sampler .must make sure the boots/waders are not leaking and are compatible with the potential contaminants in the surface water body. Samples can then be collected by either direct dipping with the container or with a separate sample collection tool.

For sampling larger rivers and lakes, a boat most likely will be needed in order to obtain the desired samples. If a boat is used by members of the MEDEP/DR, the boat must be appropriately equipped with proper safety gear/equipment as specified by the Coast Guard, including personal flotation devices (one per person), anchors, flares, etc. If the boat used is a has a gasoline powered engine, then one member of the sampling team should be dedicated to operation of the motor to prevent contamination of samples with gasoline and oil. The staff member operating the boat must be trained and/or have experience in using a similar craft.

When accessing the surface water for sample collection, safety considerations should be paramount. If possible, pick a good, safe spot on the shore/bank of the surface water where the shore/bank is stable and the sampler is not likely to fall in the water. If the sampler cannot safely sample from the shore/bank and must enter the surface water body in order to obtain a representative sample, the sampler must, when possible, take precautions to enter the water from a downstream location and must always collect the sample from an upstream location. When sampling a surface water body, be careful to sample water which doesn't contain sediments that the sampler has disturbed. Make sure to wear the appropriate personnel protective equipment (i.e., gloves) for the contaminants potentially in the water.

6.2 SPECIAL CONSIDERATIONS FOR WATER BODY TYPES

6.2.1 Special Considerations for Flowing Water

In addition to safety considerations of flowing water, the sampling of moving surface water, such as streams, rivers, estuaries, and drainage ditches, uses different strategies and techniques for sampling than does standing surface water. With moving surface water there will be more mixing and less stratification than in standing surface water. Discharge points, merging streams, springs, and the presence of pools and eddies must also be considered when sampling moving surface water. A reconnaissance of all sampling points is recommended before conducting the actual sampling. All sampling points should be clearly marked to assure consistency in sampling rounds.

After selecting representative sampling points which adequately address the sampling objectives, decide how many samples to take and what type of analyses are appropriate. Samples should be collected directionally from downstream sites to upstream sites to avoid disturbing water that is to be sampled. If these precautions are taken, the sample should be free of any sediment and/or contaminants stirred up by the sampler. The location of the samples depends directly on what the objectives of the sampling event are and are dependent on the specifics of the site (as long as the sample can be safely obtained).

6.2.2 Special Considerations for Standing Water

The sampling of standing surface water, such as ponds, lakes, lagoons, and impoundments, is different from the sampling of moving surface water because standing surface water often is stratified and zoned within the surface water body. The lack of movement results in very little mixing, therefore requiring more sampling points than moving surface water.

In a standing surface water body, the section nearest the source of contamination is likely to be the area of highest contamination. The sampler might also expect a vertical stratification of contamination due to a lack of mixing.

7.0 SAMPLING PROCEDURES FOR SURFACE WATER SAMPLES

7.1 DIPPING CONTAINERS

In many instances, MEDEP/DR members will be sampling a surface water body from the shore/bank of the surface water body. Because of this fact, the sample container will usually

be the easiest piece of equipment to use to collect the sample. Using the actual sample container to take the sample eliminates most of the chance of cross-contaminating samples (by unnecessary transfer of samples from a sampling device to a sample container) and also eliminates the need for extensive decontamination of sampling equipment. Dip the sample container just below (1 inch) the surface of the water, with the opening of the container pointing upstream. Remember, however, that the outside of the sample container should be clean prior to sampling, and wiped dry or if necessary, decontaminated (see SOP DR#017: Decontamination of Equipment Used at Uncontrolled Hazardous Substance Sites) prior to being placed in a cooler with other samples.

Dipping of containers may not be recommended for large surface water bodies, such as lakes or rivers, as the surface water directly at the surface might not reflect conditions deeper in the water body. As with all sampling, a well thought out conceptual site model and must be part of the SAP.

7.2 SAMPLING USING KEMMERER OR BETA

Use of the Kemmerer or Beta is for the most part intuitive. After opening and cocking the sampling device by pulling the plugs located on either end, lower the device to the desired depth of sample collection and then send the messenger down the rope to spring the device. After retrieving the sampler, fill containers as directed by laboratory from the spigot located on the side of the sampler. Once sample collection is complete, the sampler should be decontaminated before being used at the next sampling location.

