QUALITY ASSURANCE PLAN

FOR

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION'S

DIVISION OF REMEDIATION

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LIST OF ATTACHMENTS

Attachment	Title
A	Organizational Hierarchy of MEDEP/DR and MEDEP/TS
B	MEDEP/DR Standard Operating Procedure Manual, Data Collection
C	MEDEP/DR Standard Operating Procedure, Work Practices
D	MEDEP Basic Data Review Checklist

1.0 INTRODUCTION

This document serves as the Quality Assurance Plan (QAP) for the Division of Remediation (MEDEP/DR), one of five divisions within the Bureau of Remediation and Waste Management, (BRWM), a Bureau within the State of Maine's Department of Environmental Protection. This document will describe, or reference attached documents that describe:

- The MEDEP/DR functional statement and organization;
- Personnel responsible for assuring the standards set in the QAP are met;
- Quality standards goals;
- The basic flow of project activities, including preparation of sampling plans, implementation, report preparation, and document control;
- Standard Operating Procedures (SOPs) for conducting field work and routine work processes;
- MEDEP/DR procedures for obtaining analytical support;
- Quality Assessment; and
- Training.

The United States Environmental Protection Agency (EPA) requires that all environmental monitoring and measurement efforts mandated or supported by U.S. EPA participate in a centrally managed Quality Assurance Plan (QAP). The Maine Department of Environmental Protection's (MEDEP) Quality Management Plan (QMP) requires its' Programs to develop guidance to assure the quality of the work conducted. Therefore, the MEDEP/DR has developed this Non-Site Specific Quality Assurance Plan to meet these requirements. In accordance with 40 CFR Part 35, Subpart O, Section 35.6055(b)(2), this document will be submitted to USEPA for approval. The MEDEP will evaluate this QAP as part of its own internal Quality Management System, as outlined in the MEDEP's Quality Management Plan.

2.0 QUALITY ASSURANCE STATEMENT

It is the goal of the MEDEP/DR to implement a Quality Assurance Program (QAP) for all environmental activities that generate data. The QAP is a management tool that will help guarantee that data is of sufficient known quality to withstand scientific and legal challenge relative to the use for which the data is obtained. Additionally, MEDEP/DR strives to assure its work practices are conducted appropriately, uniformly, and transparently in carrying out the responsibilities of programs its administers. This QAP and associated Standard Operating Procedure Manuals will set out the basic requirements for achieving the goals of these programs.

All Quality Assurance/Quality Control (QA/QC) procedures must be in accordance with applicable professional technical standards, USEPA requirements, government regulations and guidelines, and specific project goals and requirements. Any party generating data under this QAP has the responsibility to implement procedures to assure that the precision, accuracy, completeness, and representativeness of its data are known and documented.

3.0 MEDEP/DR ORGANIZATION

3.1.1 Specific Programs Within MEDEP/DR

The MEDEP/DR is a Division within the MEDEP's Bureau of Remediation and Waste Management (BRWM) that administers several different programs within the MEDEP, all related to remediation of hazardous substances, lead and asbestos, and landfills. These programs are:

- Uncontrolled Sites – This program investigates and remediates hazardous substance contamination under the states Uncontrolled Hazardous Substance Sites Law;
- Federal Facilities – This program provides State oversight of remedial activities at National Priority List (NPL) Sites. This program also works with the Department of Defense (DOD) in addressing hazardous substance contamination at Federal Facility Sites and other sites considered to be formerly used defense sites (FUDS). This program receives funding through a NPL Support Agency Cooperative Agreement for Site Specific support agency activities at NPL Sites, and DOD cooperative agreements.
- Landfill Closure – This program oversees the closure and long term maintenance and remedial actions of municipal landfills throughout the State;
- RCRA Corrective Action (RCRA CA) – This program provides state oversight of remedial activities at RCRA CA Sites and at RCRA sites that are closing.
- Voluntary Response Action Program (VRAP) – This program oversees voluntary investigative and remedial activities of hazardous substance and petroleum contaminated sites.
- The Federal Site Assessment Program – This program conducts pre-remedial investigative activities at Sites that are on Superfund Enterprise Management System (SEMS), the list of sites being investigated for inclusion on the NPL. It is funded under a Multi-Site Cooperative Agreement with USEPA Region I.
- The Brownfields Program – This program conducts investigative and remedial activities at Federal and State funded Brownfield Assessment projects. It also provides state regulatory oversight to municipalities and other quasi - municipal entities that receive funding through EPA's Brownfields program. This program receives funding under a cooperative agreement from the EPA Brownfields Program.
- Lead and Asbestos Abatement Program (LAAP) – This program provides State oversight of lead and asbestos abatement throughout the State. Due to the requirements of the LAAP, the LAAP will develop and implement their own QAP and associated SOPs for data collection and work practices That QAP will be kept as a separate document from this QAP.

3.1.2 Organizational Hierarchy

The MEDEP/DR organizational chart can be found in Attachment A. Additionally, the MEDEP/DR often receives technical support from staff in MEDEP's Division of Technical Services (MEDEP/TS), whose organizational chart can be also found in Attachment A. TS staff are assigned to specific MEDEP/DR projects on a case-by-case basis.

Additional staff from other Divisions in the MEDEP may also be assigned to MEDEP/DR projects on an as needed basis.

3.2 Personnel Responsible for QAP Implementation

All Staff: All data acquisition and documentation activities conducted by MEDEP/DR personnel will be completed as outlined by this QAP and associated Attachments. All personnel outside of MEDEP/DR that are working on projects assigned to MEDEP/DR shall also follow all procedures in this QAP. All staff are responsible for working as a team to ensure that the procedures in this document are followed, and for recommending improvements to QA procedures to the QAC.

Unit Supervisors: The Unit Supervisors are responsible for determining which activities their staff will be responsible for conducting, and for seeing that their personnel receive adequate training in order to conduct the tasks appropriately, safely, and provide the required QC for all environmental monitoring and/or measurement.

Division Director: The Division Director shall designate the Quality Assurance Manager (QAM) for the MEDEP/DR. The current QAM is a Brownfields and VRAP OHMS II project manager (indicated in Attachment A). The Division Director shall also work with DEP management to ensure that the Division has the appropriate resources to implement the procedures in this document. Finally, the Division Director shall promptly resolve any conflict between personnel regarding implementation of this QAP.

Quality Assurance Manager (QAM): The QAM is responsible for drafting and updating the QAP as necessary, and seeing that the specific quality control (QC) procedures as outlined in the QAP are followed. The QAM is responsible for initiating and conducting (with appropriate assistance from other staff, both internal and external to MEDEP/DR and MEDEP/TS) any QC programs for the Division, including those outlined in Section 9.0 and any other QC programs deemed necessary by the Division Director. The QAM will determine, upon initiation of such QC programs, who will be responsible for tracking and recording the results of QC programs within the Division, and responsible for notifying the appropriate personnel and their supervisors, when necessary, of any observed problems needing corrective action. The QAM shall notify EPA QA personnel of pending changes to this document and seek EPA's approval for the changes.

QA Team Coordination: Supervisory staff, the QAM, field team leaders and EPA may periodically observe staff under actual field conditions to ensure that the Standard Operating Procedures (SOPs), as outlined in this document, are being followed. When requested, the QAM with input from other observers, will investigate data quality problems and suggest alternate methods when appropriate to avoid the generation of data of questionable quality. If laboratory data quality problems are suspected, the QAM will communicate directly with the laboratory to resolve all issues. If any laboratory data quality issues are suspected, the QAM or project manager for the project involved, will notify the Chemistry Unit Leader (CUL) in the MEDEP/TS of any suspected problems and work to develop possible corrective actions. A laboratory audit of applicable analytical methods may be initiated when laboratory issues cannot be quickly and completely resolved.

The QAM, CUL, appropriate supervisor(s), and project manager(s) (if applicable) will determine the need for corrective action. The CUL is responsible for assuring the appropriate staff, appropriate supervisor(s) or management (as necessary) understand the corrective action needed. The appropriate supervisor(s) and management are then responsible for ensuring that the corrective action is completed.

USEPA QA Personnel: As this QAP will be used to meet the Quality Management requirements of multiple programs that receive USEPA funding, (Pre-Remedial, Brownfields, Superfund, etc.), USEPA will inform the QAC of the appropriate USEPA staff required to review and approve the QAP. EPA QA personnel shall review the procedures in this document to ensure that they meet federal standards for quality assurance plans for the federal grant money used to obtain environmental data by DEP/DR. EPA QA personnel shall promptly notify the QAM of pending changes to federal QA requirements that pertain to this document. A signature approval page will be maintained for the QAP to provide a record of USEPA, MEDEP, and any other applicable Agency review and approval.

4.0 PROJECT ACTIVITY FLOW

Unit Supervisors/ Program Managers assign individual projects that are referred to the Division to appropriate program staff based on the nature of the project (i.e., Uncontrolled Sites project, VRAP project, Brownfields project, RCRA, etc.) in consultation with the Division Director. Once assigned to a program, the Program Manager assigns the project to a specific project manager. The Project Manager is then responsible for coordinating the project tasks and schedule required to complete the project, including coordinating the appropriate project team. In the case of small projects, the team may consist of only the Project Manager; in the case of large projects, the team may consist of staff in other programs in the Division, Staff in other Divisions and Bureaus of the MEDEP, consultants and contractors directly hired by the MEDEP, outside stakeholders of the project (such as site owners, responsible parties, municipal officials, EPA, etc), and the agents (consultants, contractors, etc.) of outside stakeholders.

Individual projects within the Division vary widely in scope; however all share the same general flow:

1) Determining the extent and nature of all hazardous substance and petroleum contamination at the site;
2) Determining the risks to human health and the environment posed by the contamination;
3) Determining the appropriate remedial actions and long-term requirements to mitigate the risk posed by the identified contamination;
4) Completing the appropriate remedial activities to address the identified risks; and
5) Developing a written public record of project activities to assure all stakeholders, now and in the future, understand actions and decisions made for the Project, including long-term requirements of the Projects.

Specific work tasks are conducted to complete the project flow stated above. Examples of specific work tasks include: Phase I/II Investigations, targeted source delineation investigations, migration pathway studies, soil gas surveys, surface water body assessments, remedial investigations; development of conceptual site models; feasibility studies, containerized waste surveys, soil removals, container removal actions, biopile construction and monitoring, soil vapor extraction system installation, Operation and Maintenance Plans, Declarations of Environmental Covenants, etc.

Although the scope will vary based on the task, work tasks are completed through the following basic steps:

1) Planning of the task;
2) Conducting the task;
3) Evaluating the completed task;
4) Documenting the task; and
5) Filing documents for future retrieval.

All of the above steps involve actions or activities that result in the collection, evaluation, reporting, and/or eventual storage of data. For example, the task of delineation of soil contamination may consist of the actions of soil sample collection, field screening of soil samples utilizing PIDs and FIDs, and soil screening using portable X-Ray Fluorescence (XRF) Spectrometers, and documenting results. All of these actions have SOPs. SOPs for conducting most of the data collection actions or activities that will be completed by staff can be found in Attachment B – Standard Operating Procedure Manual. All data collected must be collected in a manner that meets the Data Quality Objectives (DQOs) identified in a site-specific plan for the project and the specific work task(s). Work practices regarding project management can be found in Attachment C - Uniform work practices SOPs. Examples of work practices would include notification of liability requests, designation of an Uncontrolled Site, VRAP Certification of Completion, project filing, and updating of Division databases.

4.1 Data Quality Objectives

DQOs are qualitative and quantitative statements that specify the quality of the data required to support decisions made from data gathered during site assessments and other tasks, and are an integral part of any plan involving the collection of data. DQOs are dependent on the end uses of the data that is collected. Project and task specific DQOs will be established prior to collecting data and incorporated into the SAP, QAPP or work plan. Three steps will be followed in developing DQOs: 1) Identify the goal of the site assessment or work task, 2) Identify the use of the data, and 3) Identify the data quality needed to meet the site assessment or work task goal and data use.

4.2 Task Planning

Planning is the most important part of any data collection task, as vast projects should not be implemented from half vast ideas. Any task that involves the collection of data must have a plan developed prior to the task, such as a sampling plan, QAPP, work plan, or remedial action plan, that outlines goals of the task and actions/activities to meet those goals.

4.2.1 Work Plan Development

The work plan will discuss the what, how, where, why, and when of the site activities as completely as possible. MEDEP/DR has developed a Standard Operating Procedure (SOP) for the development of a Sampling and Analysis Plan and for Development of a Site Specific Quality Assurance Project Plan to Meet USEPA Hazard Ranking System (HRS) Requirements; These SOPs can be found in the MEDEP/DR SOP Manual (Attachment B). Tasks that involve the collection of data, but are not specifically sampling tasks (such as contaminated soil removal actions with post excavation sampling) must still have DQOs addressed as part of the task's work plan.

The first step in developing any sampling or work plan is to develop a conceptual site model (CSM). ASTM defines a CSM as "*a written or pictorial representation of an environmental system and the biological, physical and chemical processes that determine the transport of contaminants from sources through environmental media to environmental receptors within the system*." The CSM is a dynamic tool to be updated as new information becomes available, and therefore should be amended, as appropriate, after each stage of investigation. A description of the CSM does not have to be included in every work plan; however the CSM should be referenced in the plan and made available to all staff working on the project for review.

4.2.2 Sampling and Analysis Plan

All sampling specific activities require the development of a Sampling and Analysis Plan (SAP). The minimum specific requirements for a MEDEP/DR SAP can be found in SOP DR#014 in Attachment B. The SAP will define the proper procedures to be followed in the collection, preservation, identification and documentation of environmental samples and field data. The SAP shall outline the data quality objectives (DQOs) and protocols for data collection activities to ensure that the data generated by these activities are of a quality commensurate with their intended use. The SAP will include reference to the SOPs to be followed. Any planned deviation from the referenced SOP shall be described and an evaluation of the deviation's impact on the DQOs shall be included in the final report. Overall responsibility for developing the SAP will belong to the project manager for the site, with input by the project team, the QAM, and field personnel as necessary.

4.2.3 Site Specific QAPP

The majority of sampling activities performed by MEDEP/DR will not require the development of a site specific QAPP, and the completion of the SAP will be adequate. However, for those projects requiring the strictest QA/QC guidelines, a site specific QAPP will be generated. A QAPP will be generated for field work conducted specifically for Pre-Remedial HRS related and Brownfields Site Assessment related tasks. Additionally, a QAPP may be generated for a specific site if determined appropriate by the QAC, the MEDEP/DR project manager and supervisor, and the appropriate project personnel at MEDEP and EPA. Examples in which a site specific QAPP may be

generated would be a site which will, in all likelihood, be listed on the National Priority List (NPL), or a site in which there is a great possibility of litigation.

If a QAPP is necessary, it will include the elements listed in SOP DR#016 – Requirements for the Development of a Site Specific QAPP to Meet USEPA HRS Requirements, found in Attachment B.

4.2.4 Data Use

The data use(s) will be identified in the plan. Prior to collecting data, the end use for that data should be identified. Some examples of data use of data collected include, but are not limited to, the following:

- To determine the presence of hazardous substance and petroleum contamination;
- To determine the need for emergency action;
- To determine the quantity and levels of contamination;
- To determine if soil concentrations exceed Remedial Action Guideline levels
- To identify and quantify specific source areas;
- To identify migration pathways;
- To identify impacted targets/receptors and natural resources;
- To develop a site score including SI Scoresheets and Hazard Ranking System Packages.
- To document the need for further action or no further action.
- To determine the endpoint of remedial actions;
- To monitor the long-term effectiveness of remedial systems.

As stated earlier, the DQOs of the project must meet the goals of the end use of the data.

Historical and third-party data is sometimes available for projects and may be utilized as part of the decision making process. Prior to its use for decision making, historical and third-party data will be evaluated based on such factors as: relevance and applicability, age, method, QA/QC, SOPs used by the collectors and laboratory, source of data, and detection limits.

4.2.5 Data Quality/Quantity Necessary for Project

The quality and quantity of data needed to meet the decisions made above will be identified in the work plan. Factors that are considered in determining quality are: appropriate analytical levels (e.g. field screening, portable laboratory, or fixed laboratory), contaminants of concern, levels of concern, required detection limit and critical samples. Additional data quality indicators that should be considered are: precision, accuracy, representativeness, completeness and comparability (see Section 8.0 - Data Quality Assessment).

The quantity of data needed will vary based on available usable data, data use, analytical methods used, and goal of the data collection activity. The quantity of data must meet goals of the end use of the data.

4.2.6 Data Collection Methodology

The Work Plan must outline the specific actions that will occur, i.e., soil sampling, groundwater sampling, surface water sampling, etc. The MEDEP/DR has developed an SOP manual for routine data collection activities. This manual can be found in Attachment B. Activities that do not have a specific SOP can be completed as long as the work plan has a project specific SOP for that particular action or the action is sufficiently documented in the final report that outlines the completed task.

The SAP, QAP, or work plan will also identify the analysis methodology utilized by the laboratory, with containerization and sample preservation requirements for any samples collected.

Depending on the DQOs, QA/QC samples may be required; please Section 8.6 – "QA/QC Samples".

4.3 Conducting the Work Task

As stated earlier, MEDEP/DR has SOPs for most data collection and sampling procedures (see Attachment B). Staff are to complete the procedures following the work plan as closely as possible. However, the Work Plan should be considered as a dynamic tool that can evolve in the field as the task progresses and more information is obtained regarding a specific site. A chain of command should be stated in the work plan for making substantive changes to the site activities. However, field staff should be empowered to make common sense changes due to field conditions encountered that are different than expected. Some examples include, but not limited to, the following:

- Depth to groundwater is deeper or shallower than expected;
- Utility lines are located unexpectedly;
- Geology formation is not conducive to the type of sampling proposed;
- Sediment type is not conducive to sampling;
- Property lines are different than expected;
- Additional information is obtained from knowledgeable persons regarding locations of tanks, dry wells, disposal areas, etc.

Changes in the Work Plan must be documented in field notes outlining the change, the reason for the change, and the expected impact of the change to the data.

4.3.1 Documentation of Field Activities

It is expected that field samplers and analytical laboratories will follow standard operating procedures (Attachment B) and adhere to generally accepted "good field and laboratory practices". With that stated, staff will document work activities following the protocol outlined in MEDEP/DR SOP DR#013 – Documentation of Field Activities and Development of a Trip Report (found in Attachment B). Generally, the Trip Report will

describe actual sampling locations, field conditions, actual activities completed, field decisions, deviations from the SAP and SOPs, copies of chains of custody, and any other information that the field personnel deem relevant to the field activities for that sampling event. The person responsible for developing the Sampling Event Trip Report (SETR) will be stated in the Work Plan for that activity.

It should be mentioned that occasionally, certain quality assurance requirements cannot be met, and deviations from SAPs and SOPs are needed in order overcome “real life conditions”. In such cases, the reason for the deviation should be stated in the SAP or the SETR, along with the expected or observed impact on the data.

4.4 Work Task Evaluation

After completion of the work task activities, the project manager should review the field notes and laboratory analytical data to determine whether the goals of the task, including the DQOs, were met. Any deficiencies will be documented in the final report outlining the work task.

Data quality indicators to consider are: precision, accuracy, representativeness, completeness and comparability (see Section 8 - Data Quality Assessment).

4.5 Work Task Documentation

After completion of any project work task, a final report outlining the task will be completed. Depending on the scope of the work task, the final report may consist of a simple Trip Report (See MEDEP/DR SOP#013 – Documentation of Field Activities and Development of a Trip Report), or a stand alone document, such as a Phase II Site Investigation Report, Remedial Action Report, etc.

The project manager will be responsible for determining the “comprehensiveness” of the final report; however, it must meet the minimum requirements stated in MEDEP/DR SOP #013. It must also outline any data quality deficiencies noted during the evaluation of the data.

All project documents must be maintained as outlined in Section 5 – Document Control of this QAP.

5.0 DOCUMENT CONTROL

The term document control, as it applies to MEDEP/DR projects, refers to the maintenance of project files. The Administrative Record for Remediation Sites is switching from this paper format to an all-electronic format. The goal is to have the official Administrative Record be all electronic by December 31, 2021. There will be a transition period between the effective date of this SOP and that date, where some files will be in paper format and adhere to the SOP NO. RWM-DR-WP001, Project Records Retention Protocol (February 8, 2010) and others will be electronic and adhere to this SOP (001).

Project files are public records of the activities at a Site, and are therefore required to be kept in a manner that is available to the public. "Public record" or "public records" shall mean all documents, papers, letters, maps, books, tapes photographs, films, sound recordings, or other material regardless of physical form or characteristics made or received pursuant to law or ordinance or in connection with the transaction of official business by the MEDEP/DR.

