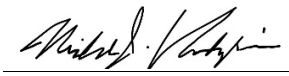
Cover Sheet
Standard Operating Procedure

Operation Title: **Incremental Sample Methodology for Site Investigation and Risk Assessment**

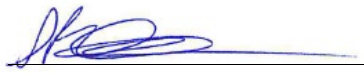
Originator Name: **Becky Blais**
Quality Assurance Coordinator
Maine Department of Environmental Protection
Division of Remediation

Approvals:

Division of Remediation Director:

Nick Hodgkins		4/22/2026
Print name	*Signature*	*Date*

Bureau of Remediation and Waste Management Director:

Susanne Miller		4/24/2026
Print name	*Signature*	*Date*

Distribution:

(x) Division of Remediation and Division of Technical Services
By: Becky Blais Date: 07/14/2026

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 may be utilized by other Divisions within MEDEP, as determined by the respective Division Directors or their designees.

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 utilizing Incremental Sampling Methodology (ISM), also known as Multi-Incremental Sampling (MIS), for investigation and assessment of chemical concentrations in soil or other media. This document is not intended to comprehensibly describe Incremental Sampling Methodology or its applications. MEDEP recommends referencing and adhering to the Interstate Technology and Regulatory Council (ITRC) comprehensive guidance document: Incremental Sampling Methodology (ITRC 2020), or most recent revision.

3.0 Key Definitions

Decision Unit (DU): A specific, designated area or volume of soil/material that is evaluated for contamination as part of a site investigation or remedial action The pre-defined area for which a decision will be made based on an ISM result. The entire area may be sampled or there may be smaller ISM sample units within the DU that are used to make a decision for the entire area.

Data Quality Objective: Qualitative and quantitative statements derived from a structured, seven-step EPA-based planning process. DQOs clarify study goals, define the necessary type, quality, and quantity of data, and specify tolerable levels of decision errors to ensure data supports scientific and legal defense of environmental decisions.

Exposure Unit (EU): For risk assessment purposes, an area where a receptor is assumed to move randomly across the area and may be exposed to a spatially averaged contaminant concentration.

Replicate: Additional sample or samples collected from an area using ISM methods, this material is processed and analyzed in the same manner as the original sample, analogous to a field duplicate in discrete sampling.

Sampling and Analysis Plan (SAP): A required document detailing the strategies, methods, and procedures for collecting and analyzing environmental samples to ensure data is of known, defensible quality.

Sample Unit (SU): a defined area to be sampled as an individual ISM sample.

4.0 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 SOP. MEDEP/DR staff reviewing data by outside parties should ensure that this SOP (or an equivalent) was followed, depending on the specific Data Quality Objectives (DQOs) of the task.

Other MEDEP SOPs may also apply when performing this task, including, but not limited to MEDEP/DR SOP RWM-DR-014 - Development of a Sampling and Analysis Plan (SAP). The SAP should consider quality assurance and quality control (QA/QC) samples and measures, the specifics of which will depend on the DQOs for the task. Types of QA/QC samples are discussed in more detail in the DR Quality Assurance Plan (QAP). SAP development includes provisions for creating a Health and Safety Plan (HASP) associated with the activity, including compliance with Dig Safe notifications when disturbing soil with powered equipment or tools (i.e., not hand tools). Dig Safe notification does not include public utility clearance requests which must be completed separately (e.g., sewer and water lines). These utility marking requests typically do not extend onto marking private property (i.e., they may only mark lines in the public right of way), so hiring a private utility marking company may be necessary, depending on site specifics. Fieldwork and data collection tasks must be properly documented in accordance with applicable MEDEP SOPs and policies.

5.0 Guidelines and Procedures

5.1 Introduction

Incremental Sampling Methodology (ISM), also referred to as “Multi-Incremental Sampling,” is a statistically supported sampling method for obtaining a representative mean concentration of a contaminant across a

predefined area (area of concern, exposure unit, or decision unit). ISM is typically applied to solid particulate media such as soil and sediment and can include other environmental media such as groundwater or waste. For risk assessment or MEDEP RAGs risk calculator purposes, if 3 or more replicate ISM samples are completed then a 95% Upper Confidence Limit (UCL) of the mean can be calculated. Individual values can be directly compared to criteria if the project team agrees to that approach. Use of this technique requires careful planning and project team agreement on Data Quality Objectives (DQOs) but yields a statistically defensible result to support project decisions.

The methodology described in this document is appropriate for use when an average chemical concentration is required for a pre-defined site area, and the site sampling is not otherwise outlined in a site-specific Quality Assurance Project Plan (QAPP), Sampling and Analysis Plan (SAP) or another document.

5.2 Planning

A well-developed Conceptual Site Model (CSM) is imperative for effective application of ISM. 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). Decision Units (DUs) or Exposure Units (EUs) need to be determined based upon the CSM and potential future use of the property. Source areas can be targeted with small DUs and outer areas of a site can be adequately characterized with larger DUs. Replicates should be completed on DUs where a 95% UCL of the mean is needed, where there is uncertainty about the variability of the contamination, and on at least a portion of the site to assess variability in the sample and analytical methods. The sampling plan should include specifics regarding DQOs, which are important for determining the number of replicate ISM samples to collect, the number of increments to collect, specific laboratory procedures, and the regulatory criteria that will be used in project decisions.