7.3 SAMPLING USING THE PERISTALTIC PUMP

Operate the peristaltic pump as stated in the manufacturer's manual. Attach the appropriate amount of tubing needed for the depth desired, and lower the intake to the appropriate depth in the water column. This can be done by using stiff piping, PVC well material, an appropriate sized stick, or just weighing the end of the tubing. Turn on the pump, and collect sample from exhaust tubing using containers as directed by the laboratory.

7.3 OTHER EQUIPMENT

In the SIR Division, samplers can choose dippers with longhandled poles, buckets with string attached, and extended bottle samplers. This type of equipment is generally "homemade", and built for a specific sampling event. Use of this type of "exotic" equipment will be outlined within the SAP for the sampling event, as well as in the Sampling Event Trip Report (SETR) for the event (see SOP DR#013 - Field Documentation and SETR Development).

8.0 SAMPLING PROCEDURES FOR SEDIMENT SAMPLING

Both the Ponar and Ekman Dredge are, for the most part, intuitive in their use. After opening the "jaws" of the device, the sampler is then locked open with the spring mechanism, and lowered to the sediment to be sampled. It is better to lower the device slowly, hand over hand with the rope, rather than to just drop the sampler into the water. Upon impact, the spring mechanism should release, and the jaws close to collect the

sample. The sampler is then raised to the surface, and after draining excess water, the sampler is opened and contents emptied into a clean bowl. Containers are then filled using spatulas or appropriately chemical resistant gloves, as directed by the laboratory conducting the analysis.

Shovels are also intuitive in their use. After "digging up" the sediment sample, the sample is then containerized as directed by the laboratory conducting the analysis.

Samples should also be collected from areas that are believed to be least contaminated to areas of greater concentration. As with surface water sampling, sampling points should be approached from downstream, and care must be taken not to step into the area of sample collection when wading.

8.1 OTHER ISSUES PERTAINING TO SEDIMENT SAMPLING

An attempt should be made to obtain sediment samples that are similar in there organic content and formation, i.e, silty, sandy, clay, etc. Excess organic material, such as leaves, roots, and larger aquatic organisms (slugs, mussels, clams, beach goers) should be removed from the sample prior to containerization.

9.0 DECONTAMINATION

All equipment should be decontaminated between sampling points, following the procedure outlined in MEDEP/DR SOP RWM-DR-017 – Decontamination procedures, and as outlined in the project specific SAP.

10.0 QUALITY ASSURANCE/QUALITY CONTROL

Data quality objectives should be stated in the sampling plan. Quality Assurance/Quality Control (QA/QC) samples may be collected if needed 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 sediment sample collection. For an additional discussion of QA/QC, please refer to the MEDEP/DR Quality Assurance Plan, Section 5.

10.1 EQUIPMENT BLANKS

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

10.2 DUPLICATE SAMPLES

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

10.3 BACKGROUND SAMPLES

Background samples should be collected as part of the surface water and sediment evaluation. Background sample requirements should be outlined in the SAP.

10.4 TRIP BLANK

When collecting samples for volatile organic compound analysis, trip blanks are recommended.

11.0 DOCUMENTATION

Documentation is the most important aspect of any sampling event, but even particularly so with a surface water/ sediment 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, diagram a map of the area and locate the sampling points on the map. Also record observational data concerning the surface water such as relative depth at the sampling point, odor, color, turbidity, and relative velocity (low, medium, or high). Make sure to record in your personal field book any and all information which is pertinent to the sample. Refer to the MEDEP/DR SOP DR#013 - Documentation of Field Notes and Development of a Sampling Event Trip report. It is very important that all information regarding a sampling event (or any events/activities) be accurately recorded. Record all information obtained while sampling such as sample numbers, measurements taken (i.e., pH, conductivity, temperature, etc.), observations made (i.e. turbidity, color, and odor of the water) and other comments (problems with the sampling, why certain areas were not sampled). A trip report package should also be completed for the event, as outlined in MEDEP/DR SOP DR#013.

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

12.0 HEALTH AND SAFETY

As part of the overall work plan at a hazardous substance site, a site specific health and safety plan (HASP) must be developed and adhered to by all personnel working at the site. Refer to MEDEP/DR SOP DR#014 - Development of a Sampling and Analysis Plan.

All personnel must understand that if a sample can not be obtained safely, the sample should not be taken at all. If a sample cannot be obtained due to safety considerations it should be documented in the sampler's field book.