All final documents, work plans, sampling plans, letters, memorandum, telephone records, printed emails, analytical data, and any other documents related to the specific project must be kept in the specific projects file, as outlined in MEDEP/DR SOP#WP001 – "Project Filing Protocols" , found in Attachment C – "Work Practices SOP" of this QAP.

Under no circumstances are any personal opinions or irrelevant information to be filed in the official project files. The project manager shall review the file at the conclusion of the project to insure that the file is complete.

The following records shall not be placed in the project file:

- Trade secrets and commercial or financial information obtained from a person, firm, or corporation, which is of a privileged or confidential nature under state law;
- Preliminary drafts, notes, impressions memoranda, working papers, and work products;
- The contents of real estate appraisals, engineering or feasibility estimates and evaluations made for or by MEDEP/DR relative to the acquisition of property or to prospective public supply and construction contracts, until such time as all of the property has been acquired or all proceedings or transactions have been terminated or abandoned, provided the law of eminent domain shall not be affected by this provision;
- All investigatory records of public bodies pertaining to possible violations of statute, rule or regulation, other than records of final actions taken, provided that all records prior to formal notification of violations or non-compliance shall not be deemed public; and
- Records, reports, opinions, information, and statements required to be kept confidential by federal or state law, rule, rule of court, or regulation by state statute.

6.0 STANDARD OPERATING PROCEDURES

6.1 Standard Procedures for Data Collection Methodology

MEDEP/DR's standard operating procedures for conducting sampling and other data collection activities can be found in Attachment B - MEDEP/DR Standard Operating Procedures Manual.

Depending on circumstances and needs, it may not be possible or appropriate to follow these procedures exactly in all situations due to site conditions, equipment limitations,

health and safety issues, and limitations of the standard procedures. In some instances, it may be necessary to perform an activity that does not have a specific SOP. Whenever SOPs cannot be followed, they may be used as general guidance with any and all modifications fully documented in either the SAP or the SETR. If no SOP for an activity is available, a description of the activity will be included in the task work plan.

Any changes in MEDEP/DR SOPs must be approved by the QAC. The SOPs are controlled documents and revisions should be indicated on each page in the right hand corner along with the revision date.

6.1.2 Equipment

A variety of equipment is available to the MEDEP/DR for conducting data collection tasks. This includes equipment that is owned by MEDEP directly, and equipment that is available through rental agencies. All equipment shall be maintained and calibrated according to the manufacturers instructions and in accordance with the appropriate analytical methods. Manufacturers instructions and other instructional documentation will be kept with the equipment. Additionally, some specialized equipment, such as portable vapor monitors (PVMs) and XRF Spectrometers, have specific SOPs for their use (See Attachment B). Equipment with its own SOP will be operated and maintained as stated in its SOP.

In the case of rental equipment, staff will be trained in the use of the equipment by the rental company prior to its use by staff for data collection. Training will be documented as part of the final report for the task.

Equipment that requires calibration for use, such as PVMs, etc., shall be calibrated routinely on a monthly basis, or as directed by the manufacturer, and prior to its use in the field at the beginning of each work day. Additional calibration may also be conducted throughout the work day as directed by the manufacturer, or as deemed necessary by the field personnel when equipment appears to be reporting suspect results. Documentation of routine calibration and maintenance shall be kept in the calibration and maintenance log book for that specific piece of equipment. Documentation of calibration of equipment prior to and during its use in the field will be noted in the field log book of the person conducting the calibration.

6.2 Work Processes SOP

As stated in the MEDEP QMP, Section 6 “Standard Operating Procedures”, and Section 4 “Project Activity Flow”, an activity performed regularly and requires uniform conduct each time it is performed should have a standard accepted methodology, including operational procedures and boilerplate document drafting. A list of operational procedures and boilerplate document drafting that has specific SOPs can be found in Attachment C – Operational Procedures SOP Manual.

7.0 LABORATORY SERVICES

MEDEP/DR is currently using a bidding system for routine analytical services. As part of the "Request for Qualifications" process, the laboratories used must present proof of certification for the analysis performed, and the Laboratory's Quality Assurance Manuals will be obtained and reviewed by the CUL.

In instances of non-routine analysis or field laboratory analysis, the project manager (or designee), with assistance from the CUL, will review the field laboratories specific methodology to assure DQOs will be met prior to conducting the task.

Occasionally, MEDEP/DR will use laboratories other than those listed for "non-routine analysis", such as dioxin analysis or air sampling, or employ mobile field laboratories for site work requiring field analysis. The project manager, with input from the CUL and project team, will work with the specific lab(s) to ensure that quality control measures meet the DQOs stated in the Work Plan for the project.

For tasks which require a field laboratory, the project manager and QAC will work with the specific laboratory to ensure that quality control measures meet the DQOs stated in the SAP or QAPP for the particular project or event. Additionally, confirmatory samples will be submitted to one fixed commercial laboratory (for routine analysis) or another laboratory (for non-routine analysis) at a rate of 5 to 10%, as stated in the specific SAP, QAPP, or Work Plan for the project.

8.0 DATA QUALITY ASSESSMENT

Given that sampling and analytical procedures are not perfect, it is commonplace to find that the reported concentration and actual concentration are not identical. The difference between the reported concentration and the actual concentration of a sample is a function of both the sampling and analytical error. Sampling error is difficult to judge; however, adherence to standard sampling protocol will minimize this error. The potential magnitude of analytical error may be assessed by evaluating laboratory quality control samples, split samples with other labs, and statistical evaluations of datasets, all of which will help determine the significance of a reported concentration.

The level of assurance will vary depending on the use of the data. Even data of poor precision and/or accuracy may still be useful. The project manager, with input from the QAC and/or QAM as needed, will determine the usefulness of data that may be of poor quality.

All data generated will be reviewed by the project manager for precision, accuracy, representativeness, completeness, and comparability as described below. Additionally, field notes, custody forms, and sample extraction and analysis dates will be reviewed by the project manager to ensure holding times and other standard procedures are met. The project manager will also review QC sample results to assure that recoveries are within acceptable ranges, as well as blank, spike, and duplicate samples are also within acceptable criteria. The project manager or technical support team member will utilize MEDEP's Basic Data Review Checklist, found as Attachment D of this QAP.

If data of questionable quality is reported (i.e., outside the acceptance criteria presented in Section 8.1 – 8.5 of this QAP) or other quality control issues are uncovered, the project manager will report the issues to the QAC and/or QAM. At a minimum, the individual concerns of the data will be mentioned in the final report for which the data was generated. Need for additional corrective action, including the collection of new or additional samples, will be determined after review of the DQOs for the project on a case by case basis with input from the project manager, the QAC and/or QAM, and any other appropriate personnel. If additional corrective action is necessary, it will be carried as described in Section 10.0 - Corrective Action.

8.1 Precision

The precision required for a particular study will depend upon the difference between background levels and the action level. Laboratory precision is only one part of the total precision of the measurement process leading from sample collection through data reporting. Selection of an acceptable precision level should not be based solely on what is attainable in the laboratory. Once the sample has been submitted to the laboratory, much of the sample to sample variation has already been introduced into the sample by activities in the field.

Replicate or duplicate QC samples are submitted from the field to provide a means of determining the precision of the measurement process. The following formulas will be used for precision measured from duplicative samples, as defined by relative percent difference (%RPD) or relative standard deviation (%RSD):

$$\% \text{ RPD} = 100 \times 2(|X1 - X2| / (X1 + X2));$$

$$\% \text{ RSD} = (100/\sqrt{2}) \times (2 |X1 - X2| / (X1 + X2));$$

where: X1 is the concentration of duplicate #1; and
X2 is the concentration of duplicate #2.

The RPD should be less than 50% for soil and 35% for water, unless specified otherwise in the analytical method. If the RPD is greater than 50% and 35%, this shall be noted in the final report for the data.

8.2 Accuracy

Accuracy is controlled primarily by the laboratory and usually reported as percent recovery. Analysis of known concentrations should be within 80 - 120% for water and 70 - 130% for solids, unless specified otherwise in the analytical method. If recovery is not within the specified range, it shall be noted in the analytical data sheets, and in the final report of the data.

8.3 Representativeness

Representativeness reflects the ability to collect a sample that reflect the conditions of a particular site and must be a major focus when developing the SAP.

Representativeness is measured by how well the sampling followed the proposed SAP, so as to provide results that accurately depict the media and environmental conditions being evaluated.

Documentation of field events confirms that proper protocols were followed and all planned samples were collected an analyzed. The Trip Report will outline any deviations from the SAP, and include a discussion into the possible impact to the data from the deviation.

8.4 Completeness

Completeness is the number of valid measurements divided by the number of samples taken. The project manager will be responsible for determining the completeness of the data. If completeness falls below 80%, it will be noted in the final report for the data.

8.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through the use of standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units.

When available, analytical data will be compared to data collected from previous sampling events and other secondary source data. If currently collected data does not compare similarly with previously collected data, it shall be, at a minimum, reported to the QAC and/or QAM. Need for corrective action will be determined after review of the DQOs for the project, and follow the parameters listed in Section 12.0 - Corrective Action - of this QAP.

8.6 QA/QC Samples

QA/QC samples may be collected to ensure that the sampling methodology employed by staff is collecting the desired media without possible adulteration being introduced by the sampling methodology, or bias from background levels of compounds of concern, both naturally occurring and anthropogenic. Examples of QA/QC samples include, but are not limited to:

- Background Samples – Samples collected to determine the impact of naturally occurring compounds (such as metals), and anthropogenic caused contamination from off-site, or off-source locations. Examples of background samples include: upstream sediment surface water samples, upgradient groundwater samples, off-site/off-source soil samples, and ambient air samples.
- Trip Blanks – Sample containers of media that travel with the containers to determine possibility of sample cross-contamination, or introduction of non-site contamination to the sample. Trip blanks are only relevant for volatile compound analysis.
- Field Blanks – Collection of samples in the field to determine possible introduction of contamination to samples due to ambient conditions at the site.

- Method blanks – Samples collected to determine possible introduction of contamination to samples due to sample methodology. Tracer gas samples during soil gas is an example of a method blank.
- Rinsate/Equipment blanks – Samples collected to determine effectiveness of decontamination procedures.
- Duplicate Samples – Co-located samples for assessing possible variability due to sampling and analysis methodology and the media being sampled.

A discussion of QA/QC samples pertinent to a specific activity can be found in the activities specific SOP located in Attachment B of this QAP. Additionally, laboratories QA/QC protocol or the DQOs of the task/project may require the collection of additional sample volume in order to conduct laboratory QA/QC (i.e, matrix spike, matrix spike duplicates, etc). The work/sampling plan or QAP must outline QA/QC sampling requirements. The project manager will be responsible for communications with the laboratory conducting the analysis to ensure that enough QA/QC samples will be collected for the laboratories needs, and that meet the DQOs of the project.

9.0 QAP ASSESSMENT

Periodic assessments of the QAP will take place in the following ways:

9.1 Laboratory Performance Evaluation

The laboratory will conduct standard performance studies as outlined in their respective Quality Assurance Manual. Records of all performance evaluation studies shall be maintained by the laboratory. Problems identified in performance evaluation studies shall be immediately investigated and corrected.

9.2 MEDEP/DR Internal Assessment

Personnel responsible for performing field and laboratory activities are responsible for continually monitoring individual compliance with the QAP, Task Work Plan, SAP, and QAPP (whichever is applicable). The QAM will periodically review procedures, results, and calculations to determine compliance with the QAP. The results of this internal assessment are discussed with the QAM and appropriate supervisors, with suggestions and/or recommended requirements for a plan to correct observed deficiencies. Additionally, a “review” audit of select field methodology and documentation will be conducted periodically by the QAM, with assistance from both internal and external staff, as necessary.

9.3 External Evaluation

As part of the MEDEP’s Quality Assurance Plan (QMP), the activities of the Division will be audited periodically by the MEDEPs Audit Team. Such an assessment is an extremely valuable method for identifying overlooked problems. As outlined in the QMP, results of the assessment will be submitted to the QAM, Division Director, and Program Managers, with suggestions and requirements for a plan to correct observed

deficiencies. Additionally, the USEPA will audit the MEDEP/DR as part of its Quality Management program, as determined by USEPA. EPA audits will be coordinated with the MEDEP/DR and the MEDEP's overall Quality Management System as part of the QMP.

10.0 CORRECTIVE ACTION

Corrective actions must be taken immediately when data or field procedures are of questionable quality. These corrections may range from noting possible impact of data quality issues in the final report, to modifying certain procedures and re-conducting an entire field investigation. Any suspected problems will be brought to the attention of the QAM and, in the case of laboratory analysis, the CUL.

The need for corrective action may be identified during performance audits, standard QC procedures, or just when data "does not seem right". The steps in the corrective action are:

- Identification and definition of the problem;
- Investigation of the problem;
- Determining the cause of the problem and appropriate corrective action;
- Implementing the corrective action; and
- Verifying the problem has been corrected.

The QAM is responsible for ensuring effective corrective actions have been taken in regards to sampling activities and other field work. The CUL is responsible for ensuring effective corrective actions have been taken in regards to laboratory activities.

11.0 TRAINING

Training for the MEDEP/DR consists of three (3) categories: 1) Professional Development, 2) Health and Safety, 3) Data Collection activity, and 4) QAP training.

11.1 Professional Training

All staff will receive professional training for carrying out the responsibilities of their position as outlined in the MEDEP QMP (Section 3.0 – Personnel Qualifications and Training).

11.2 Data Acquisition/Field Activities Training

Procedures/activities with specific training requirements (such as use of the XRF spectrometer, or use of air monitoring devices for personnel protection decisions) are outlined in that activities specific SOP, and staff with need of those skills, as determined by the specific staff person, and their supervisor, will be appropriately trained and documented (as stated in the SOP).

Staff will receive in-house training on data acquisition techniques from the QAC, or their designee(s), through either formal training, or “on the job” training, on an as needed basis for those activities without specifically stated training in its SOP.

11.3 Health and Safety Training

In addition to the required training for all MEDEP staff as outlined in the MEDEP QMP, all permanent staff will receive 40-hour HAZWOPER Health and Safety Training, as well as Annual 8-hour HAZWOPER Refresher Training. In addition, all Supervisors will receive the HAZWOPER Supervisor Training. All staff will receive Red Cross CPR training and Red Cross First Aid training every two years. Staff will also receive specific health and safety training, such as respirator training, based on the requirements of the staff person’s specific position requirements, as determined by the staff and their respective supervisor.

11.4 QAP Training

As stated in the MEDEP QMP, all staff are required to be familiar with the QMP, and Division and/or Program Managers must annually review the QMP with staff. All data related programs requiring QAP/ QMP have, within those documents, standards and procedures for ensuring that program staff receive training in QA/QC related to their activities, and maintain proficiency in the QA/QC requirements of that program. To meet these requirements, all MEDEP/DR staff will be required to review this QAP within 360 days of its renewal. As new staff is hired by MEDEP/DR, they will be required to review this QAP within 90 days of their hiring date. Once Staff has reviewed the QAP, they will be required to sign the “QAP Log Sheet” that is in the custody of the QAC.

12.0 IMPLEMENTATION SCHEDULE

This QAP will be implemented by MEDEP/DR once USEPA has given approval. This QAP is to be considered a “working document”. Although the requirements outlined in the QAP will be followed until a new QAP is created, this QAP will be periodically updated and revised as technology, policy and protocol change.

13.0 DISTRIBUTION LIST

Upon approval and implementation of this QAP, the original shall be kept with the QAC, and a copy placed in the MEDEP/DR Library. Additionally, an electronic change protected copy of the document will be placed on the MEDEP’s webpage.

14.0 LIST OF ACRONYMS

BSA - Brownfield Site Assessment
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
SEMS - Superfund Enterprise Management System
CLP - Contract Laboratory Program
Data Quality Objectives
DD - Division Director

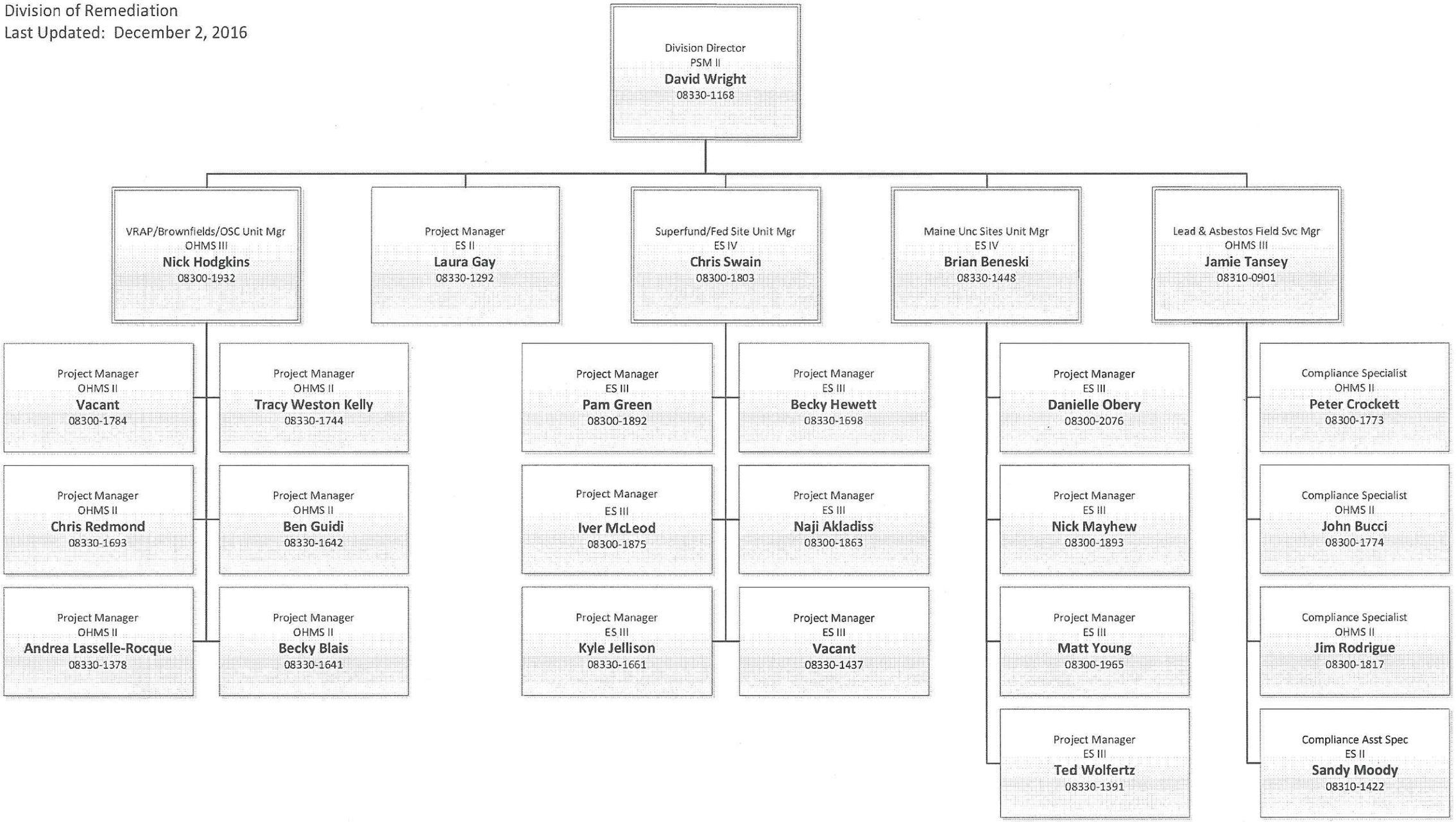
DQ - Data Quality
ES - Environmental Specialist
HETL - State of Maine Health and Environmental Testing Laboratory
HRS - Hazard Ranking Scoring
LUST - Leaking Underground Storage Tank
MEDEP/DR - Maine Department of Environmental Protection, Division of Remediation
MEDEP/TS - Maine Department of Environmental Protection, Division of Technical Services
MSCA - Multi - Site Cooperative Agreement
NPL - National Priorities List Sites
OHMS - Oil and Hazardous Materials Specialist
PA - Preliminary Assessment
QA - Quality Assurance
QA/QC - Quality Assurance/Quality Control
QAC - Quality Assurance Coordinator
QAM - Quality Assurance Manager
QAP - Quality Assurance Plan
QAPP - Quality Assurance Project Plan
QMP – Quality Management Plan
RCRA – Resource Conservation and Recovery Act, subsection C (Hazardous Waste)
RP - Responsible Party
SAP - Sampling and Analysis Plan
SASS - MEDEP/DR, Site Assessment and Support Services Unit
SDP - Site Discovery Project
SETR - Sampling Event Trip Report
SI - Site Inspection
SIP - Site Inspection Prioritization
SOP - Standard Operating Procedure
USEPA - United States Environmental Protection Agency, Region I
VRAP - Voluntary Response Action Program

ATTACHMENT A

QUALITY ASSURANCE PLAN
Maine Department of Environmental Protection
Division of Site Remediation

Organizational Hierarchy of the Division of Remediation
And Division of Technical Services

Bureau of Remediation & Waste Management
Division of Remediation
Last Updated: December 2, 2016



ATTACHMENT B

QUALITY ASSURANCE PLAN
Maine Department of Environmental Protection
Division of Site Remediation

MEDEP/DR Standard Operating Procedure Manual,
Data Collection

COVERSHEET
STANDARD OPERATING PROCEDURE

Operation Title: **WATER SAMPLE COLLECTION FROM WATER SUPPLY WELLS**

Originator: **Brian Beneski**
Quality Assurance Manager
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:

WILLIAM Longfellow — *Print name*
Signature
12/20/16 — *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 MEDEP/DR's procedure for collecting water samples from water supply wells. Water samples are collected from water supply wells to determine extent of groundwater contamination and the impact of groundwater contamination on human health at the exposure point. This standard operating procedure (SOP) is designed to be a guideline for collecting water samples from these wells, either with or without filter systems, to assure samples are collected in a consistent, appropriate manner that will provide accurate data for making decisions and meeting the data quality objectives of the task.