Prior to sample collection the project team must agree as to how the data will be used, what criteria will be used for comparison, how replicate analyses will be handled, and whether the average, mean or 95% UCL of the mean or other statistical calculation will be used as a basis for decisions regarding mitigation or cleanup of the site being investigated.

5.3 Procedure Overview

Field methodology and laboratory procedures are two significant components to ISM that are designed to limit error inherent in any environmental sample resulting from matrix properties, field sampling methods and laboratory practices. The field component of the method involves collection of a large number of increments or aliquots that are combined to a single sample. This approach limits the error found in discrete samples, which may hit or miss contamination due to media heterogeneity. The laboratory processing component involves some combination of drying, sieving, grinding and sub-sampling to reduce the laboratory error related to the selection of the small mass of media that is actually analyzed. The method is easily applied to surficial media but can also be useful in assessing sub-surface media using investigative techniques such as hand augers or direct-push technology to obtain sub-surface increments, or to install groundwater sampling equipment, if desired.

The method is particularly useful where there is a heterogeneously distributed contaminant that limits the value of discrete sampling approaches. Large areas can also be characterized without collecting (and paying for) an excessive number of laboratory samples. For example, the ISM approach may be used on properties where source areas have been targeted for removal, but the remaining property needs to be assessed for risk evaluation. ISM can also be applied to environmental sites where a mean value for bulk media is needed to determine if the treatment (i.e. ex-situ, biopile, etc.) has reached project goals. This method is not recommended for sites where limited understanding of the release mechanisms and potential source areas exist, as there would be potential for missing source areas if decision units are inadequately defined.

The site conceptual model (CSM) is also important for determining the number of increments needed for a DU. Generally, 30 is the minimum recommended, with up to 150 for very large areas, or for areas with extremely high contaminant heterogeneity.

5.4 Project-Specific Considerations

The project-specific methodology needs to consider factors such as:

- Volatile organics - may be “composited” in a large volume of methanol rather than dried/sieved etc.
- Semi-volatile compounds - the grinding step may be “pulsed” to avoid overheating the soil and causing losses of compounds of interest.

- Metals – metals such as lead may benefit from grinding the soil, to improve reproducibility of the mean concentration. Metals such as chromium can be artificially elevated by grinding the soil particles, due to contamination introduced by losses from the stainless steel in puck mill components. Where lab processing is a concern for metals analysis, samples may be dried, homogenized, sieved and sub-sampled without a grinding step, to avoid lab contamination of samples.

ISM can be utilized for PAHs, PCBs, SVOCs, inorganics and VOCs, though the project-specific sample and laboratory methods need to be tailored to the contaminant of interest.

The expected difference between regulatory criteria and the site concentrations is another factor in determining DU size and number of increments. Higher numbers of increments may be warranted where 95% UCL of the mean concentration may be close to project action limits, and greater certainty is required for the data.

Small DUs can be designed to characterize source areas, while peripheral portions of a site where no contamination is expected may be appropriate for larger DUs, if the CSM is well defined. If the DU for a site is very large, a decision can be based on data from smaller sample units (SUs) within the DU. For example, if the DU is a 100-acre parcel, 5 representative 2-acre SUs could be sampled rather than the entire area. If the data is to be used in a risk assessment, one or more DUs may be part of each exposure unit (EU). In these cases, results from multiple DUs or SUs may be combined to obtain a single result for comparison to the project goals or use in risk assessment if the data shows that the units are similar and combining units meets the project objectives. Combining DUs is not appropriate where the project objective is to assess a removal action or characterize multiple source areas for evidence of a release.

Details of the theory and basis for the sample method, and “decision-tree” approaches to choosing decision units, numbers of increments and project-specific processing methods can be found in ITRC’s 2020 Technical Guidance document, or most recent revision, [BB1.1]and in the other references listed below.

6.0 References

The following are listed for guidance purposes. The most recent versions of these documents should be consulted, and other guidance may also be applicable.

ITRC's (Interstate Technology and Regulatory Council) Incremental Sampling Methodology **(ITRC, 2020)**

Incremental Sampling Methodology (ISM) for Metallic Residues **(U.S. Army Corps of Engineers, Engineer Research and Development Center, 2013)**

EPA and State Guidance:

Guidance for Screening Level Human Health Risk Assessments **(California Department of Toxic Substances Control, 2019)**

Field Sampling Guidance **(Alaska Department of Environmental Conservation. Division of Spill Prevention and Response Contaminated Sites Program, 2024)**

Use of Multi-increment Samples to Characterize DU's **(Hawaii Department of Health, 2024 2016)**

M2S2 Webinar Series, **(Clu-In Contaminated Site Clean-Up Information, 2014)**

Incremental Sampling Methodology and Applications RRD - Resource Materials **(Michigan Department of Environmental Quality, 2018)**

Incremental Sampling for Soils and Sediments **(Ohio Environmental Protection Agency Field Standard Operating Procedures (FSOPs), 2021)**

Incremental Sampling Methodology (ISM) at Polychlorinated Biphenyl (PCB) Cleanup Sites **(U.S. EPA, 2019)**

User Guide – Uniform Federal Policy Quality Assurance Project Plan for Soils Assessment of Dioxin Sites **(U.S. EPA, 2011)**