COVER SHEET
STANDARD OPERATING PROCEDURE

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

Originator: **Brian Beneski**
Quality Assurance Coordinator
Division of Remediation
Bureau of Remediation and Waste Management

APPROVALS:

Division of Remediation Director:

David Wright — *Print name*
David Wright — *Signature*
12/1/2016 — *Date*

Bureau of Remediation and Waste Management Director:

DAVID BURNS — *Print name*
Signature
12/4/16 — *Date*

QMSC Chair:

Bill Longfellow — *Print name*
Signature
12/30/16 — *Date*

Department Commissioner:

PAUL MERCER — *Print name*
Signature
1-3-2017 — *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 DEP/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's standard operating procedure 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.

3.0 RESPONSIBLITIES

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 GUIDELINES AND PROCEDURES

4.1 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 affect 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.

4.2 SAMPLING EQUIPMENT

The following is a list of standard equipment for surface water and sediment sample collection.

4.2.1 SURFACE WATER

4.2.1.1 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.

4.2.1.2 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.

4.2.1.3 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.

4.2.1.4 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.

4.2.2 SEDIMENT SAMPLING

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

4.2.2.1 Ponar grab

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

4.2.2.2 Ekman Grab

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

4.2.2.3 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.

4.2.2.4 Vibracore Sampler

A sampling device that advances by vibration, not rotation that facilitates unconsolidated sediment sampling in a complete core.

4.2.2.5 Shovel

A general garden type spade.

4.2.2.6 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.

4.3 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# RWM-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 Conceptual Site Model (CSM) 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. Whenever MEDEP/DR staff are working near water bodies, appropriate personnel floatation devices (PFD) are required.

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 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 personnel entering the surface. Personnel must make sure the boots/waders do not leak 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 large water bodies personnel may utilize a boat to facilitate sample collection. 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 a boat is used and 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. Personnel 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 personnel are not likely to fall in the water. If personnel cannot safely sample from the shore/bank and must enter the surface water body take precautions to enter the water from a downstream location and 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, eye protection) for the contaminants potentially in the water.

4.3.2 SPECIAL CONSIDERATIONS FOR WATER BODY TYPES

4.3.2.1 Special Considerations for Flowing Water

In flowing surface water bodies there is a potential for more mixing and less stratification than in stagnant water bodies. Discharge points, merging streams, springs, and the presence of pools and eddies must also be considered when sampling flowing 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 on the data quality objectives (DQOs) of the sampling event are and are dependent on the specifics of the site (as long as the sample can be safely obtained). For example, sediment sampling to assess risk to biota may target very shallow depths, while sampling for removal may target deeper sediments.

4.3.2.2 Special Considerations for Stagnant Water

The sampling of stagnant surface water bodies is different from the sampling of flowing surface water bodies because stagnant water is often stratified in zones based on temperature and dissolved oxygen within the surface water body. The lack of movement may result in very little mixing and require more selective sampling that does not disturb the natural conditions.

4.4 SAMPLING PROCEDURES FOR SURFACE WATER SAMPLES

4.4.1 DIPPING CONTAINERS

In many instances, MEDEP/DR members will be sampling a surface water body from the shore/bank of the surface water body and the sample container will usually be the sample device. 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 MEDEP/DR SOP# RWM-DR-017 – Equipment Decontamination Protocol) prior to being placed in a cooler with other samples.

Direct dipping of the laboratory containers should be avoided if the containers contain sample preservatives such as acids or bases.

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 must be part of the SAP.

4.4.2 SAMPLING USING KEMMERER OR BETA

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 the 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.

4.4.3 SAMPLING USING THE PERISTALTIC PUMP

A peristaltic pump can be used by lowering the tubing intake to the appropriate depth in the water column. This can be done by using stainless steel tubing, PVC well material, other inert material,, or using a weight at the end of the tubing. Turn on the pump,purge 1-3

tubing volumes of water and collect the sample using the laboratory supplied containers with appropriate preservation as directed by the laboratory.

4.4.4 OTHER EQUIPMENT

In the case of unique or hard to sample situations, personnel may choose alternate custom fabricated samplers built for a specific sampling event. Use of this type of sampling equipment will be described in the SAP for the sampling event, as well as in the Sampling Event Trip Report (SETR) for the event (see SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report).

4.5 SAMPLING PROCEDURES FOR SEDIMENT SAMPLING

Ponar and Ekman Dredge devices are operated in a similar method. However, care should be taken when preparing the devices because the jaws are sharp and spring loaded. After carefully opening and locking the "jaws" of the device, the sampler is then lowered at the desired location to the sediment surface. 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 contact with the sediment, 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 carefully 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. If the sampler does not activate upon contact with the sediment surface, raising and lowering it suddenly should activate it.

Shovels are also intuitive in their use, but care should be taken to select the sample depth based on the DQO's as mentioned previously..

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.

4.5.1 OTHER ISSUES PERTAINING TO SEDIMENT SAMPLING

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

4.6.0 DECONTAMINATION

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

5.0 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, Sections 4 and 8.

5.1 EQUIPMENT BLANKS

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

5.2 DUPLICATE SAMPLES

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

5.3 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.

5.4 TRIP BLANK

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

6.0 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# 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. 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# RWM-DR-013.

If possible, sample locations should be located using global positioning system (GPS) for future reference.

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

7.0 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# RWM-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.