3.0 DEFINITIONS

3.1 Treatment System - A device which removes contaminants and/or naturally occurring compounds from the water. This may include granular activated carbon (GAC) Filters, water softener, particle filter, air stripper, or reverse osmosis systems.

3.2 MEDEP Installed Treatment System – Any treatment system device that A MEDEP administered program has placed on a water supply to remove contamination or condition the water prior to contamination removal.

3.3 Sample Point - Any location from which a representative water sample may be obtained. Sample points can be located before the treatment system, between treatment system devices, or after the treatment system.

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 procedure. MEDEP/DR staff reviewing data by outside parties are responsible for assuring that the procedure (or an equivalent) was utilized appropriately.

5.0 GUIDELINES AND PROCEDURES

5.1 INTRODUCTION

Correct sampling of household water supplies is essential to the proper investigation of groundwater contamination. Each well supplying a household(s) also represents a monitoring well for local groundwater. Such information/data must be factored into the groundwater investigation program.

The three most important aspects of household water sampling are as follows: 1) develop a Sampling and Analysis Plan (SAP) that adequately and appropriately meets the sampling goal (see also SOP# RWM-DR-014 - Development of a Sampling and Analysis Plan); 2) follow established sampling procedures to ensure the integrity of the sample, and; 3) keep accurate records of sampling data (i.e. locations, bottle numbers, etc., See also SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report).

5.2 PREPARATION

SAP development guidance can be found in SOP# RWM-DR-014 - Development of a Sampling and Analysis Plan. However, residential sampling does require several unique aspects, one being scheduling. It is best to inform property owners at least one week ahead of the scheduled sampling event, particularly if access treatment systems is required. Be aware of the past contamination history of the site(s) and try to plan visits so that sampling begins with the least contaminated households and ends with the most contaminated households. This method allows the least potential for cross-contamination, and should be followed whenever practical. In planning a sampling event it is recommended to allow thirty (30) minutes between each sampling appointment. If this is an initial visit to a household, bring a well data sheet (Attachment A) and get as much information about each household's well(s) as possible. Important information/data to gather when sampling household wells includes: date of installation of the well; the type of well (drilled, dug, point, or other); gallons per minute produced; depth to the screened interval (and width of screened interval if applicable), and type of piping used. Permission should be obtained to GPS the location of the well.

5.3 EQUIPMENT

Below is a list of recommended equipment to have when household sampling:

- Bucket (to collect excess water when sampling treatment systems),
- Disposable nitrile gloves (to prevent exposure and/or cross-contamination),
- Flashlight (to enter dark basements/cellars),
- Field Notebook (to record pertinent information),
- Chain of Custody Forms (to document chain-of-custody),
- Label Tags (to label sample points at households with filters),

- Container of clean water (for rinsing),
- Container of Soapy Water(for washing),
- Sample Containers from laboratory
- Short section of hose to attach to spigot

5.4 HEALTH AND SAFETY

Part of completing a successful household sampling assignment is completing it in a safe and healthful manner. Whenever sampling water from any point, at a minimum wear disposable nitrile gloves and safety glasses. Hand and eye protection decrease the chance of dermal exposure and also reduce the chance of cross-contamination of samples.

Also be aware of physical hazards; treatment systems are usually located in the basement, so make sure to take a flashlight. Watch for overhead hazards such as low ceilings and/or hanging objects. Be especially careful of electrical hazards such as outlets near the sampling area and/or bare wires. Lastly, try not to splash the water when sampling; splashing contaminated water in the eyes or on exposed skin could be harmful if the water is significantly contaminated. If water supplies are known or suspected to be contaminated, care should be taken to avoid cross-contamination with other water samples being collected as part of the same sampling event.

5.5 SAMPLING

5.5.1 Sampling Water Supplies Without DEP Installed Treatment System

When sampling a water supply well without any treatment system, samples may be obtained from an indoor faucet (kitchen, bathroom, other),or an outside faucet (spigot). If MEDEP has sampled the well previously and conditions have not changed (house renovations, family size, etc.) samples should be obtained from the same location as previously sampled. If MEDEP has not sampled the well before, or if conditions have changed, samplers should inspect the plumbing and select a sample location closest to the pressure tank or pump. Samplers should make sure that the sample point is clean (i.e., no grease, lead soldering, or other possible contaminants) and that no possible sources of cross-contamination (gas cans, solvents, etc.) are nearby. If a water treatment system (such as radon, sediment filters, or water softeners) is present, the sample should be collected prior to these systems. If sampling from a faucet, remove the aerator; if sampling from an outside spigot, remove existing hoses from the spigot.

Run the water on cold at full flow for least ten(10) minutes prior to collecting a sample. Running the water will accomplish two goals. First, it will purge the pipes of any stagnant water; second, it will drain the pressure tank and cause the pump to turn on and start pumping water from the well. This should allow the collection of a representative sample from the well.

Record any observations and/or comments about matters pertinent to the sample location or to the site.

After the water has run for approximately 10 minutes, reduce the flow to facilitate sample collection with minimal aeration and begin filling the laboratory containers. See Section 6.4.3 below for special procedures when sampling for EPH or VPH.

5.5.2 Sampling Households With Treatment System

For households with a MEDEP installed treatment system, samplers should collect samples after the treatment system first (post-treatment), between treatment devices second, and before the treatment system (pre-treatment) last to reduce likelihood of cross-contamination. The pre-treatment samples should be collected before any filter, softener, or other device that the landowner or MEDEP has installed.

The plumbing system, including the any treatment devices should be purged by turning on a faucet located on the downstream end of the devices. This may be a kitchen or bathroom faucet. If sampling from a faucet, remove the aerator prior to purging and sampling. Sufficient water should be purged to flush the treatment devices as completely as possible (10-20 minutes depending on the number of devices present). In most situations, purging can continue while samples are being collected at the designated sample points. The sample before the filter system is taken last due to its highest probability of being contaminated. If multiple treatment systems are present, sampling should proceed from point of use to point of entry, in order to reduce potential for cross-contamination. Care should be taken to accurately label the sample containers with the correct sample location designation (pre-, mid-, and post-filter). Each sample port location should be purged for 10 to twenty seconds to remove stagnant water prior to sample collection. When sampling, it may be appropriate to attach polyethylene tubing to the sampling port and collect purge water in a bucket. Properly preserved laboratory containers should be filled using a flow rate that is appropriate for the type of analysis and container type.

If multiple treatment devices are present, it may be necessary to take more samples. Samplers should take care to accurately identify and label sample locations and associated laboratory containers. Filtration devices can often be bypassed with bypass valves included in the plumbing. When sampling any of these devices, trace the route of the plumbing (pipes) to make sure the sample is being taken from the correct sampling port. Be sure to include contingencies for such devices in the sampling plan.

Once all the samples have been collected at a water supply, remove gloves, and return all plumbing to its original position (aerator back on faucet, all sample ports closed, etc.). Record water meter readings if the residence is equipped with a meter. Be sure to note if the meter reading is in cubic feet or gallons. The water meter reading will give (in conjunction with the previous reading) the amount of water being used, which is useful in predicting/explaining the breakthrough in GAC filters. Place the samples in a cooler on ice for transport to the laboratory.

5.5.3 Special Situations

There are certain situations that require unique sampling methods. For example, when sampling for petroleum hydrocarbons by either the VPH or EPH methods, it may be necessary to collect samples from spigots at high flow rates. Under these circumstances, a section of hose fitted with a "Y"-control valve may be required to assure that grease associated with the moving parts of the fixture or spigot is not introduced into the sample by opening or closing the fixture just prior to sampling. Another example of a unique situation is when tritium is used to investigate the relative age of the groundwater. Samplers need to remove their watches before collecting samples that will be analyzed for tritium (if the watch is a tritium-illuminated type). Special circumstances should be outlined in the sampling plan.

6.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

In order to insure that the samples are representative of the water at a given sampling point, the sampler must pay close attention to QA/QC procedures. At each household the sampler must be aware of four (4) areas which may be sources of cross-contamination of the samples: **1)** samplers hands--wear a new pair of gloves at every residence sampled and at each sample point; **2)** sampling order--sample at the least contaminated households first, the most contaminated last; and at the least contaminated point in any filtration system first (post-filter) and the most contaminated point last (pre-filter) **3)** self-contamination--make sure the sampling area is free of any possible sources of contamination (grease on the tap, solvent bottles near the sample port, etc.), and; **4)** piping--look at the plumbing and pipe materials and note the presence of lead soldering or improper lubrication (i.e. WD-40, oil, etc.) on the pipes. Also, ask the resident if any work had recently been done on the well, plumbing, or any other components of the water system.

A trip blank should be preserved with the same preservative as the actual samples, stored and transported with the other samples collected during the sampling event, and then analyzed (along with the other samples) for the appropriate suspected contaminants by the lab. If a sampling event is completed and the trip blank contains contaminants, this indicates that the containers may not have been clean or other QA/QC procedures have failed. In this case, it may be necessary to re-sample.

Samplers should avoid fueling a vehicle until after the samples have been delivered to the laboratory or after securing them in a cooler. Avoid the use of colognes, perfumes and bug sprays on sampling days. In addition, sampling personnel should avoid any contact with inside surfaces of sample containers and covers or caps.

If sample results indicate that contamination is present at unanticipated levels or between filters re-sampling may be warranted. All sample data should be reviewed for possible sources of error before re-sampling the water supply. Re-check all field documentation from the trip to insure the sample numbers were recorded correctly in both the field notebook and on the laboratory analysis request sheet and/or chain of custody. If the documentation check fails, go back to the site and re-sample. When re-sampling, be sure to check the plumbing to make sure all valves are properly opened and closed. An open bypass valve would bypass the filters and supply unfiltered raw water to the house.

7.0 DOCUMENTATION

All sampling activities must be documented as outlined in MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report. Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol.

8.0 REFERENCES

- U.S. Environmental Protection Agency, "A Compendium of Superfund Field Operations Methods," EPA-540/P-87/001, December 1987.
- U.S. Environmental Protection Agency, "Sampling of Hazardous Materials," EPA, April 1990.

ATTACHMENT A
Well Questionnaire

MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION

Well Questionnaire

A. CURRENT OWNER

Name: _____
Address: _____
_____
Telephone: _____

PREVIOUS OWNERS (if any)

Name: _____
Address: _____
_____
Telephone: _____

B. WELL LOCATION

Tax Map _____ Lot Number _____ Street Location _____

C. DESCRIPTION OF WELL

1. Date Installed: _____

2. Who installed the well?
____Contractor
____Owner/Occupant
____Unknown
____Other (_____)

Name: _____
Address: _____
_____

3. Type of Well:
__ Dug Well ____Drilled Well ____Other (gravel or sand packed)
__Spring ____Well Point

4. Well Specifications:
Depth of Well _____ Type of Pump _____
Casing Length _____ Pump Depth _____
Casing Material _____ Piping Material _____

5. Is the top of the well above ground? Yes __ No __

6. Well Covering: Concrete Roof Board Other

7. Depth to Bedrock or Ledge: _____
Water Bearing Material:
Sand/Gravel Sand Till ____Silt/Clay Bedrock

8. Estimated Yield (gal/ min or gal / day) _____ Date ___
Estimated Consumption (gal / day) Date ___

9. Is the water currently being treated?
Chlorinator Softener Other ___)
Iron Removal ____pH control

10. Have you experienced any problems with water quality or quantity?

11. Has the water quality ever been tested? By whom?

Today's Date: _____

Mail to: ME DEP; BRWM/DR
17 State House Stn.
Augusta ME 04333-0017

COVER SHEET
STANDARD OPERATING PROCEDURE

Operation Title: **GROUNDWATER SAMPLE COLLECTION FOR SITE INVESTIGATION AND ASSESSMENT MONITORING**

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

APPROVALS:

Division of Remediation Director:

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

Bureau of Remediation and Waste Management Director:

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

QMSC Chair:

William Longfellow		12/30/16
Print name	*Signature*	*Date*

Department Commissioner:

PAUL MERCER		1-3-2017
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 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 procedure for collecting groundwater samples that are not part of a long-term groundwater monitoring program.

MEDEP/DR has two SOPs for collection of groundwater samples from monitoring wells. This SOP will outline the collection of groundwater samples from Newly Installed Wells or from Existing Wells (See definitions, Section 4.0) that are not part of a long-term groundwater monitoring program designed to monitor long-term contaminant concentration trends. MEDEP/DR SOP# RWM-DR-003 (Groundwater Sampling Using Low Flow Purging and Sampling for Long-term Monitoring) describes the MEDEP/DR's procedure for collection of samples that are part of a long-term groundwater monitoring program utilizing the preferred "low flow" sampling method. Site specific Data Quality Objectives (DQOs) should be reviewed to determine which SOP and sampling methods are applicable.

3.0 DEFINITIONS

3.1 Newly Installed Well – For the purpose of this SOP, a Newly Installed Well is a well that has been installed for less than 48 hours. Typically these wells have not yet developed a stagnation zone in the Well Riser Pipe. These wells may also be temporary, being abandoned immediately after initial sampling. See additional discussion in Section 7.2 of this SOP.

3.0 Existing Monitoring Well – For the purpose of this SOP, an Existing Well is a well that has been in place for greater than 48 hours. Typically these wells have developed a stagnation zone in the water column which may influence sampling methodology. See additional discussion in Section 7.2 of this SOP.

3.1 Low Flow Purging – For the purpose of this SOP, Low Flow Purging is defined as pumping a well at a rate equal to the recharge rate of the formation such that a stable drawdown of the water level is achieved at a constant pumping rate.

3.2 Variable Speed Pump – A mechanical device specifically manufactured to remove water from a well at selected rates that are equal to or lower than the

recharge rate of the well. For the purposes of this SOP it is limited to bladder or peristaltic type positive displacement pumps, and submersible type rotodynamic pumps.

3.3 Reciprocating type Positive Displacement Pump- This includes all positive placement type pumps that rely on the use of a cylinder or piston arrangement with a foot valve to displace water. This includes all WaTerra™ inertial type pumps.

3.4 Bailer - A long narrow cylinder or bucket-like device with an open top and a check valve at the bottom that is used to remove water from a monitoring well.

3.5 Equipment Blank – De-ionized water run through a piece of sampling equipment and collected for analysis to determine if equipment may be a source of contamination.

3.6 Purging - The process of evacuating standing water from the monitoring well prior to sample collection.

3.7 Trip Blank – De-ionized water put in the appropriate containers under laboratory conditions which is transported with the samples during a monitoring event and analyzed for quality assurance/quality control purposes.

3.10 Well Riser Pipe - A length of solid pipe which extends from the screened interval of a monitoring well to the ground surface where the well is accessed.

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 procedure. MEDEP/DR staff reviewing data by outside parties are responsible for assuring that the procedure (or an equivalent) was utilized appropriately.

5.0 GUIDELINES AND PROCEDURES

5.1 INTRODUCTION

The purpose of this MEDEP/DR SOP (RWM-DR-002) is for collecting groundwater samples from Existing Monitoring Wells that are not part of a long term groundwater monitoring program. It also applies to Newly Installed Wells (typically installed only for the duration of site investigation and then abandoned, sometimes after the initial sampling) where data quality objectives (DQOs) do not require the establishment of long-term contaminant concentration trends. Site specific DQOs should be reviewed to ensure the sampling methods are appropriate.

Low Flow Purging and Sampling (LFS) is the preferred method for obtaining

groundwater samples from monitoring wells as part of a long-term monitoring program designed to establish long-term contaminant concentration trends (see MEDEP/DR SOP# RWM-DR-003 - Groundwater Sampling Using Low Flow Purging And Sampling For Long-term Monitoring).

5.2 PLANNING

A well-developed Conceptual Site Model (CSM) is imperative for effective groundwater 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). The sampling plan should include specifics regarding DQOs, as DQOs will be part of the determination of which groundwater sampling procedure is required (this SOP or RWM-DR-003), as well as the method of sample collection outlined in this SOP.

5.3 SAMPLING PROCEDURES AND EQUIPMENT

5.3.1 OVERVIEW

The collection of groundwater samples can be achieved in several ways. This SOP focuses on collecting samples from Newly Installed Wells or Existing Wells for the purposes of an initial site investigation or assessing the current water quality at a site with existing monitoring wells where the data is not used to establish long-term trends in contaminant concentrations. Additionally, site specific DQOs may allow for a lower quality of data collection than outlined in SOP RWM-DR-003 in exchange for a more efficient sampling method while still meeting the DQOs of the sampling event.

5.3.2 MONITORING WELL TYPES

For the purposes of this SOP well types will be divided into two general categories; Existing and Newly Installed Wells (See definitions, Section 4.0). Both types of wells may include micro-wells (less than 2-inch diameter), monitoring wells (2-4 inch diameter) and bedrock water supply wells (6-inch diameter). Newly installed wells can include those installed with direct push methods where no drilling fluids are used or with more traditional methods that utilize drilling fluids. Depending on site specific DQOs, both Existing Wells and Newly Installed Wells may be properly abandoned (according to MEDEP Guidance) once the sampling and assessment are complete OR may remain at the site once the sampling and assessment are complete. All of these variations, including DQOs, will influence the pump selection and the methods used to obtain a groundwater sample.

5.3.2.1 Existing Wells

It may be desirable to sample Existing Wells during a site investigation or site assessment where DQOs do not meet the requirements for long-term monitoring. The wells may be former bedrock water supply wells, wells from a previous site investigation, or wells installed for monitoring water levels during aggregate mining (sand and gravel

pits). Existing Wells may have water in the well riser pipe or cased portion of the well that is not in direct contact with the formation (including bedrock fractures). Care should be used in pump selection to limit disturbance of the stagnant water in the well riser pipe. It may be desirable to monitor select field parameters to determine when to sample an existing well. DQOs will dictate the selection of field parameters and the method of collection (e.g. open flow cell, closed flow cell, colormetric field kits, meters, etc.).

5.3.2.2 Newly Installed Wells

Wells are frequently installed as part of a site investigation or assessment and sampled within 48-hours of installation. The well diameter, particularly the smaller diameter of micro wells, as well as the depth to water influences pump selection. Newly Installed Wells do not have time to develop a stagnation zone in the well riser pipe and field parameters are not needed to monitor mixing in the well. However, selected field parameters may be useful for characterizing the groundwater conditions. DQOs will dictate the selection of field parameters and the method of collection (open flow cell, closed flow cell, colormetric field kits, meters, etc.).

5.3.3 SAMPLE COLLECTION PROCEDURE

The groundwater sampling pumps included in this SOP include variable speed pumps, bailers, and reciprocating positive displacement pumps (See definitions, Section 4.0) The type of pump selected and associated method of sampling will impact the quality of the results. The order of preferred pump selection is based on the order of declining quality of results beginning with variable speed pumps, bailers, and then reciprocating positive displacement pumps type pumps as a pump of last resort. Single speed submersible pumps such as a 12-volt purge pump (e.g. Whale pump, GeoSub, Cyclone, Water Spout, etc.) may be used in certain situations if the pump discharge is less than the yield of the formation and a constant drawdown can be achieved without dewatering screens or water bearing fractures. In this case, the use of the single speed pump would provide results of similar quality to a variable speed pump. The following sections discuss the sampling pumps in decreasing order of sample quality.

5.3.3.1 Variable Speed Pumps

Variable speed pumps include bladder, submersible, or peristaltic pumps that are manufactured with a control mechanism that allows the user to mechanically change the speed of the pump discharge without the use of flow restrictors on the pipe or tubing. These pumps allow for the highest quality sample collection included in this SOP.

All pumps should be operated according to the manufacturer's instructions to assure proper use of the equipment. If a gasoline powered generator is used as a power supply, care should be taken to eliminate cross-contamination. Any equipment that comes into contact with groundwater and is used at more than one sample location should be properly decontaminated between sample locations according to the site specific Quality Assurance Project Plan (QAPP).

5.3.3.2 Procedure for Variable Speed Pumps

1) Utilizing a water level indicator, obtain and record the water level. If water levels will be utilized for determining groundwater flow, it is recommended that water levels be obtained before the insertion of tubing or pumps into the well, as this will displace water, initially raising the water level of the well and giving a false water level.
2) Insert submersible pumps and/or tubing into the well. Place intake at desired monitoring zone, and record depth if required by Sampling and Analysis Plan (SAP).

3) Purge and sample the well. Efforts should be made to purge and sample the well (Existing or Temporary) at a rate equal to the yield of the formation. This is determined by observing the water level with a meter for draw down. Stabilized drawdown is not a requirement of this SOP, but it is encouraged for obtaining a sample representative of the most permeable portion of the screened zone, and will improve the overall quality of the data if the static and drawdown levels are recorded. If a constant drawdown level is not achievable, then a modified no-purge option (See SOP# RWM-DR-003) can be used as long as it meets the DQOs for the site. Modifications to the no-purge procedure will depend on the type of well being sampled.

5.3.3.3 Newly Installed Wells Purge Requirements

It is recommended that Newly Installed Wells be purged (if rate of recharge allows) to remove silt that may have been introduced into the well during construction. Once sufficient water has been removed from the well to meet the DQOs for the site, field parameter collection may be desirable to determine aquifer conditions. Field parameters are not required for stabilization prior to sampling because Newly Installed Wells have not developed a stagnant water column. Site specific DQOs will determine the purpose for collecting field parameters.

5.3.3.4 Existing Wells Purge Requirements

Depending on site specific DQOs, it may be desirable to monitor select field parameters to determine when to sample an Existing Well. DQOs will dictate the selection of field parameters and the method of collection (e.g. open flowcell, closed flow cell, colormetric field kits, meters, etc.). In general, any field parameters that are monitored will increase the overall quality of the sampling event.

5.3.3.5 Bailers

Bailers produce lower quality groundwater samples due to the uncontrolled filling rate of the bailer each time it is lowered below the water level, the physical disturbance of water in the solid riser portion of the well, the impacts of slug removal on the formation and sand pack each time the bailer is filled, and the potential composite nature of the sample from within and above the screened zone. Prior to purging and collecting a groundwater sample with a bailer, the water in the well riser pipe must be purged in order to assure that fresh groundwater in the well is being sampled. To ensure that all riser water is replaced with formation water, USEPA protocol recommends that three to five well volumes be evacuated from the well prior to sample collection.

The reason for the use of bailers instead of Variable Speed Pumps should be outlined in the SAP or Sampling Event Trip Report (SETR) developed for the specific activity. The use of dedicated or disposable bailers is encouraged for each well to avoid cross-contamination.

5.3.3.6 Bailer Sampling Procedure

1) Calculate the water volume in a given well. Begin by using the water level indicator to measure depth to water. Use a clean weighted tape measure to determine the overall depth of the well if it is not known. Whenever possible, measure from the top of the well riser pipe and not from the top of the steel outer casing. Then calculate the height of the water column by subtracting the height of water in the well from the total depth of the well, in feet.

Use the formula and chart below to calculate well volume in gallons. Again, at least three volumes should be purged from the well. When this is not possible, as in the case of purging a slow recharge well until dry, it is acceptable to sample the well as soon as enough water (assumed to be fresh groundwater) has entered the well to obtain a sample.

FORMULA FOR CALCULATION OF WELL VOLUME:
Gal. H_2O/Ft. of well casing x Height of H_2O Column (Ft.) = Vol. of H_2O in Well (Gallons)

Gallons H_2O per foot of well casing by casing diameter
2 inch diameter well casing = 0.1632 gal H_2O per foot of casing
4 inch diameter well casing = 0.6528 gal H_2O per foot of casing
6 inch diameter well casing = 1.469 gal H_2O per foot of casing

2) Purge the well. Attach clean line to the bailer and lower it into the well until it touches the bottom. Then secure the end of the line or cord to an anchor on the well casing that will hold the bailer in the event that it may be accidentally dropped down the well. Raise the bailer up the well while keeping the line off the ground. Empty the bailer water into a graduated bucket and repeat this procedure until the desired purge volume has been extracted.

3) Sample the well. Once purged, the well may be sampled by lowering the bailer slowly below the water level and pouring the contents directly into the appropriate laboratory containers.

5.3.3.7 Reciprocating-Positive Displacement Pumps

Reciprocating-Positive Displacement Pumps, of which WaTerra™ is a specific example, produce the lowest quality sample due to the physical movement of the pump in the well. The reciprocating action disturbs the sediment in the bottom of the well, generates friction between the well materials and the pump, and partially mixes water in the screen zone with water in the well riser pipe. Additionally, the hydraulic forces exhibited by the pump disturb the equilibrium the aquifer has with the filter sand and acts to re-develop

the equilibrium (re-develop the well) during the sampling event. The reason for using Reciprocating-Positive Displacement Pumps instead of Variable Speed Pumps or bailers should be outlined in the SAP or SETR developed for the specific activity. If this type of pump is used at a site, it should be used according to the manufacturer's instructions.

5.3.4 SAMPLE CONTAINERIZATION

Container requirements, including size and preservation method, should be stated in the project SAP, as required by the laboratory conducting the sample analysis.

5.4 DECONTAMINATION

Decontamination of sampling equipment should be conducted following 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 SAP. Quality Assurance/Quality Control (QA/QC) samples may be collected if needed to meet DQOs. The following are typical types of QA/QC samples that may be collected as part of the QA/QC program for groundwater sample collection utilizing this SOP. Other QA/QC samples may be collected as stated in the SAP. For an additional discussion of QA/QC, please refer to the MEDEP/DR Quality Assurance Plan, Section 4 and Section 8. All analytical data should be reviewed and assessed to determine if DQOs have been met. If review indicates DQOs have not been met, corrective action will be recommended by the reviewer.

6.1 TYPICAL QA/QC SAMPLES

6.1.1 Equipment Blanks

If using non dedicated or disposable equipment, equipment blanks should be collected at a rate of 5%, which is equivalent to one equipment blank per twenty samples collected. The equipment blank will consist of purging de-ionized water through submersible pumps and piping, and/or rinsing equipment with de-ionized water, and collection for appropriate sample analysis.

6.1.2 Duplicate Samples

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

6.1.3 Trip Blank

A trip blank may be necessary when sampling for volatile organic compounds (i.e. EPA

8260 analysis). The need for a trip blank will be outlined in the SAP.

6.1.4 Background Samples

The need for background groundwater samples will be outlined in the SAP.

6.2 SPECIAL CONSIDERATIONS FOR METALS ANALYSIS

Temporary Monitoring Wells or wells that have been installed and constructed improperly may not allow for the collection of a silt free (low turbidity) sample. This silt does not represent the natural mobile load in the aquifer, and samples that include the silt (elevated turbidity) may introduce non-mobile elements into the water sample. Therefore, it is recommended that samples collected for metals analysis utilizing this SOP be filtered with an in-line 0.2-0.45 µm particulate filter. The filter should be purged (approximately 25 - 50 mL) with the groundwater being sampled prior to sample collection, or per the filter manufacturer's instructions. Site specific DQOs will determine if unfiltered samples are necessary under this SOP.

7.0 DOCUMENTATION/ CHAIN OF CUSTODY

All site visits, including groundwater sampling events must be documented as described in the SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report. Use of specialized sampling forms is allowed, following the procedure outlined in DR-013. Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol.

COVER SHEET
STANDARD OPERATING PROCEDURE

Operation Title: **GROUNDWATER SAMPLING USING LOW FLOW PURGING AND SAMPLING FOR LONG-TERM MONITORING**

Originator: **Brian Beneski**
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Print name	*Signature*	*Date*

QMSC Chair:

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

Department Commissioner:

PAUL MERCER		1-3-2017
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 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 procedure for collecting groundwater samples from wells utilizing the "Low Flow" purging and sampling procedure. This Standard Operating Procedure (SOP) is similar to SOP# RWM-DR-002 - Groundwater Sample Collection for Site Investigation and Assessment Monitoring. RWM-DR-002 is intended to be used at sites where Data Quality Objectives (DQOs) do not require long-term monitoring of concentration trends. The purpose of this SOP (RWM-DR-003) is to outline the procedure for collecting groundwater samples from existing monitoring wells where DQOs require consistently documented procedures for collecting groundwater samples at regular intervals (quarterly, tri-annual, bi-annual, annual, etc.) to monitor data trends over time. Site specific DQOs should be reviewed to ensure the sampling methods are appropriate.

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

Low flow sampling (LFS) is an appropriate method for long-term monitoring of groundwater at sites. The goal in any groundwater monitoring activity is to collect groundwater samples that are representative of mobile organic and inorganic loads in the vicinity of the selected open well interval. Current research indicates that LFS is the best available technique for: 1) obtaining the most consistently representative samples of groundwater from the formation surrounding the screened interval of a properly installed monitoring well; 2) eliminating variability introduced by sampling technique; and 3) providing a basis for evaluating appropriateness of long-term groundwater sampling data.

LFS includes both a purge and no-purge option. The purge option for LFS involves pumping the well at a rate that minimizes drawdown in a well to reduce mixing of the riser water and groundwater in the aquifer. Field parameters, such as pH, dissolved oxygen, temperature, turbidity and conductivity are monitored during purging until readings have stabilized; at this point, groundwater entering the pump intake represents formation water and the sample is collected.

In low permeability formations or poorly installed monitoring wells it may not be possible to collect groundwater samples using the specified purge techniques. In such instances, the no-purge option should be evaluated (see Attachment A).

Additionally, this procedure is not designed to collect samples from wells containing light or dense nonaqueous phase liquids (LNAPLs or DNAPLS).

LFS is a skill which requires considerable experience and ongoing education and tuning on the part of those who perform it; therefore, at least one experienced person in LFS should always accompany every sampling team.

4.2 EQUIPMENT

The following list of equipment is necessary when performing LFS. Specific brand names indicate equipment owned by either MEDEP/DR and MEDEP/TS, and is available to staff for use equipment with similar performance may be used in place of the specifically identified equipment. (see SOP# RWM-DR-014 - Development of a Sampling and Analysis Plan).

4.2.1 PUMP

The pump selected must have capabilities of adjusting the flow rate without the use of flow restrictors. Types of acceptable pumps include: submersible, bladder and peristaltic pumps. Physical limitations on the use of peristaltic pumps also apply to wells with deeper water levels; wells with water levels greater than approximately 24 feet cannot be sampled with a peristaltic pump. In these instances, a submersible or bladder pump should be used.

The Department recommends the use of dedicated equipment, where possible, for long-term monitoring.

4.2.2 TUBING

Low density polyethylene (LDPE) is recommended for most situations. However, site specific DQOs should be reviewed before selecting the appropriate tubing. For example, sites with low concentrations of certain petroleum related contaminants should consider the use of Teflon lined polyethylene tubing. Peristaltic pumps typically use 1/4-inch or 3/8-inch outside diameter (OD) LDPE tubing together with 3/8-inch OD silicone tubing. Submersible pumps typically have barbed fittings that accommodate 3/8-inch or

1/2-inch inner diameter (ID) LDPE tubing, depending on the pump manufacturer. Note that larger diameter tubing (1/4 inch ID or greater) is generally easier to install in monitoring wells equal to or greater than 2 inches in diameter.

As in the case with pumps the use of dedicated tubing, where possible, is recommended for long-term monitoring programs.

4.3 POWER SUPPLY

The power supply options for the pumps include generators, deep cycle batteries, and compressed gas. If a gasoline generator is used, it must be located downwind and at a safe distance from the well so that the exhaust fumes do not contaminate the samples. If the operator of the generator has handled gasoline, then he/she should not risk cross-contamination by handling the sampling equipment or sample containers.

4.4 INDICATOR PARAMETER MONITORING INSTRUMENTS

Site specific Data Quality Objectives (DQOs) should be used to select appropriate field parameters. Field parameter options include, but are not limited to:

- pH (EPA Methods 150.1 or 9040),
- turbidity (EPA Method 180.1),
- specific conductance (EPA Methods 120.1 or 9050),
- temperature (EPA Method 170.1),
- oxidation reduction potential (ORP), and
- dissolved oxygen (EPA Method 360.1).

A flow-through cell is required for dissolved oxygen and ORP measurements.

4.5 WATER LEVEL/FLOW MEASURING TOOLS

Water level and flow measurement are required for LFS. Several different water level meters, including Solinist® and Well Wizard®, are available to staff. A graduated cylinder and stopwatch are used for measuring flow in mL/minute.

4.6 DOCUMENTATION SUPPLIES

This includes a field notebook for taking field notes, and the MEDEP LFS data sheet included in Attachment B.

4.7 WELL DOCUMENTATION

A well's location, well construction, previous sampling data, and the Sampling and Analysis Plan (SAP) should accompany samplers in the field.

4.8 MISCELLANEOUS SUPPLIES

Miscellaneous supplies include decontamination equipment and material, sample bottles, preservation supplies, sample tags and labels.

4.9 LFS PURGE AND SAMPLE PROCEDURE

4.9.1 PREPARATION

Prior to conducting an LFS event, information regarding well construction, development, and water level records for each well to be sampled should be obtained and reviewed to determine the appropriate pump to be used, the depth of intake, and the potential groundwater recharge rate of the well. If this information is not available, a reconnaissance should be made prior to the actual sampling event to determine well depth, water level, length of screen, and a pump test to determine the recharge rate of the well. Additionally, wells that have **not been sampled for two years should be redeveloped** prior to conducting the actual sampling event. Redevelopment of Monitoring wells is outlined in SOP RWM-DR-028 – Maintaining and Redevelopment of Inactive Monitoring Wells.

4.9.2 FIELD PROCEDURE

1) Obtain static water level. Measure and record the depth to water (to 0.01 ft) in the well to be sampled before inserting tubing or preparing to purge the well. Care should be taken to minimize suspension of any particulates attached to the sides or at the bottom of the well. If wells to be sampled are arranged in clusters (i.e. shallow/middle/deep), then depth to water readings should be collected from all wells in the cluster before purging.

2) Install sampling pump or tubing. The use of dedicated sample tubing will reduce disturbance and water mixing in the well. In situations where dedicated equipment is not used, field staff will lower equipment (i.e. pump, safety cable, tubing and electrical lines) slowly into the well so that the pump intake is located at the center of the saturated screened interval to avoid disturbing sediments in the bottom of the well.

3) Purge well. Flow rate and water level (drawdown) should stabilize before connecting the flow cell or obtaining any other measurements. Air or gas bubbles trapped in the sample tube can usually be removed by elevating the discharge tube and pump to allow the air to continue rising until discharged with the water. However, some groundwater has high dissolved gas levels and gas can not be completely removed from the sample

tube. Check previous data sheets to assist in well set up, flow rates, and notes regarding gas presence in the sample tube.

Monitor water level and pumping rate frequently during the first five minutes of purging. If the recharge rate of the well is less than minimum capability of the pump, then the water level will not stabilize. If a constant water level can not be maintained at a flow rate of 80 to 100 mL/min., then the no-purge option should be evaluated (see Section 4.12 No-Purge Option). Care should be used to avoid dewatering the screen or lowering the water level to the intake depth.

Once the water level has stabilized during purging, monitor field indicator parameters every three to five minutes. Measurements of dissolved oxygen and ORP must be obtained using a flow-through cell. Purging is complete and sampling may begin when all field indicator parameters have stabilized (variations in values are within ten percent of each other, pH +/- 0.2 units, for three consecutive readings taken at three to five minute intervals).

4) Collect Samples. Collect samples in appropriate containers as indicated by laboratory conducting the analysis. Samples for laboratory analyses must be collected before the flow cell. This can be done by disconnecting the flow cell after reaching stabilization, using a sample port before the flow cell, or by disconnecting the flow cell once parameters have stabilized.

LFS will help reduce turbidity caused by improper purge and sampling techniques. The need for filtering water samples will be reduced by using this method. However, if turbidity values equilibrate above 20 NTUs, one should consider the need to collect both a filtered and an unfiltered sample. An in-line 0.2-0.45 um particulate filter should be pre-rinsed with approximately 25 - 50 mL of groundwater prior to sample collection, or as per filter manufacturers instructions. **Note that filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations representative of total mobile loads.**

After collection of the samples, any tubing used may either be dedicated to the well for resampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

4.10 PROCEDURE EVALUATION

The purpose of the LFS purge option is to sample the groundwater from the surrounding aquifer. If your well is not receiving sufficient recharge from the formation, then the water level in the well will drop as pumping continues. This means that the discharge water could contain a significant percentage of stagnant water from the well casing. As the percentage of casing water increases, the representativeness of the sample decreases. If the percentage of casing water is significant, an alternative sampling technique, such as the no–purge option, should be considered (see Section 4.12). A decision process for implementing low flow/no purge sampling can be found in Attachment B.

The second step in evaluating the viability of LFS for a potential no–purge well is to determine the volume of groundwater needed to fill the laboratory containers. Compare this volume to the volume of groundwater in the screened section of the monitoring well. If the volume of water contained in the screened zone is greater than the volume of sample required to fill the sample containers, then the no-purge option is appropriate for this well.

4.10.1 CALCULATING FORMATION/STAGNANT WATER RATIO

The following calculation will determine how much of the water being pumped is coming from the well, and how much is coming from the aquifer. This is done by comparing the total volume being purged to the drawdown volume in the well. If the equilibrium flow rate is 150 mL/min or lower for a given well, the following evaluation should be followed:

- Calculate the total volume of water discharged for a given time interval.
- Measure the total drawdown of the water level in the well during that time interval.
- Calculate the total drawn down volume in the well (see Attachment B for mL/ft conversions of typical monitoring well sizes)

Compare the total volume of water discharged to the total drawdown volume. If the drawdown volume comprises 60% or more of the discharge volume, then the well construction should be evaluated.

4.10.2 WELL CONSTRUCTION EVALUATION

Evaluate the well construction. Was the appropriate screen slot size selected? Was the appropriate filter sand selected? If the well construction details are not appropriate for the formation, then consideration should be given to installing a replacement well that is properly designed. A poorly designed well will not yield representative samples no matter what purging procedure is utilized.

4.11 PROCEDURE MODIFICATIONS

The LFS procedure can be modified to meet the DQOs for the Sampling Event. In long-term monitoring events it may be possible to reduce the field parameter list after baseline information is obtained over the first year or two. Careful consideration should be given to the purpose of each parameter used in the procedure. Each parameter has importance that extends beyond the measurement for equilibrium. If Low-Flow sampling is not appropriate for a particular site, then SOP RWM-DR-002 – Groundwater Sample Collection for Site Investigation and Assessment Monitoring should be used for the site.

Cold weather considerations must be factored into a low flow sampling plan.

Monitoring wells with recharge rates below 100 mL/min may not be capable of being pumped at a continuous rate. Therefore, low purge or no purge options should be considered.

4.12 NO – PURGE OPTION

The theory of no-purge sampling is that the water in the screened zone is in equilibrium with the aquifer and the water in the riser portion of the well is not. The goal is to sample only the water in the screened zone and to minimize any mixing with the water in the riser.

In certain low permeability formations it may not be possible to maintain a constant drawdown at low flow rates (~80-100 mL/min.). In these formations the only option may be to obtain a groundwater sample without purging.

4.12.1 NO-PURGE PROCEDURE

Dedicated equipment is required to properly complete this procedure (to eliminate any additional mixing of the water in the riser with the water in the screen).

The pump intake must be in the screened zone, at or slightly above the midpoint of the screen.

1) Calculate the volume of water standing in the discharge line.

2) Turn on the pump at the lowest possible flow rate.

3) Purge the volume of water that was standing in the discharge line.

4) Immediately begin sample collection after the discharge line is purged.

4.13 DECONTAMINATION

Dedicated equipment will not need decontaminating. However, non dedicated equipment should be cleaned prior to field work, after each sampling location, and upon return to the office from the field, as outlined in MEDEP/DR SOP# RWM-DR-017 – Equipment Decontamination Protocol, with specific procedures for cleaning submersible pumps outlined below. The pump, including support cable and electrical wires which are in contact with the well will be decontaminated by one of the procedures listed below. Note that if historical data is available for site wells, non-dedicated equipment decontamination in the field can be minimized or even eliminated by sampling monitoring wells in order from cleanest to dirtiest. Non dedicated tubing should be discarded.

The decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump or the pump can be disassembled and flushed with the

decontaminating solutions. It is recommended that detergent and isopropyl alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is flushed out. The outside of the pump and the electrical wires must be rinsed with the decontaminating solutions as well. The procedure is as follows:

- Flush the equipment/pump with deionized or tap water. Flush pump by allowing pump to run with water for several minutes in basin filled with water.

- Flush with non-phosphate detergent solution for several minutes.
- Flush with deionized water to remove all of the detergent solution. In some instances of high levels of contamination, it may be appropriate to use isopropyl alcohol in this step. The need for this will be determined in the Site Specific Sampling and Analysis Plan (See SOP# RWM-DR-014)

- Flush one final time with distilled/deionized water. If required (as determined in Site Specific Sampling and Analysis Plan), collect equipment blank after final flushing.

5.0 QUALITY ASSURANCE/ QUALITY CONTROL

DQOs should be stated in the site Sampling and Analysis Plan (SAP). Quality Assurance/Quality Control (QA/QC) samples may be collected if needed to meet your data quality objectives. The following are typical types of QA/QC samples that may be collected as part of the QA/QC program for groundwater sample collection utilizing this SOP, other QA/QC samples may be collected as stated in the SAP. For an additional discussion of QA/QC, please refer to the MEDEP/DR Quality Assurance Plan, Sections 4 and 8. All analytical data should be reviewed and assessed to determine if DQOs have been met. If review indicates DQOs have not been met, corrective action will be recommended by the reviewer.

5.1 TYPICAL QA/QC SAMPLES

5.1.1 Equipment Blanks

If using non dedicated or disposable equipment, equipment blanks should be collected at a rate of 5%, which is equivalent to one equipment blank for every twenty samples collected. The equipment blank will consist of purging de-ionized water through submersible pumps and piping, and/ or rinsing equipment with de-ionized water, and collection for appropriate sample analysis.

5.1.2 Duplicate Samples

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

5.1.3 Trip Blank

A trip blank may be necessary when sampling for volatile organic compounds (i.e. EPA 8260). The need for a trip blank will be outlined in the SAP.

5.1.4 Background Samples

The need for background groundwater samples will be outlined in the SAP.

6.0 DOCUMENTATION

All site visits, including groundwater sampling events shall be documented as described in the SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report. A field log must be kept each time ground water monitoring activities are conducted in the field; the LFS Data Sheet in Attachment A is the approved form for use by staff. The field log should document the following:

- Well identification, condition of well
- Static water level
- Pumping rate, or flow rate including units
- Time of all measurements
- Water Level at the specified pumping rate
- Indicator parameters values
- Well sampling sequence and time of sample collection.
- Types of sample bottles used and sample identification numbers.
- Preservatives used.
- Parameters requested for analysis.
- Name of sample collector(s).
- Calibration information of meters.

7.0 REFERENCES

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ATTACHMENT A
DECISION PROCESS FOR IMPLEMENTING LOW FLOW/NO PURGE SAMPLING

Decision Process for Implementing LFS

1) Obtain well construction, development, and water level records for each well being sampled. Compile total depth, screened interval, water level, and available hydraulic conductivity information for field technician(s).
   Continue to 2

2) Review available equipment. Make sure the pump is capable of variable speeds and can pump water at low rates without the use of mechanical flow restrictions. Reducing flow by altering the diameter of the discharge pipe is not acceptable for purposed of LFS. Make sure the chamber being used to collect field parameters is appropriate for the parameters being measured. For ORP and DO measurements with probes, the chamber must be an enclosed chamber that does not allow water to contact the atmosphere and does not impact the water quality. Additionally, the size of the chamber should be appropriate given the expected flow rates.
   Continue to 3

3) The objectives of the sampling event should be reviewed to determine the important stabilization parameters as well as the important field parameters for geochemical analyses.
   Continue to 4

4) Is the well being used as part of a long-term plan to monitor trends in groundwater chemistry?
   Yes ... Go to 5
   No ... Go to 6

5) Complete Well Performance Evaluation on Well prior to first sampling event.
   Continue to 6

6) Will water level (under pumping conditions) stabilize above the top of the screen?
   Yes ... Go to 11
   No ... Go to 7

7) Is the static water level above the top of the screen?
   Yes ... Go to 9
   No ... Go to 8

8) Will the stabilized water level reduce the volume of water in the well by greater than 10%?
   Yes ... Go to 12
   No ... Go to 11

9) Is there sufficient water in the well to purge and sample the well given the measured drawdown rate without dewatering any part of the screen?
   Yes ... Go to 10
   No ... Go to 12

10) Is the volume of water attributable to the change in water level greater than 20% of the volume of water being discharged during the same time period?
    Yes ... Go to 12
    No ... Go to 11

11) Complete the Standard Low Flow Sampling Procedure and collect groundwater samples once the selected stabilization parameters have equilibrated.

12) Evaluate the appropriate application of Reduced Purge Procedures for this well.
    Continue to 13

13) Is the sampling equipment (pump or sample tube) dedicated to the well and/or has it been installed for more than 2 weeks prior to sampling?
    Yes ... Go to 15
    No ... Go to 14

14) Install the pump or tubing and purge a volume of water equal to 1.5 times the volume required to fill the laboratory containers. Purging must be completed at the lowest setting possible (must be less than 100 mL/min). Then shut-off the pump and allow the well to recharge until the water level returns to the static water level
    Continue to 15

15) Set the pump rate to the lowest possible setting (must be lower than 100 mL/min) and purge a volume of water equal to the volume of water in the sample tube. Then immediately begin collection of laboratory samples at the same rate. Record the water level at the beginning of sample collection and at the end of sample collection. If field parameters are to be collected, they must be collected after laboratory samples are collected.

ATTACHMENT B
LOW FLOW DATA SHEET

Monitoring Well Purge and Sample Data Sheet

Well#

Date

Site Name

Static Water Level

Total Depth | Well Diameter

Begin Time of Purge

Screen Interval | Formation | Sample Device

Time	Water Level	Flow	DO	Temp.	Cond.	pH	ORP	Turb.	
Min.	Feet below MP	mL/Min	mg/L	Celcius		-log[H+]	mV	NTU	
Write Meter Number of Instrument Used									Comments

Equilibrium Goals

3 consecutive readings 3-5 min. apart

Flow 1-2 mL/Min	Cond. +- 3%
Water Level +- 0.01	pH +- 0.1
DO +- 10%	eH +- 10 mV
Turb +- 10%	Temp. +- 0.1

Eh Correction for Ag/AgCl probe:

Add 199 mV to ORP value

mL/Ft Information

3/4 in well = 87 mL/Ft

2 in well = 617mL/Ft

4 in well = 2470 mL/Ft

Record all instrument calibrations in Instrument Calibration Log Book or Field Book

Samplers:

Analysis / Depth

Laboratory Sample ID

Date Revised 1/28/2002

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:

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David Wright	David Wright	12/1/2016
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Bill Longfellow		12/30/16
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Department Commissioner:

PAUL MERCER		1-3-2017
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 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.

COVERSHEET

Operational Title: Soil Gas Sample Collection Method Utilizing Hand Tools

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)

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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 procedure for using hand tools to collect soil gas samples for the evaluation of contaminant vapor intrusion.

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 GUIDANCE AND PROCEDURES

4.1 PREPARATION

4.1.1 SAMPLING PLAN

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

When evaluating vapor transport it is important to identify preferential vapor pathways that are created by relatively permeable non-native fill associated with site development. Utility trenches are of particular importance because they can facilitate transport of both vapor and groundwater. At a minimum a CSM should identify potential site sources (e.g. current and former USTs, petroleum dispensers, dry cleaning machines, and ventilation hoods), preferential pathways (and interrelationships), surface water drainage patterns (both natural and man made or influenced), and closest receptors in all directions from the site.

4.1.2 SCHEDULING

It should be noted that sampling during heavy precipitation and saturated soil conditions may negatively effect collection of soil gas samples. A provision to have alternate days for conducting field work if scheduled days are raining, or immediately following heavy rains, should be made.

4.2 EQUIPMENT

4.2.1 EQUIPMENT LIST

The Equipment used for the collection of soil gas samples when following this this SOP may include:

- Pilot Hole Tool
  - Mechanical small diameter drill and bit (3/8 to 5/8-inch),
  - Tile Probe with slam bar
  - Removable or fixed drive point and rod,
- Thin walled narrow diameter screened stainless steel sampling tube;
- Vacuum pump, such as peristaltic;
- Bentonite clay or modeling clay;
- Polyethylene tubing (see Section 5.2.3)
- Teflon lined tubing (see Section 5.2.3)
- Containers (Summa Canister or Tedlar Bags, see Section 5.2)

4.2.2 Specific Container and Tubing Considerations for Soil Vapor Sampling

Due to the nature of soil gas sampling, additional planning must be undertaken in order to assure the appropriate sample collection/analysis methods and appropriate containers for a sampling event. Two types of sample containers are described in this SOP; Summa Canisters and Tedlar Bags. When deciding which container to use, staff should consider the data quality objectives (DQOs) for the sample and the availability of a laboratory capable of analyzing the sample that is both State certified and capable of reaching required detection limits.

4.2.2.1 Summa Canisters

A Summa canister is a clean metal container sealed with a vacuum; this vacuum is then used to draw in the gas sample. Summa canisters must be ordered from a laboratory in advance of the sampling event and are available from a limited number of labs. Samples from Summa canisters are analyzed by certified labs only, and by methods which have been approved by EPA and have detection limits that generally meet the ambient air guidelines.

Summa canister samples can collect two types of samples; grab and time elapsed. Grab samples are collected utilizing the vacuum of the canister for a sample with a collection time of

less than 30 minutes. Time elapsed are samples collected utilizing the vacuum of the canister over an extended period of time, up to and beyond 24 hours. Both sample types require a regulator between the tubing and canister to control the length of time the sample is collected. The regulator will be provided and calibrated by the laboratory conducting the analysis of the sample. The type and duration of sample should be indicated as part of the SAP.

Clean Summa canisters must be obtained from the laboratory providing the analysis for each sampling event. Unused canisters will be sent back to the laboratory. The laboratory will need to be informed as to the sample collection method used and the duration of collection time prior to shipping the Summa canisters and regulators for the sampling event.

4.2.2.2 Tedlar Bag

A tedlar bag is a bag manufactured from Tedlar (Polyvinyl fluoride) with a two way valve. Tedlar bag samples require less time for planning because they can be ordered in advance and kept on hand until they are needed. However, the bags must be stored in a clean location. Laboratories capable of analyzing these samples are even more limited than the Summa Canisters. Holding time for tedlar bag samples is 48 hours. However, tedlar bags can be analyzed in the field with a mobile laboratory (that is capable of providing the analysis), providing real time data. Due to detection limits for this analytical method (generally 10 times the indoor air standard for most compounds), tedlar bag collection is most often used for screening purposes. There is not an USEPA approved method; samplers using tedlar bag collection must communicate with the laboratory conducting the analysis, prior to sampling, to be sure DQOs will be met..

4.2.2.3 Tubing Selection

Certain volatile chemicals (especially those found in petroleum products) may interact with certain types of tubing used for collecting samples. Tubing used for vapor sampling is usually a flexible, polyethlene based tubing. These interactions will affect the quality of sample results, and may require a contaminant specific tubing, such as a Teflon lined tubing (e.g. when sampling for petroleum vapors). Therefore, contaminants of concern for the site should be determined before collecting samples (refer to the Site's CSM). If tubing interaction is a concern, the laboratory and/or the DEP Chemist in the DEP's Division of Technical Services should be consulted prior to sample collection to assure appropriate tubing is used. Type of tubing used should be noted in the field notes of the samplers.

4.3 SAMPLE COLLECTION

4.3.1 Overview

The drill or tile probe is used to create a pilot hole between 18 and 48 inches below the ground surface. The thin wall screened stainless steel or aluminum tube is inserted into the pilot hole

and advanced to an optimum depth of 3-4 feet. The sample tube is sealed at the surface with clay and at least one sample tube volume should be purged with a peristaltic pump. To help assure that a representative sample will be collected, atmospheric CO_2 and O_2 can be compared to subsurface CO_2 and O_2 measurements using a multi meter field instrument. Atmospheric O_2 concentrations are usually much higher than subsurface O_2 levels. Atmospheric CO_2 concentrations are usually much lower than subsurface CO_2 levels. To collect a sample for analysis, tubing is connected to the top of the sampling tube and a soil gas sample is either pumped or collected under vacuum directly into the sample container. If utilizing a Summa canister be sure to record both the starting and ending pressures on the canister.

5.0 QUALITY CONTROL

Due to cross contamination issues inherent with soil gas sample collection, more rigorous quality control sampling may be required then the sampling of other media. DQOs should be stated in the SAP. Quality Assurance/Quality Control (QA/QC) samples may be collected if needed to meet your DQOs. The following typical types of QA/QC samples should be collected as part of the QA/QC program for soil gas 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 should be collected at a rate of 5%, which is equivalent to one equipment blank for every twenty samples collected. The equipment blank will consist of purging a complete drive rod and closed point system with zero air and collecting the air for analysis in either a Tedlar bag or Summa canister.

5.2 DUPLICATE SAMPLES

It is recommended that duplicate samples be collected at a rate of 10% to assess sample location variability.

5.3 BACKGROUND/AMBIENT AIR SAMPLES

One to two ambient air samples per day should be collected at the sampling locations to assess ambient air conditions.

5.4 TRIP BLANK

A trip blank should be collected particularly when utilizing tedlar bags as sample containers. The trip blank will consist of a tedlar bag filled from a canister of zero air that is kept with the sample containers at the start of the day and travels with the containers to the laboratory.

5.5 TRACER GAS DISPERSION

Difficult ground or weather conditions, such as frost or cold weather, may make sealing of the direct push rods from ambient air difficult. This will allow ambient air to intrude into the soil formation, and not provide a true sample of the gas within the soils spaces. In these situations, a tracer gas such as sulfur hexafluoride (SF^6) can be dispersed around the ground penetration point during sample collection to determine if ambient air contamination of the sample is present. If the immediate analysis indicates SF^6 detection in the sample, re-sampling of the location may be warranted. Alternatively, the O_2 - CO_2 comparisons can be used to assure good quality samples were collected.

6.0 SYSTEM DECONTAMINATION

In an effort to provide the most representative soil vapor samples possible, all tooling and materials in contact with the site soils will be cleaned with a detergent wash and potable water rinse prior to re-use, as outlined in MEDEP/DR SOP# RWM-DR-017 – Equipment Decontamination Protocol. Additional cleaning of the tooling with steam cleaning may be warranted depending on the site contamination.

New, flexible tubing (i.e. dedicated) will be used at each different sample location, regardless as to the type of tubing used.

7.0 DOCUMENTATION/CHAIN OF CUSTODY

All sampling activities must be documented as outlined in MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of a Trip Report. Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol. Due to the nature of soil gas sampling, attention should be made to the following:

1) Weather conditions particularly precipitation within past 3 days;
2) Depth of sample collection;
3) Possible sources of off site contamination (gas stations, dry cleaners, automotive body shops, etc.) in the vicinity of the investigation field work;
4) Possible sources of cross contamination (fueling vehicles/equipment, etc)
5) Length of time of sample collection.

COVERSHEET
STANDARD OPERATING PROCEDURE

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

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

APPROVALS:

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Department Commissioner:

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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 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 procedure for collecting soil samples for evaluating soil contamination.

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 procedure. MEDEP/DR staff reviewing data by outside parties are responsible for assuring that the procedure (or an equivalent) was utilized appropriately.

5.0 DEFINITIONS

5.1 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.

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

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

5.4 COMPOSITE SAMPLE - Two or more portions of material mixed together to yield a single sample for analysis.

5.5 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.

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

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

6.0 GUIDELINES AND PROCEDURES

6.1 INTRODUCTION

Soil sample collection is the most basic aspect of the investigation of hazardous 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 surficially, from a variety of sources such as poorly stored containers leaking into soil, or direct sub-surficial soil discharge 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, from which contamination can migrate and contaminate additional soil, and can contaminate 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 with required preservation, as specified by the analysis methodology.

6.2 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 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.

6.1.2 SPECIAL CONSIDERATIONS REGARDING CONTAINERIZATION

Many analytical procedures require more specific containerization and preservation protocols than just "jamming dirt in a jar and keeping it cold". For example, 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. As an example, one of these containers may require a specific amount of soil sample (e.g. 5 grams), placed in a pre-weighted jar with 10 ml of methanol added; other containers in the set will have a different requirements. MEDEP/DR expects these 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 as required by the analytical method.

6.2 EQUIPMENT

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

- 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 Safey 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. A stated earlier, specific tools for sample containerization must be outlined in the SAP.

The sampling equipment's composition may vary with analytical needs. For instance, stainless steel is preferred for organic analysis whereas Teflon and/or plastics are preferred for inorganic sample collection.

6.2.1 Equipment for Surficial Soil Sample Collection

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

6.2.2 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 coarseness, rocks, etc. 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 in no means complete, as any type of tool capable of "digging" can be used for soil sampling, as long as it is clean. 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.

6.3 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, boring and drilling rigs, and earthmoving equipment should only be used by staff trained specifically in the use of that piece of equipment.

6.4 SAMPLING PROCEDURE

6.4.1 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 resulting from some occurrence other than natural conditions. For instance, pooling liquids are a quick indication of a low area where liquid contaminants are likely to have concentrated. 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 and work zones and establish a secure perimeter to keep out unauthorized persons.

6.5 SAMPLING PROCEDURE

6.5.1 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 sample point to gain a representative sample material.

An attempt should be made to keep the samples collected as similar with each other as possible. Choose sample locations that have same soil type, organic matter content, and depth if such locations are available and still allow collection of data that is consistent with the goals of the SAP and the data quality objectives (DQOs) of the project.

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. *Or*, the tool will be used to remove the soil from the formation and the soil containerized directly from the tool. Either method will work; chose the specific procedure that allows sample collection with the minimal amount disturbance of the actual soil to be submitted to the lab. 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 the surface by tools, or soil having fallen into the excavated hole from the surface.

An example:

Samples for volatile organic compound (VOC) analysis are generally collected utilizing a plastic syringe pushed into the soil to collect a specific amount (typically approximately 5 grams). This "plug" of soil is then extruded from the syringe into the container, with preservation fluid added. Metals are generally collected by placing approximately 250 grams of the soil in a plastic "whirlpak" style bag. So, 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 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.

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.

6.5.2 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 as minimal disturbance of the soil and limiting the amount of handling and tooling contact to the sample collected. If using a shovel, 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. 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 the surface by tools, or soil having fallen into the excavated hole from the surface.

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 the 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. Then, 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, worms, 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, removed the bucket auger and empty out soil. Remove any soil that might have collapsed into the hole with bucket auger after removing the first time. 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.

6.5.3 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 excavation 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 excavation from 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 to have the excavator dig to the desired depth, scrape the side or bottom wall of the pit to remove slough and smeared material, and then obtain soil for sampling. When collecting from the excavator bucket, try to watch the bucket as it collects the soil, and obtain the soil for the sample from an area of the bucket that did not touch the bucket itself. For example, the interior soil of clods would not have touched the bucket, so remove the clod, break in half, and collect a sample from the freshly broken face of the clod.

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. Then 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 sample should be collected and containerized with as minimal handling and disturbance as possible. Wipe or wash off any large soil particles adhering to the jar lab.

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 lab.

COVER SHEET
STANDARD OPERATING PROCEDURE

OPERATION TITLE: **DUST WIPE COLLECTION PROTOCOL**

ORIGINATOR:

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Bureau of Remediation and Waste Management

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Department Commissioner:

PAUL MERCER		1-3-2017
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 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 procedures and protocols for collecting settled dust samples.

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 GUIDELINES AND PROCEDURES

4.1 INTRODUCTION

Wipe Sampling for Settled Metal-Contaminated Dust. Wipe samples for settled metal contaminated dust can be collected from floors (both carpeted and uncarpeted), interior and sash/sill contact areas, and other reasonably smooth surfaces. Wherever possible, hard surfaces should be sampled. Wipe media should be sufficiently durable so that it is not easily torn, but can be easily digested in the laboratory. Recovery rates of between 80-120% of the true value should be obtained for all media used for wipe sampling. Blank media should contain no more than 25 ug/wipe of any target metal (the detection limit using Flame Atomic Absorption).

4.2 SAMPLING EQUIPMENT

4.2.1 DISPOSABLE WIPE: Any wipe material that meets the following criteria may be used:

- Contains low background metal levels,
- Is a single thickness,
- Is durable and does not tear easily (do not use Whatman™ filters),
- Does not contain aloe or lanolin,
- Can be digested in the laboratory,

- Has been shown to yield 80-120% recovery rates from samples spiked with metal dust (not metals in solution),
- Must remain moist during the wipe sampling process (wipes containing alcohol may be used as long as they do not dry out).

4.2.2 NON-POWDERED DISPOSABLE NITRILE GLOVES. Disposable gloves are required to prevent cross-sample contamination from hands.

4.2.3 NON-STERILIZED POLYETHYLENE CENTRIFUGE TUBES (50 ml size) or equivalent hard-shell container that can be rinsed quantitatively in the laboratory.

4.2.4 DUST SAMPLE COLLECTION FORMS.

4.2.5 CAMERA to document exact locations (Optional).

4.2.6 TEMPLATE. Masking tape or hard, smooth, reusable templates may be used to define the area to be wiped. Periodic wipe samples should be taken from the templates to determine if the template is contaminated. Disposal templates are also permitted so long as they are not used for more than a single surface. Templates must be larger than $0.1ft^2$, but smaller than $2ft^2$. Templates for floors are typically $1ft^2$. Templates are usually not used for windows due to the variability in size and shape (use masking tape instead).

Note: Masking tape may damage the painted surface. Drafting tape or painter's tape may be less damaging to the paint. Any tape will be harder to remove, the longer it has been in place.

4.7 CONTAINER LABELS OR PERMANENT MARKER.

4.8 TRASH BAG or other receptacle (do not use pockets or trash containers at the residence).

4.9 RACK, bag, or box to carry tubes (optional).

4.10 MEASURING TAPE.

4.11 DISPOSABLE SHOE COVERINGS (optional).

4.3 SINGLE SURFACE WIPE SAMPLING PROCEDURE

4.3.1 Outline Wipe Area:

4.3.1.1 Floors:

Identify the area to be wiped. Do not walk on or touch the surface to be sampled (the wipe area). Apply masking tape to perimeter of the wipe area to form a square or rectangle of about one square foot. No measurement is required at this time. The tape should be positioned in a

straight line and corners should be nominally perpendicular. When putting down any template, do not touch the interior wipe area.

4.3.1.2 Window Sills and other rectangular areas:

Identify the area to be wiped. Do not touch the wipe area. Apply two strips of masking tape across the sill to define a wipe area at least 0.1 square foot in size (approx. 4 inches x 4 inches).

4.3.2 Preliminary inspection of the disposable wipes.

Inspect the wipes to determine if they are moist. If they have dried out, do not use them. When using a container that dispenses wipes through a "pop-up" lid, the first wipe in the dispenser at the beginning of the day should be thrown away. The first wipe may be contaminated by the lid and is likely to have dried to some extent. Rotate the container prior to each use to ensure liquid inside the container contacts the wipes.

4.3.3 Gloves

Don a disposable glove on one hand; use a new glove for each sample collected. If two hands are necessary to handle the sample, use new gloves, one for each hand. It is not necessary to wipe the gloved hand before sampling.

4.3.4 Collection of sample

Place the wipe at one corner of the surface to be wiped with wipe fully opened and flat on the surface. For square sample areas, complete a first wipe pass side-to-side as follows. With the fingers together, grasp the wipe between the thumb and the palm. Press down firmly, but not excessively with both the palm and fingers (Do not use only the fingertips or the heel of the hand to hold down the wipe, because there will not be complete contact with the surface and some dust may be missed.) Do not touch the surface with the thumb. Proceed to wipe side-to-side with as many "S"-like motions as are necessary to completely cover the entire wipe area. Exerting excessive pressure on the wipe will cause it to curl. Exerting too little pressure will result in poor collection of dust. Attempt to remove all visible dust from the wipe area.

Fold the wipe in half with the contaminated side facing inward. (The wipe can be straightened out by laying it on the wipe area, contaminated side up, and folding it over.) Once folded, place in the top corner of the wipe area and press down firmly with the palm and fingers. Complete a second wipe pass moving from top-to-bottom and wiping the area with "S"-like motions. Attempt to remove all visible dust. Do not touch the contaminated side of the wipe with the hand or fingers. Do not shake the wipe in an attempt to straighten it out, since dust may be lost during shaking.

For rectangular sample areas, two side-to-side passes must be made over half of this surface, the second pass with the wipe folded so that the contaminated side faces inward. For a window sill, do not attempt to wipe the irregular edges presented by the contour of the window channel. Avoid touching other portions of the window with the wipe. If there are paint chips or gross debris in the window sill, attempt to include as much of it as possible on the wipe. If all of the

material cannot be picked up with one wipe, field personnel may use a second wipe at their discretion and insert it in the same container. Consult with the analytical laboratory to determine if they can perform analysis of two wipes as a single sample. When performing single-surface sampling, do not use more than two single surface wipes for each container. If heavily dust-laden, a smaller area should be wiped. It is not necessary to wipe the entire window well but do not wipe less than 0.10 ft^2 (approx. 4" x 4").

4.3.5 Packaging the Wipe

After wiping, fold the wipe with the contaminated side facing inward again, and insert aseptically (without touching anything else) into the centrifuge tube or other hard-shelled container. If gross debris is present, such as paint chips in a window well, make every attempt to include as much of the debris as possible in the wipe.

4.3.6 Seal the tube and label with the appropriate identifier.

Record the laboratory submittal sample number on the field sampling form.

4.3.7 Area Measurement

After sampling, measure the surface area wiped to the nearest eighth of an inch using a tape measure or a ruler. The size of the area wiped must be at least 0.10 ft^2 in order to obtain an adequate limit of quantitation. No more than 2 square feet should be wiped with the same wipe or else the wipe may fall apart. Record specific measurements for each area wiped on the field sampling form.

4.3.8 Form completion

Collect and maintain any field notes regarding type of wipe used, lot number, collection protocol, etc.

4.3.9 Trash Disposal

After sampling, remove the masking tape and throw it away in a trash bag. Remove the glove; put all contaminated gloves and sampling debris used for the sampling period into a trash bag. Remove the trash bag when leaving the dwelling. Do not throw away gloves or wipes inside the dwelling unit where they could be accessible to young children, resulting in a suffocation hazard.

4.3.10 Blank Preparation

After sampling the final dwelling unit of the day, but before decontamination, field blank samples should be obtained. Analysis of the field blank samples determines if the sample media is contaminated. Each field blank should be labeled with a unique identifier similar to the others but that identifies the sample as a field blank.

Blank wipes are collected by removing a wipe from the container with a new glove, shaking the wipe open, refolding as it occurs during the actual sampling procedure, and then inserting it into

the centrifuge tube without touching any surface or other object. One blank wipe is collected for each dwelling unit sampled or, if more than one dwelling unit is sampled per day, one blank for every 50 field samples, whichever is less. Also, collect one blank for every lot used. Record the lot number.

5.0 SAMPLER DECONTAMINATION

After sampling, wash hands thoroughly with plenty of soap and water. A bathroom in the dwelling unit may be used for this purpose, with the owner's or resident's permission. If there is not running water in the dwelling unit, use wet wipes to clean the hands. During sampling, sampler must not eat, drink, smoke, or otherwise cause hand to mouth contact.

6.0 DOCUMENTATION/ CHAIN OF CUSTODY

Submittal Form Preparation. Fill out the appropriate field sampling forms completely. The sample numbers on the sample container must be the same as those on the field sampling form and must also be used on the laboratory submittal form. Confirm that all samples recorded are in fact present on the laboratory submittal form.

All site visits must be documented as described in the SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report. Use of specialized sampling forms is allowed, following the procedure outlined in DR-013. Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol.

COVERSHEET
STANDARD OPERATING PROCEDURE

Operation Title: **PROTOCOL FOR COLLECTING INDOOR AIR SAMPLES**

Originator: **Brian Beneski**
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12/1/2016 — *Date*

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12/4/16 — *Date*

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12/30/16 — *Date*

Department Commissioner:

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1-3-2017 — *Date*

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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 MEDEP/DR procedure for collecting indoor air samples from buildings in the context of evaluating a completed vapor intrusion pathway.

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 GUIDELINES AND PROCEDURES

4.1 PREPARATION

Investigators should evaluate the potential for vapor intrusion simultaneous with indoor air sample collection or prior to indoor air sampling. Indoor air samples should never be completed without an appropriate vapor intrusion evaluation (appropriate ASTM Guidance, soil gas sampling, subslab soil gas sampling, etc.).

4.2 SAMPLING PLAN

A well developed Site conceptual model is imperative for effective indoor air sampling. Prior to conducting any sampling event, a sampling plan should be developed (see MEDEP/DR SOP# RWM-DR-014 - Development of a Sampling and Analysis Plan). 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. Included in the sampling plan should be specifics regarding the anticipated contaminants of concern, data quality objectives, the laboratory conducting analysis, sample containers and Quality Assurance/Quality Control.

The owner of the property being considered for sampling must be made fully aware of, and approve of the sampling event and the need for follow-up monitoring. Staff will work with the

Office of Commissioner and the Attorney General's office to obtain access if permission is denied. Additionally, the owner/operator of the building should identify any sub slab utilities, foundation/column footings, vapor barriers, radon sub slab depressurization systems, or any other foundation structures, building renovations, and building contents that might impact the results or collection of indoor air samples.

If collection of indoor air sampling will become part of a routine monitoring program, it is recommended that follow-up samples be collected at the same location, unless the data quality objectives warrant sampling from more than one location.

4.3 SCHEDULING

It should be noted that sampling during times when soil pores are water filled (spring thaw, extended rain events, or heavy short duration rain events greater than 0.25 inches over an 8 hour period) may negatively affect collection of indoor air samples. For this reason rain dates should be planned in the proposed field work schedule. Sampling should not take place when doors and windows remain open to facilitate ventilation during warmer temperatures unless arrangements have been made to keep them closed. Custody seals are recommended for windows and doors during warmer weather or when building security is an issue.

4.4 EQUIPMENT

The equipment for collection of indoor air samples following this this SOP may include:

- Photo-ionization Detector (ppb level)
- Multi-gas Meter for oxygen (%) and carbon dioxide (ppm) (optional for indoor air sampling)
- Sampling Containers (Summa Canister, see Section 5.2.1 and 5.2.2)
- Flow Control Regulator Assembly
- (2) Adjustable Wrenches
- Indoor Air/Subslab Sampling Field Sheet
- Camera
- Laboratory Supplied Chain of Custody Form
- Sample containers
- Custody seals

4.2.1 SAMPLE CONTAINER CONSIDERATIONS

Care must be given to selecting the appropriate container type and volume based on the analytes, analysis method(s), and sample collection duration, to meet the data quality objectives for the sampling event. It is assumed that indoor air samples will be collected to determine the potential risk to occupants of the building from vapor intrusion into the building. Therefore, this SOP provides details for the use of Summa Canisters with 24-hour sample collection duration. However, it may be appropriate to use an alternative sample container and duration based on

the data quality objectives. Justification of the alternatives must be provided in an approved Sampling and Analysis Plan.

4.2.1.1 Container Type

The standard container type for collection of indoor air samples is a 6-Liter Summa canister for determining potential risk to building occupants or future occupants. A Summa canister is a sealed metal container supplied by the contracted laboratory. The laboratory prepares the canister with sub-atmospheric pressure (vacuum) prior to shipment. The sampler must verify the presence of the vacuum by recording the initial vacuum in the canister when sampling begins.

The laboratory certifies the canister has been appropriately cleaned prior to shipment. Laboratory certification can be done on individual canisters or from one representative can in a batch. **For indoor air sample collection personnel should request individually certified clean canisters unless data quality objectives allow for batch certification.**

With the advancement of technology, it may be possible to utilize alternative containers for the collection of indoor air samples (syringes, tedlar bags, or tubes). Such alternatives will be considered on a case-by-case basis and may require confirmation with summa canister sampling. Such alternative sampling could be used for screening buildings as part of a larger vapor intrusion investigation.

5.2.2 Sample Collection Duration

Time integrated indoor air sampling is considered the best option for evaluating potential risks associated with vapor intrusion into indoor air. Time integrated sampling is completed through the use of a flow controller or regulator that is connected to the sampling container (i.e. Summa canister). The flow controller may have a critical orifice, capillary, or adjustable micro-metering valve to regulate the flow of air into the sample canister. The flow regulator is calibrated by the laboratory for the desired sample duration specified by the sampler at the time the order is placed. The standard sample collection duration for indoor air sampling is 24-hours, regardless of exposure scenario (residential or commercial) because the objective is to collect a representative sample of the air in the building. However, this duration can be modified based on data quality objectives and location specific conditions. The Sampling and Analysis Plan should specify the desired sample duration and any changes due to location specific conditions should be clearly noted in the sample documentation and communicated summary report. Depending on the sample program, it may be necessary to obtain permission for the change in sample duration before the samples are collected.

Together, the sample duration, list of analytes, laboratory methods (including quality assurance and control), and desired reporting limits will determine the appropriate sample type and volume.

6.0 SAMPLE COLLECTION PROCEDURE

1) Connect flow control regulator assembly to canister. Using the appropriate fittings (Swagelok[tm] or similar) connect the controller assembly to the canister and tighten using two adjustable wrenches. Note that some laboratories supply "quick connect" fittings that connect and release in lieu of threaded fittings with tightening nuts.

2) Select appropriate canister location based on data quality objectives. Select a location to avoid drafts from windows and doors, especially if the building is occupied. Select a location within the breathing zone to determine potential risk exposure or near the floor of a suspected vapor intrusion surface to determine the flux of contamination.

3) Record appropriate information. Use the Indoor Air/Subslab Sampling Field Sheet to record building conditions, sample canister and flow controller identification numbers, as well as ambient and pre-sample concentrations from field screening instruments as appropriate. Make an accurate sketch of building interior with notations that describe the exact location of the canister. If PID screening is conducted, record interior PID readings on the interior sketch. If sampling inside a residential basement or commercial maintenance shop area, note the storage of household chemicals, lubricants, or other products that may influence indoor air sample results.

4) Use camera to document interior. A digital camera can be used to document contents in building, features that are hard to sketch, and the location of the sample canister.

5) Open the sample canister valve and record time and pressure in can. Record the Sample Initiation Time and Initial Vacuum on the Indoor Air/Subslab Sampling Field Sheet and on the Chain of Custody Form.

6) Retrieve Sampler after time has elapsed. Efforts should be made to shut-off the canister valve while there is still a negative pressure vacuum in the canister between -1 and -5 inches of Hg to prevent sample loss. **It is important not to allow the canister to equilibrate to atmospheric pressure** during the sampling period. Therefore, it may be necessary to shorten the sample period to maintain a negative pressure within the canister. It is also important to collect sufficient sample volume for the laboratory to meet the data quality objectives for the sampling event. Therefore, it may become necessary to contact the laboratory to determine the appropriate vacuum reading should the valve become clogged during sampling.

7) Record final vacuum and sample end time. Record this information on the Indoor Air/Subslab Sampling Field Sheet. The need for post-sampling PID, oxygen, and carbon dioxide concentrations will depend on the data quality objectives.

8) Maintain chain of custody and ship samples. Sample containers should be packaged in the appropriate carrier for transport. Chain of Custody forms should be filled out, signed, and kept with the containers during transport to the laboratory.

7.0 ANALYTES AND METHODS

Once sample collection is complete, the canister and regulator are returned to the laboratory under chain of custody for analysis. Samples from Summa canisters are to be analyzed by a Maine certified laboratory (http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm) using Maine certified methods having laboratory reporting limits that meet the data quality objectives for the sampling event. It is best to contact the laboratory and provide them with the data quality objectives and analytes of concern, which allows the laboratory to select the appropriate sample container size, regulator type, and method of analysis. Note that Selective Ion Monitoring (SIM) methods may be necessary to meet the data quality objectives.

With the advancement of technology, it may be possible to utilize alternative analytical methods (field laboratory methods) that are not Maine Certified. Such alternatives will be considered on a case-by-case basis and will likely require confirmation with summa canister sampling. Such alternative methodologies will likely be considered screening values within the context of a vapor intrusion investigation.

8.0 QUALITY CONTROL

Due to cross contamination and carry-over issues inherent with air collection and analysis, 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 should be collected as part of the QA/QC program for soil gas sample collection. For an additional discussion of QA/QC, please refer to the MEDEP/DR Quality Assurance Plan, Section 4 and Section 8.

8.1 DUPLICATE SAMPLES

It is recommended that duplicate samples be collected at a rate of 10% to assess sample location variability.

8.2 BACKGROUND/AMBIENT AIR SAMPLES

Depending on data quality objectives, one to two ambient air samples per day may be collected at the sampling locations to assess ambient outdoor air conditions.

8.3 TRIP BLANK

A trip blank should be collected when utilizing tedlar bags as sample containers. The trip blank will consist of a tedlar bag filled from a canister of zero air. Trip blanks should also be collected when using canisters to indicate whether or not the canisters were clean.

9.0 DOCUMENTATION/CHAIN OF CUSTODY

All sampling activities must be documented as outlined in MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Notes and Development of a Sampling Event Trip Report. The Indoor Air/Subslab Sampling Field Sheet (updated as of the effective date of this SOP) should be used each time a soil gas sample is collected. Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol. Samplers should contact the selected laboratory to determine the most appropriate method for avoiding carry-over of highly contaminated samples during the laboratory analyses. Due to the complex nature of indoor air, attention should be made to the following:

- Weather conditions (particularly precipitation within past 3 days);
- Building conditions;
- Modifications to the procedure;
- Building Contents;
- Building Construction / Remodeling Materials;
- Possible sources of off site contamination (gas stations, dry cleaners, automotive body shops, etc.) in the vicinity of the investigation field work;
- Possible sources of cross contamination (fueling vehicles/equipment, etc);
- Duration of Sample Collection

As with all sampling events, any deviations from the sampling plan or SOPs must be documented.

10.0 REFERENCES

USEPA. 2013a. *OSWER Final Guidance for Assessing and Mitigating the VI Pathway from Subsurface Sources to Indoor Air* [External Review Draft].

USEPA 2013b. *Guidance for Addressing Petroleum VI at Leaking Underground Storage Tank Sites* [External Review Draft].

USEPA. 2012a. *EPA's Vapor Intrusion Database: Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compounds and Residential Buildings* [EPA 530-R-10-002].

USEPA. 2012b. *Conceptual Model Scenarios for the Vapor Intrusion Pathway* [EPA 530-R-10-003].

USEPA, 2011. *Background Indoor Air Concentrations of Volatile Organic Compounds in North American Residences (1990-2005): A Compilation of Statistics for Assessing Vapor Intrusion* [EPA 530-R-10-001].

MEDEP, 2013. *Maine Remedial Action Guidelines for Sites Contaminated with Hazardous Substances*

MEDEP 2014, *Remediation Guidelines for Petroleum Contaminated Sites in Maine*

COVER SHEET
STANDARD OPERATING PROCEDURE

OPERATION TITLE: **MICROWELL INSTALLATION PROTOCOL**

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 MEDEP/DR procedure for installation of microwells.

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 GEOPROBE® – A method of obtaining soil borings utilizing Geoprobe Systems direct push technology.
4.2 BOREHOLE – The hole created in the ground after using the Large Bore Soil Sampler for collecting soil borings, or the Large Bore Pre – Probe designed specifically for creating a hole for installation of a Microwell, or for continued soil sampling at depth.
4.3 ANNULUS – Space in the borehole between Microwell screen or casing and the borehole wall.
4.4 RISER – Threaded 3/4 inch ID pipe constructed of polyvinyl chloride (PVC) plastic, available in various lengths.
4.5 SLOTTED SCREEN – Threaded, 3/4 inch ID PVC casing constructed with 0.010 slots to allow water to enter the microwell from the surrounding formation.
4.6 FILTER SAND - Clean, well rounded screened sand that is placed in the annulus between the borehole wall and the well screen to keep formation material from entering the completed microwell.
4.7 BENTONITE - a hydrous aluminum silicate available in powder, chip, granular, or pellet form, that is used to provide a tight seal between the borehole wall and the well casing.

5.0 GUIDELINES AND PROCDURES

5.1 INTRODUCTION

Microwells provide an inexpensive, yet effective method for obtaining overburden groundwater samples. Microwells can be installed for collection of groundwater samples on a temporary basis, or placed in secured, out of the way locations, can be effective as long term monitoring points.

5.2 EQUIPMENT

Equipment required for installation of microwell include:

- Direct push type boring system, such as Geoprobe® Systems soil boring system;
- ¾ inch PVC Riser;
- ¾ inch PVC 0.010 inch slotted screen;
- ¾ inch PVC threaded end caps;
- Geoprobe® 1.1 inch OD expendable point;
- filter sand; and
- Granular bentonite.

5.3 MICROWELL INSTALLATION PROCEDURE

1) Using the boring system, construct a bore hole to the depth desired for the microwell (refer to the manufacturer's operations manual for use of the boring system). In microwells over 15 feet deep, it is sometimes prudent to bore one or two feet deeper than desired. After reaching the depth desired, leave soil borer or probe in borehole (to prevent premature borehole collapse), and proceed to Step 2.

2) Construct the microwell using the PVC riser, slotted screen, and end cap or disposal tip. Length of Screen and Riser will vary, depending on the formation to be sampled and depth of the individual well. For shallow wells (less than 15 feet), a blunt end cap will usually suffice. In deeper wells or easily collapsible formations, construct a "modified screen" by sawing off the threads to the riser with a hacksaw (approximately one inch off of the tip), and hammer a Geoprobe Expendable Point into the end of the riser by banging the riser and tip on a truck tailgate or other sturdy object. Deeper wells may also require the construction of the well in sections while installing the well in the borehole; use best field judgement to determine the technique.

3) Remove the soil Borer or pre - probe from the borehole, and install the microwell immediately after withdrawal. If the well does not finish into the borehole to the required depth, utilize a hammer to provide extra force in pushing the well into the borehole (be careful not to apply enough force to crush the slotted screen).

4) If the well still does not advance to the appropriate depth, remove the well, and re - drill the borehole with the soil borer or blunt probe. It is sometimes helpful to clean out collapsed material from the borehole by "resampling" with the soil borer several times. Reinstall the microwell when re – drilling is completed.

5) Carefully pour filter sand into the annulus around the casing to ensure that the well screen is surrounded by the filter sand. The level of filter sand should rise above the top of the screen by a minimum of 1 foot.

6) Pour bentonite into the annulus to Seal the well against surface water infiltration. A minimum of two feet of bentonite is sufficient to seal a microwell. Filter sand or native fill should be used to fill at least the top foot of the annulus.

Once the microwell has been installed, it should be properly surveyed in (if to be used for water level information), capped with an appropriate end cap, and permanently marked with the correct well designation. The appropriate security measure (such as a road box, or locking outer casing), if required, can then be installed over the microwell. The well should then be developed (see Section 8).

5.4 WELL INSTALLATION EVALUATION

If the microwell does not install into the borehole after repeated attempts to clean out collapsed material, the particular formation may not allow for installation of a microwell with this method. It may be necessary to utilize a temporary well point system, or installation of a monitoring well with a rotary drilling rig.

5.5 MICROWELL DEVELOPMENT

Development is necessary in order to remove fines from the vicinity of the well screen, and remove silt that has accumulated in the well during its installation. Development is also necessary to develop the filter sand in the annulus around the well. Fine particles are drawn into the pore spaces of the sand pack to block other fine material from entering. Microwells can be developed by overpumping, or a combination of surging and overpumping. Microwell development is a skill which is developed over time, as each well is unique in its development requirements.

5.5.1 DEVELOPMENT PROCEDURE

Using a peristaltic pump and ¼ inch polyethylene tubing, pump the wells while agitating the well with the tubing to stir up fines silt and silt, and allow this material to flow out with the purged water. Allow the tubing to reach the bottom of the well to remove as much settled material as possible. It may be necessary to completely evacuate the well several times in order to fully removal all of the fines and settled material.

If water from the microwell is still turbid, it may be necessary to surge the well with a surge block type device in order to remove sediment (A device which works very well for this is a screw together chimney sweep rod extension). After surging the well with the device to flush water in

and out of the well through the slot and the sand pack, continue with pumping the well as described above until the water is generally silt free.

While developing the well, records regarding flow rates and recharge rates should be kept in order to fully evaluate the well and the formation in which it is screened. This information will also be used in developing purge rates for future sampling.

The well should then have ¼ inch tubing dedicated to the well. The ideal location for the tubing intake is directly in the middle of the screen. However, if the screen is not fully saturated (not ideal, but acceptable), then the intake should be placed halfway between the lowest expected water level and the bottom of the screen.

After development, the microwell can be sampled. Sampling the microwell should be conducted following MEDEP/DR SOP# RWM-DR-002 – Groundwater Sample Collection For Site Investigation and Assessment Monitoring.

6.0 DOCUMENTATION

Documentation of well installation, and subsequent sampling, should be conducted following MEDEP/DR SOP# RWM-DR-013 – Documentation of Field Activities and Development of a Trip Report. Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of this procedure. However, all field work should be conducted following "standard field procedures" for sampling, decontamination, and safety and health issues, as described in this task's specific MEDEP/DR SOP.

COVER SHEET
STANDARD OPERATING PROCEDURE

Operation Title: **PROTOCOL FOR COLLECTING SAMPLES FROM CONTAINERS**

Originator: **Brian Beneski**
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)

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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 procedure for the handling and sampling of containers containing unknown and known hazardous chemicals and petroleum products. This includes drums of all sizes, tanks of all sizes, buckets, cans and any other type of vessel that may contain chemicals (in all phases) as well as petroleum.

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 GUIDELINES AND PROCEDURES

4.1 INTRODUCTION

The situations in which containers of chemicals are discovered and require sampling for characterization is wide and varied. Situations can include a few containers of unknown material in an abandoned residential garage, a cache of drums located in the basement of a mill, or mass burial of drums and tanks in a field. Each of these situations provides its own hazards, constraints, and sampling requirements. Therefore, this SOP will outline the items that need to be considered for planning and implementing container sampling.

4.2 PLANNING/ SITE RECONNAISSANCE

Planning and preparation is the key to a safe and productive container sampling event. Prior to conducting any type of container sampling, a sampling and analysis plan (SAP) and a health and safety plan (HASP) must be developed. Protocol for the development of a Sampling and Analysis Plan can be found in SOP# RWM-DR-014 – Development of a Sampling and Analysis Plan. However, container sampling does have additional needs. A full reconnaissance of the site should be conducted prior to actual opening and sampling of containers. All containers should be identified, inventoried, and conditions noted prior to the actual sampling event.

Additionally, all staging, sampling and storage areas should be inspected to assure the areas are of suitable size, provide stable conditions, and adequately protect staff and containers during sampling and storage until disposal is arranged. It is better to make additional reconnaissance trips to assure that all needed information is obtained, rather than be surprised during sampling when containers will be open, and chemicals exposed.

The SAP should address all of the following items:

1) Purpose of sampling. Is sampling to determine what material is, or for disposal purposes? What analysis will be run? How much material is needed for each sample? What are the data quality objectives?
2) Location and Access of containers. Where are the containers on the site located? Are they buried? Is it safe to excavate them? If located in a structure, is it safe for access? Will the structure require shoring? If the containers are not sealed or are leaking, have they created a hazardous situation where they are located?
3) Number of Containers to be sampled. How many containers are there? Have they all been identified, or will more be located? Is each one to be sampled? Can they be grouped together?
4) Type and Size of Containers to be sampled. Are all containers of the same type and size, or are they different? Will you need different size/ type of opening devices for containers?
5) Condition of Containers. Are containers intact, or will they fall apart if moved?
6) Moving of containers. Can containers be sampled where they are currently located, or must they be moved? How will they be moved? Do containers with non compatible material exist near each other?
7) Opening of containers. How will containers be opened? Does the access port work, or are they rusted shut? Will we need to puncture containers to access contents?
8) Material within containers. What most likely is the material to be sampled? Are there markings? From what industry did the material come from? Is it a solid, liquid, or gas? Might it be multiphase, and layered? Which layers should be sampled? Are the contents unused chemicals in their original containers, or a waste chemical in a reused container?
9) Health risks posed by material. How toxic is the material? Will it explode? Will it release toxic gases once open? Do I have the correct personal protective equipment?
10) Security of containers after sampling. Can the containers be closed after opening? Will containers be safe from weather and people accessing site?
11) Surrounding area. Is it residential, urban, industrial, or commercial? If containers leak or explode, will neighbors be affected? Can vandals break into the site and disturb containers after sampling?
12) Shipping of material to lab. Are there any rules or regulations that apply to shipping the material that has been sampled? Any special manifests or tamper proofing required? Is material safe to transport via standard shipping? What if a container breaks?
13) Decontamination. Certain chemicals may require additional decontamination procedures. Will the site be able to support required decontamination? Will a water supply or electricity be required that isn't currently available at the Site location?
14) Documentation. What level of documentation is required? Will documentation be needed to meet disposal requirements, or will documentation be used in an enforcement action? Will specialized forms be used?

15) Exposure to material. What will happen to staff if exposed, and can local hospital decontaminate accident victims if necessary?

The SAP should also include a map or description of the activities area showing staging areas, egress routes, hot/cold zones, decontamination areas, container storage areas, and any other areas of activity or hazard.

It should be noted that container sampling situations exist that may require use of PPE that require specialized training and health monitoring. Personnel are not to conduct work in scope that is beyond their training, job classification, and health monitoring.

4.3 EQUIPMENT

Equipment for a container sampling event can be varied depending on the containers to be sampled, condition, and location, as well as its task. Generally, equipment required will be:

- Personnel protective equipment (PPE);
- Environmental monitoring equipment,
- Container staging equipment;
- Container opening equipment;
- Sampling equipment;
- Sampling containers; and
- Decontamination equipment.

4.3.1 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Container sampling provides additional health and safety risks than standard environmental sampling. Chemicals will be encountered in a non diluted form, as a solid, liquid, or gas, and may pose additional dermal and respiratory risks. Additionally, physical hazards with accessing and opening containers, such as sharp edges, may also be present. Therefore, in addition to standard field PPE (steel toed/shank boots, coveralls, eye protection) additional PPE may be required, based on the expected chemicals to be sampled, and the environment in which the containers will be located during sampling. Additional PPE that may be required includes:

- Chemical protective boots or overboots;
- Chemical specific coveralls;
- Chemical specific gloves;
- Face shields or other splash or vapor protection;
- Respiratory Protection – air purifying respirators (APR) or self contained breathing apparatus (SCBA). APRs and SCBA can only be used by those participating in the DR's Respiratory Protection Program.

It is imperative that selected PPE meet the needs of the sampling, and are compatible with the chemicals expected to be encountered. PPE and Chemical compatibility can be found from suppliers of PPE, manufacturers of PPE, and OSHA and USEPA websites and guidebooks. Guidance changes as new material for PPE is developed and additional toxicological

information is developed; it is imperative that up to date information be obtained. As stated earlier, PPE must be outlined in the sampling plan; references should be included from which compatibility is determined.

Respiratory protection is based on chemicals encountered and the environment of sampling. For example, opening and sampling of containers in a basement with no air exchange may require respiratory protection, whereas sampling of containers in a wide open field may not. As with the case of PPE, health safety levels of chemical vapors can be found in various OSHA, NIOSH, and USEPA websites and guidebooks, and manufacturers of respiratory sampling equipment. Up to date information must be obtained to assure appropriate respiratory protection decisions are made. The need and requirements for respiratory protection must be addressed on the sampling plan; references for determining levels of respiratory protection should be included.

4.3.2 ENVIRONMENTAL MONITORING EQUIPMENT

It may be necessary to conduct monitoring of the ambient air prior to, during, and after sampling to assure a safe environment, and levels of PPE required. MEDEP/DR and Maine Department of Environmental Protection Division of Technical Services (MEDEP/TS) maintain various environmental monitoring equipment, including but not limited to:

- Flame ionization detector (FID);
- Photoionization detectors (PIDs) with parts per million and parts per billion detection limits;
- Multi-gas meters (methane, oxygen, hydrogen sulfide, and carbon dioxide);

Staff should receive training on the proper use of monitoring equipment prior to using in the field and review the SOPs for that equipment's use.

It must be documented in the HASP that the field monitoring equipment selected for a sampling event will detect the chemicals of concern at the chemicals' health and safety guidance levels. Information regarding the use and detection limits of specific monitoring equipment is provided by the manufacturer. Detection limits and health levels, including action levels for determining appropriate PPE and can be found at USEPA, NIOSH, and OSHA guidebooks and websites.

Given the potential sampling situation, it may be necessary to rent additional equipment to provide monitoring that MEDEP equipment cannot. All users of rented equipment must be appropriately trained for its use and interpretation of the results.

4.3.3 CONTAINER STAGING EQUIPMENT

If containers need to be moved to be staged or stored, the equipment necessary for moving the containers must be determined prior to the sampling event. This may include items for manual moving, such as drum dollys or other hand carts, and mechanized equipment, such as pallet jacks, bobcats, and excavators with appropriate container grappling equipment. The Sampling and analysis plan will outline the method for moving and securing containers.

4.3.4 CONTAINER OPENING EQUIPMENT

Devices for opening containers depend on the type of containers to be opened, the condition the containers are in, and the material within the container. Some containers have bungs requiring a specific bung wrench; others may be opened with a standard adjustable wrench. Many containers in which the entire top is removed may require only a flat screwdriver. Tool requirements for opening containers should be determined during site reconnaissance. Depending on the suspected material in the container, it may be necessary to utilize non sparking tools constructed from a copper alloy to prevent sparks. Due to corrosion, many containers entry points may be corroded shut. In these instances, puncturing the drum with a hammer and spike, or a spike attached to a hydraulic arm (such as on an excavator or backhoe) may be necessary. Many tools are available constructed from copper alloys to prevent sparks igniting combustible atmospheres.

Possible tools that may be used for opening containers include:

- Bung Wrench, standard and non sparking;
- Adjustable wrench, standard and non sparking;
- Flat screwdriver, sparking or non spark;
- Hammer, sparking or non sparking;
- Spike or other puncturing tool, sparking or non sparking;
- Crowbar, sparking or non sparking;
- Excavator, backhoe, or other powered machinery for more puncturing power.

4.3.5 SAMPLING EQUIPMENT

There are numerous types of sampling devices that are available for the sampling of containers; drum thieves, bombs, coliwasas, etc. Each collects samples in a different way; samplers should be selected based upon the expected material and its physical characteristics; phase, viscosity, etc. Standard sampling tools such as dippers, scoops, and even shovels and crow bars may be viable tools for collecting samples from containers.

The following describes the sampling tools specific to containerized chemical sampling.

4.3.5.1 Bomb sampler

A tubular shaped sampler attached to a rope or chain with a remote operated opening. Bomb samplers are made from a variety of material, such as plastic, Teflon or stainless steel, so the appropriate sampler can be selected for compatibility with expected material to be sampled. Samplers are used to extract liquid samples (typically between 4 and 32 ounces) from tanks, ponds, larger drums, at specific depths. The bomb sampler requires two lines - one to lower and raise the device, and one to open the plunger, which allows the liquid to flow into the sampler.

4.3.5.2 Coliwasa

A **Co**mposite **li**quid **wa**ste **sa**mpler. is a "tube" of varying size and material with a means of opening and closing the lower end to allow the material to enter the tube, then close the tube to keep the sample from escaping. A coliwasa is designed to take a composite (from top to bottom) sample. Originally developed to obtain samples from drums, but currently available in many sizes and materials to allow use for sampling drums, tanks, pails, tank cars, etc. Available construction material includes glass, plastic, acrylic, and Teflon.

4.3.5.3 Drum thief

A drum thief is a rigid length of tubing, which is used to obtain a liquid sampler from a drum or tank. A thief differs from a Coliwasa in that it relies on capillary pressure to hold the sample within the tube. As with Coliwasas, thieves are manufactured in a variety of sizes and materials to fit the material. The samplers are manufactured in both glass and plastic.

4.3.5.4 Peristaltic Pump

A peristaltic pump is a vacuum pump that may be used to obtain a sample from a drum by lowing the tubing from the pump into the container and removal of the sample at the desired depth.

4.3.6 SAMPLING CONTAINERS

Sampling containers will be based on the requirements of the laboratory conducting the analysis. Project managers must communicate with the laboratory conducting the analysis to assure appropriate chemical analysis is being conducted, and appropriate containers are procured. Additionally, requirements for sample preservation should also be determined and included in the sampling plan.

4.3.7 DECONTAMINATION EQUIPMENT

Decontamination procedures can be found in MEDEP/DR SOP# RWM-DR-017 –Equipment Decontamination Protocol, and must be outlined in the SAP. Sampling tools such as drum thieves and coliwasas are considered one use/ disposable, and will not be decontaminated. Other devices, such as bombs, may be decontaminated. Similarly, PPE, such as gloves, coveralls, booties, etc are also considered one use/ disposable items. However, it may be necessary to remove gross contamination or to neutralize reactive chemicals prior to removal of PPE.

4.4 SAMPLING PROCEDURE

1) Conduct Site Reconnaissance/ Inventory containers. As discussed earlier a complete reconnaissance/ inventorying of the containers and possible contents must be conducted.
2) Draft Sampling Plan. Using information obtained during site reconnaissance, research into site activities, possible sources of containers, PPE requirements, and sampling needs, draft an appropriate Sampling and Analysis Plan (SAP), and Health and Safety Plan (HASP). All staff involved in sampling activities must read the SAP and HASP prior to conducting any field event.
3) Mobilize to Site. Prior to conducting and activities, conduct a field team meeting with all staff involved to assure all staff understand their rolls and responsibilities. Set up hot/ cold zones, decontamination zones, and post sampling container storage areas, and any other site specific preparation activities as outlined in the SAP.
4) Set up environmental monitoring equipment (if necessary). As outlined in the Site specific SAP, calibrate and set up all required environmental monitoring equipment, following appropriate SOPs and operators manual for the specific monitoring device.
5) Don appropriate PPE. Don all appropriate PPE as outlined in SAP/HASP.
6) Stage containers. If determined necessary, move containers to a safe and secure location for conducting the sampling.
7) Open containers. Using the appropriate tools as outlined in the SAP, open the containers to access material. Conduct monitoring of breathing zones with monitoring equipment, as outlined in the SAP. Results of monitoring should be documented in field book, as well as any other observations made such as odors, visible emissions from containers, etc.
8) Collect Samples with selected equipment. Utilizing the chosen equipment, collect samples from containers. Prior to collection, an attempt should be made to determine if contents have separated into different layers that may require multiple collection from one container. Be sure to close containers tightly after sampling to prevent any leakage. Sampling should be documented in field notes as outlined in BRWM/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of a Trip Report, and any other requirements as outlined in the SAP. Any observations regarding layers, odors, etc. should be documented in field note books, as well as any other observations considered important. It should be noted that during the act of sampling, situations may arise that were not planned for. It is better to back away and sample another day than risk injury by improvising dangerously.
9) Seal and secure containers. Replace bungs/ covers, or if damaged or samples collected through punctures, seal up containers to prevent any leakage from containers. Secure containers to prevent unauthorized access.
10) Prepare sampling containers for transport. Clean any chemicals from side of jars. It may be necessary to "double wrap" containers to prevent sample container handlers from contacting spilled material on sides of jars. Pack sample jars in cooler or other appropriate carrier to prevent damage while shipping. If transporting containers to lab via public courier such as UPS or FEDEX, make sure appropriate DOT requirements for the potential chemicals are followed.
11) Decontaminate Staff/Equipment. Following the protocol outlined in MEDEP/DR SOP# RWM-DR-017 –Equipment Decontamination Protocol and in the Site Specific SAP, decontaminate equipment and staff as necessary. If using disposable equipment/PPE, collect material and arrange for appropriate disposal. It may be necessary to store the equipment until results of the sampling have been received; be sure to find a secure location to store this material.

12) Secure containers/Site. Prior to leaving Site, make sure containers are closed and secure, along with any waste generated not being immediately removed. Be sure to secure site to prevent unauthorized access.

5.0 QUALITY CONTROL

Data quality objectives (DQOs) must be determined prior to sampling, and outlined in the SAP. If the data collected during the sampling event is to be used for enforcement activities, it may be necessary to conduct more stringent QA/QC activities. Therefore, field staff should coordinate with enforcement staff to assure QA/QC needs are being met.

As with the case with any sampling event, all data generated should be reviewed to determine if DQO's have been met. Noted deficiencies should be documented, along with expected impact to the data in the final activities report.

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 container sampling. 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 should be collected at a rate of 5%, one equipment blank every twenty samples collected if using non dedicated/disposable equipment.

5.2 DUPLICATE SAMPLES

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

6.0 DOCUMENTATION/CHAIN OF CUSTODY

All sampling activities must be documented as outlined in MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of a Trip Report. Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol.

Due to the nature of container sampling and managing of containers, it may be necessary (or just easier) to develop specific forms or use forms generated by EPA, contractors, or other agencies for record keeping. Use of forms not bound by field books is discussed in SOP# RWM-DR-013 - Documentation of Field Activities and Development of a Trip Report. Specialized forms should be outlined in the SAP. Specialized forms should be printed on waterproof paper to prevent damage during field use.

As mentioned earlier, if data collected during the sampling event is to be used for enforcement activities, it may be necessary to collect additional or more detailed documentation than normally collected, or collect data in a specific format. Therefore, field staff should coordinate with enforcement staff to assure documentation needs are being met.

COVERSHEET
STANDARD OPERATING PROCEDURE

Operation Title: **FIELD SCREENING OF SOIL SAMPLES UTILIZING PHOTOIONIZATION AND FLAME-IONIZATION DETECTORS**

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

APPROVALS:

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12/1/2016 — *Date*

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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 procedure for field screening volatile organic content of soils using a closed container and a photoionization detector (PID) or a flame ionization detector (FID).

3.0 RESPONSIBILITES

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 INTRODUCTION

In conducting this procedure, a soil sample is placed in an approved container in which the headspace of the volatile compounds are allowed to come to equilibrium. The headspace is then measured with a calibrated PID or FID, with a result expressed in parts per million (ppm). Due to the different vapor pressures and ionization potentials of the volatile compounds, concentrations of individual compounds cannot be determined. However, this technique provides an effective means of screening soil for the presence of total volatile organic compounds. It is also a helpful low-cost field technique that can be used to locate "hot spots", identify the extent of hot-spots, and as a means of screening samples for submittal for laboratory analysis.

This methodology may not be sensitive enough to identify individual VOCs at or near the appropriate guidelines (with the possible exception of petroleum contaminants). The methodology is not a substitute for actual laboratory analysis. The method is a low-cost field screening tool that is most effective when the number of site screening samples is proportional to the size of the area of concern and/or volume of contaminated soil. The methodology effectiveness is also based on the knowledge and experience of the environmental professional and the development of a good conceptual site model.

5.0 PLANNING

As with any sampling event, a sampling and analysis plan (SAP) and a health and safety plan (HASP) must be developed. Protocol for the development of a Sampling and Analysis Plan (SAP) can be found in MEDEP/DR SOP# RWM-DR-014 – Development of a Sampling and Analysis Plan.

6.0 EQUIPMENT

The following equipment is required for conducting the procedure:

- Soil sampling equipment (shovel, bucket auger, soil borer);
- Approved containers (recommend using a metalized aluminum bag or glass jar, see section 6.1);
- A PID or FID; and
- Calibration equipment, including users manual, for particular PID or FID to be used.

6.1 SPECIAL CONSIDERATIONS REGARDING CONTAINERS

Currently, the most commonly used (and recommended) containers are one quart sized metalized aluminum bag (various manufacturers make these types of bags). Also used are wide mouthed, metal screw top 16 oz jars, with a ¼ inch hole drilled through center, with foil over the top to provide the seal.

7.0 PROCEDURE

1) Warm up and calibrate the PID and FID instrument to be used according to the manufacturers recommended procedure (See Section 8 - Additional Considerations With Use of PID/FID). The PID and/or FID should be ready for use prior to collection of the first sample.

2) Collect the soil sample, as outlined in the site specific SAP, utilizing appropriate soil sampling equipment.

3) Place approximately 200 grams of the soil sample into an approved container as stated in the SAP. The same type of container should be consistently used at the site for comparison purposes; do not mix or reuse headspace containers (unless the approved container is reusable and cleaned appropriately between uses). In so far as possible, samples should be mineral soil free of vegetation and stones larger than ½ inches in diameter. If soil samples are of different type (loam, sand, silt), this should be identified in the field log book. If a duplicate sample is to be submitted to the laboratory for analysis, this sample should be containerized and preserved as appropriate **immediately**. Care should be taken to co-locate field screening and laboratory samples from the same soils. Laboratory VOC samples should not be taken from the field screening sample after it is screened, unless approved in the SAP and documented in the field notes and subsequent report. If using jars, the jars should be immediately sealed by placing a square of foil over the mouth and screwing on the lid. If using a metalized bag, the gusset at the bottom should be opened to allow development of the headspace within the entire bag.

4) Knead and break-up soil clods and shake the container for 30 seconds to thoroughly mix the contents.

5) Let Sample equilibrate for 10-minutes and shake again. Allow at least ten minutes but not more than 60-minutes for VOCs to reach headspace equilibrium with the headspace. An attempt should be made to allow the same amount of equilibration time for each sample. When ambient temperatures are greater than 70-degrees, samples should be stored in the shade. When temperatures are below 70 degrees, samples should be warmed in the sunlight or in a running vehicle.

6) Measure and record the samples headspace concentration with the instrument by recording the highest PID/FID response. Collect a sample of the headspace by inserting the PID/FID probe into the appropriate opening for the container you are using. It is important to insert the probe as quickly as possible after the seal to the container has been broken. If the highest reading is related to a spike in the instrument response, then both the spike response and the highest response should be recorded and noted. Documentation of headspace results should be outlined in the SAP.

8.0 ADDITIONAL CONSIDERATIONS WITH USE OF A PID/FID

The protocol for operating a PID/FID can be found in SOP# RWM-DR-019 – Protocol for the Use of Portable Vapor Monitors.

There are limitations of PIDs and FIDs. A PID or FID cannot detect all VOCs, nor do they detect all VOCs equally. Factors that influence the response of the particular compound include ionization potential of compound, particular energy rating of lamp, calibration standard used, response factor, response curve, etc. In some instances, such as when the contaminant of concern is a single known compound, it is possible to calibrate the instrument so that a relatively accurate measurement, when compared to laboratory analysis, can be obtained. Because of this, it is recommended that the operator of the particular instrument that will be conducting this procedure take the time before the sampling event to familiarize themselves with the particular instrument that will be used, if they are not already familiar with that instrument. This includes reviewing the specific user manual, and calibration and practice with the instrument prior to the sampling event. If petroleum constituents are the primary contaminants of concern or there is a mixture of VOCs and petroleum constituents SOP TS004 should be followed unless otherwise stated in the SAP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Data quality objectives (DQOs) should be stated in the SAP (See SOP# RWM-DR-014). Quality assurance/quality control (QA/QC) samples may be collected if needed to meet your DQOs. The following are typical QA/QC samples or tasks conducted for PID/FID field screening. Additional sampling or tasks may be added based on the DQO requirements of the project.

9.1 RECALIBRATION DURING USE

During the course of the work day, the PID/FID should be bump tested with the appropriate calibration gas every two hours during the work day, or after screening samples with headspaces greater than 1,000 ppm. If the bump test reading is more than 10% different from the calibration gas, then the instrument should be recalibrated. All bump test and recalibration readings must be documented in the field notebook.

9.2 DUPLICATE SAMPLES

Field screening duplicate samples may be collected at a rate of 5% to assess sample location variability.

10.0 DOCUMENTATION

Field notes should be collected following the standard procedures outlined in MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report. It is important that documentation include the specific lamp energy rating, calibration standard, and special response factors or curves that may be employed for the particular sampling event. When documenting such a sampling event, one should include enough information so that a person at a later date can easily duplicate the sampling and be able to compare the results.

As this type of screening is done in the field by the sampling team conducting the sampling, no chain of custody is required.

Specialized forms may be developed for recording field screening data. Additionally, some PID/FIDs have software which can record data. Any special method of recording and documenting results must be outlined in the SAP.

COVERSHEET
STANDARD OPERATING PROCEDURE

OPERATION TITLE: **CHAIN OF CUSTODY PROTOCOL**

ORIGINATOR NAME: **Brian Beneski**
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12/1/2016 — *Date*

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12/4/16 — *Date*

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12/30/16 — *Date*

Department Commissioner:

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[signature] — *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 procedure for sample chain of custody (COC).

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

- Chain of Custody Form – A document detailing who is legally responsible for samples at any point in time from collection until the sample is received by the laboratory.
- Custody--A sample is "in custody" when: 1) the sample is in the sampler's possession, or 2) the sample was in the sampler's possession and then secured by the sampler to prevent tampering, or 3) the sample is placed in a designated secure area.
- Secure Area—An area in which entry is limited by keyed lock to a designated population.

5.0 GUIDELINES AND PROCEDURES

5.1 INTRODUCTION

This SOP establishes the proper methods for implementation of sample chain of custody documentation and procedure. Proper sample chain of custody procedures are essential to collecting valid information which may be used in any legal proceedings. Additionally, samples must be stored properly until delivery to the laboratory to assure proper preservation of the sample, and to avoid introducing contamination from ambient conditions. Transportation to the laboratory should be arranged as quickly as possible to avoid exceedences of holding times for analysis.

Failure to maintain possession in the ways outlined in this SOP would constitute a break in sample custody and would likely discredit the sample(s) as use of evidence in administrative or

court proceedings and the validity of the sample. The sampler must assume that all samples collected will some day be used as evidence and treat the task of sample custody accordingly.

Sample custody begins immediately after a sample is collected. The sampler who collected the sample is responsible for the preservation and integrity of the sample(s) until that responsibility is transferred to someone else, and documented with the COC form. This COC form then travels with the sample(s), and is used to document any other transfers of custody.

5.2 CHAIN OF CUSTODY

The COC form will document the information identifying the sample and a record of the relinquishing and receiving individuals. All samples from different locations must be given separate identifiers. Sample identifier, analysis requested, date and time, type and size of container, and any added preservative must be indicated on the COC for each sample. Date, time, and name written legibly, with signature, must be included in all entries outlining a change in the position of samples. Samples which may have high levels of contamination or may be hazardous to health should be indicated as such in the comments section of the COC. The COC should also indicate who, with contact information, will receive the completed data package.

MEDEP/DR personnel will use the COC provided by the laboratory conducting the analysis of the samples, making sure to fill it out completely and accurately. Once received by the laboratory, the laboratory will use a separate internal COC for documenting access to the sample during analysis.

6.3 OVERNIGHT STORAGE

Whenever possible, all samples will be taken to the laboratory performing the analyses on the same day the samples are collected, or given to courier service to transport the samples to the laboratory. If it is impossible to check in samples at the laboratory the same day, the samples should be placed in a secure area, following appropriate protocol for sample preservation (such as cooling to 4°C).

During the winter months the sampler must make sure the samples are kept from freezing while being stored. Samples should not be stored in an area that has ambient conditions that would cross contaminate the samples, such as a garage with large amounts of gasoline storage.

If samples are not checked into the laboratory the same day as collected, the storage location and means of providing security shall be documented in the Sampling Event Trip Report (SETR) (See MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report).

6.4 USE OF COURIER SERVICES

If samples are given to a common currier, such as United Parcel Service, or FedEx, the last person who has custody of the samples will sign off on the COC, and state that the samples will be given to a common currier on the COC. The COC is then placed in the shipping container with the samples, and the shipping container sealed with a tamper proof custody seal, and given

to the courier. The COC samples while in the courier's possession is the shipping record used by the courier. All samples should be shipped for next day delivery; if shipping samples on a Friday, make sure the laboratory is staffed for Saturday delivery.

The laboratory receiving the samples must check the integrity of the shipping container seal upon receipt. If the seal is broken, the laboratory staff receiving the container must indicate the broken seal on the COC with the samples.

6.5 SAMPLE CONTAINER TAMPER PROOF SEALS

Depending on the data quality objectives (DQOs), it may be necessary to place tamper proof tape on the actual jar at the time of collection as an extra step in assuring the integrity of the sample. This may be required for projects in which the data will be used for criminal enforcement cases. The project SAP will outline the need for individual sample protection, or any other special custody requirements for meeting project specific DQOs.

6.6 DISPOSITION OF COMPLETED CHAIN OF CUSTODY

Upon drop off of the samples at the laboratory, the laboratory should retain the original copy of the COC, and provide a copy to the sample transporter. If using common courier for transport, the laboratory should send a copy of the COC after receipt of the samples. A copy of the COC should be included with the trip report, as outlined in MEDEP/DR SOP# RWM-DR-013 – Documentation of Field Activities and Development of a Trip Report.

7.0 DOCUMENTATION

This sampler must record all information pertaining to the sample in his/her field notebook (following SOP# RWM-DR-013 - Documentation of Field Activities and Development of a Trip Report), and make sure that all the pertinent information is accurately transferred to the COC.

COVER SHEET
STANDARD OPERATING PROCEDURE

OPERATION TITLE: **DOCUMENTATION OF FIELD ACTIVITIES AND DEVELOPMENT OF A TRIP REPORT**

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QMSC Chair:

Bill Longfellow		12/30/16
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Department Commissioner:

PAUL MERCER		1-3-2017
Print name	*Signature*	*Date*

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

1.0 APPLICABILITY

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2.0 PURPOSE

The purpose of this document is to describe the MEDEP/DR procedure for documenting field actions.

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

- Field Notebook - Bound books with water resistant pages in which information from field activities is documented.
- Field Notes – Information gathered during a sampling event or other field activity associated with a known or suspected hazardous substance, petroleum, or landfill site.
- Field Log Form – A special use form for obtaining field notes in a standardized format, such as for low flow groundwater well monitoring or landfill inspection form.

5.0 GUIDANCE AND PROCEDURES

5.1 INTRODUCTION

There are several reasons for taking field notes when conducting work at hazardous substance, petroleum, and landfill Sites. These include:

- To provide a record of conditions of a site at a specific time, such as an inspection;
- To document specific activities at a site;
- Noting information in the field for its use, such as recording low flow well field parameters for comparison purposes to determine stabilization;

- To allow the re - creation of an event by persons not at the site (for comparing data of different events or finding sample locations for long term monitoring);
- To provide a means of reviewing the activities at a site if quality concerns with data collected during the site visit are encountered during data review; and
- To document a site visit.

All field notes should be taken with these purposes in mind. Additionally, all field notes must be made available for both internal and external review by assuring a copy is placed in the Sites official file in the MEDEP/BRWM file room. This includes creating an electronic "pdf" copy of field notes and saving in the appropriate MEDEP/DR electronic file using current MEDEP/DR electronic file naming conventions.

5.3.0 PROCEDURE

5.3.1 INITIALIZING FIELD BOOK

Upon Receipt of a Field Notebook, enter your name, DEP address, and phone number on the inside front cover. Staff may dedicate field books to a specific site if it is a long term project, or use one general field book for all of their tasks. Field books should be given a specific designation (site name and book volume number for site specific field books e.g. Joe's Garage, Volume 1), or project manager/ year/ book number for general field books, (e.g. Frank Zappa, 2008 – 1). If a field book is not paginated, staff must number all pages, in order, prior to its use.

5.3.2 SITE DOCUMENTATION

All field notes, with the stated exceptions (i.e. use of field forms), will be kept in the standard field book issued by MEDEP/DR.

Upon arrival at a site, the following information must be written down in the field notes: 1) Date of field activity; 2) Site or project name and location; 3) names of persons visiting site, including who they represent and their positions or roles; 4) time of arrival; 5) weather conditions.

After completing the header, take field observations as necessary. At the bottom of each page, and at the end of each day or event, sign and date the field book.

The field notebook must be kept organized, legible, and accurate as it may be used as evidence in court proceedings. Do not doodle on pages or document personal comments. Additionally, only blue or black ink should be used. Pencils must never be used.

5.3.2.1 Items to be Documented

Given the variety of circumstances that can be found, it is difficult to provide a minimum for documentation. Staff should take field notes with the concept that another person will be able to

recreate the activities from the notes taken. The following list should be considered a guide for documentation:

- Names of personnel present and organization;
- The sample event date and time;
- Weather conditions;
- Field measurements (such as PID readings, pH, temperature, etc);
- Sample station location designations, sample container numbers, etc;
- Specific sample location information, such as description of location, depths of sample, tide conditions, soil conditions, water color/conditions, etc;
- Out of the ordinary events, such as equipment failure, damage to monitoring wells or evidence of tampering, observations of gross contamination, odors, etc; and
- Information the field staff believe may be useful or pertinent at a later date.

For field events with multiple personnel present, it is not necessary for each participant to take field notes. The person(s) responsible for taking field notes and completing the Sampling Event Trip report (SETR) will be stated in the Sampling and Analysis Plan (SAP) or Quality Assurance Project Plan (QAP) for the event (See MEDEP/DR SOP #RWM-DR-014 - Development of a Sampling and Analysis Plan; SOP #RWM-DR-016 - Development of a Site Specific Quality Assurance Project Plan (QAPP)).

5.3.3 ERROR CORRECTIONS

Do not scratch out or blacken over error. Place one line through error, initial it, and continue with correct information. Never rip out or otherwise remove a page from a field book.

5.3.4 FIELD LOG FORMS

Some field activities have specific forms for taking notes, or specific projects may require specialized forms to assist in data organization. If forms are used in conjunction with a field book, a field book entry must be made with reference to the forms used during that event. At the end of the day, the total number of forms used during that days' activity(s) must be indicated in the field book. If forms are used without a field book, all of the forms for that day must be paginated at the end of the day, and, if multiple forms are used for the same project, attached as a packet to a field event trip report cover sheet (found in Attachment A). If the form has all of the information on the cover sheet, a cover sheet is not required.

MEDEP/DR and Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Technical Services (MEDEP/TS) have various forms for notes, including but not limited to:

- Low flow purge and sampling of monitoring wells
- Soil boring/test pit logs
- Elevation survey forms
- Residential water supply survey form
- Well development form
- Landfill inspection form

- XRF sample log sheet
- Indoor air and soil vapor form

Site or task specific forms can also be generated on an as needed basis.

7.0 FIELD EVENT TRIP REPORT (FETR)

After each field event, a sampling event trip report (FETR) package must be completed for the event. If the field event has multiple MEDEP/DR staff present, the person responsible for completing the FETR will be stated in the SAP. At a minimum, the FETR will consist of the completed FETR cover sheet form (Attachment A to this SOP), photocopies of all field notes taken by all personnel during the event, and copies of chains of custody for samples. A cover sheet form is not required if only one form is used for a site, and that form has all of the information required on the FETR cover sheet (such as a landfill inspection form). It is also recommended that a summary memo to the file be developed and attached to the FETR form which outlines the field events purpose, activities, and outcomes, and other relevant issues.

Once completed, the original hardcopy of the FETR package will be placed in the Project Site File and a pdf electronic copy will be placed in the electronic file for the site.

ATTACHMENT A
FIELD EVENT TRIP REPORT

DIVISION OF REMEDIATION FIELD TRIP REPORT

DATE: **Weather Conditions:**

SITE NAME and LOCATION:

MEDEP PERSONNEL PRESENT:

OTHER PEOPLE PRESENT:

PURPOSE OF SITE/AREA VISIT:

- ☐ Reconnaissance
- ☐ Residential Water Sampling
- ☐ Sampling Monitoring Wells or Micro Wells
- ☐ Waste Sampling, Drums, Stained Soil, Other _____
- ☐ Soil Sampling
- ☐ Surface Water/ Sediment Sampling. Water Body _____
- ☐ Geoprobing
- ☐ Contractor Oversight _____
- ☐ OTHER _____

FIELD NOTES and SAMPLE NUMBERS RECORDED BY:

ADDITIONAL COMMENTS:

Audit of procedures conducted? Yes ☐ No ☐ _____
Deficiencies noted? Yes ☐ No ☐ If Yes, explain in written trip report and attach

ATTACHMENTS:

- ☐ Copy of Field Book Pages
- ☐ Copy of Chain-of-Custody
- ☐ Photographs
- ☐ OTHER: _____

Print Name: **Signature:** **Date:**

COVER SHEET
STANDARD OPERATING PROCEDURE-ADDENDUM

OPERATION TITLE: **DEVELOPMENT OF A SAMPLING AND ANALYSIS PLAN-**

ADDENDUM - A – ADDITIONAL REQUIREMENTS FOR THE SAMPLING OF PERFLUORINATED ALKYLATED SUBSTANCES (PFASs), PERFLUOROOCTANOIC ACID (PFOA) and PERFLUOROOCTANE SULFONATE (PFOS).

1.0 APPLICABILITY

This Standard Operating Procedure (SOP) ADDENDUM 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 ADDENDUM 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/DRs requirements for the development of a Sampling and Analysis Plan (SAP) and outline specific requirements for the sampling of compounds related to Per- and Polyfluoroalkyl Substances (PFASs), including Perfluorooctanoic acid (PFOA) and Perfluorooctane sulfonate (PFOS).

Prior to conducting any investigative field work, routine monitoring, post closure sampling or any data gathering/sample collection project, a SAP will be developed that outlines the goals of the activity and methodology to achieve that goal. A well-developed SAP that is reviewed by all field team members will assure that the goals are obtainable, the methodology is consistent, and the data generated will meet the Data Quality Objectives (DQOs) for the project.

Given the ubiquitous nature of PFAS compounds, the low detection levels that are generally requested, and the different methodologies for which these compounds are tested, additional requirements regarding sampling methodology, equipment, and analysis for PFAS compounds should be included as part of the sampling plan and during the sampling event. This document outlines those specific requirements to be included in a PFAS sampling plan and during sampling.

3.0 GUIDELINES AND PROCEDURES

3.1 INTRODUCTION

A sampling and analysis plan, regardless of whether sampling for PFAS compounds or other potential contaminants, should include all the elements in SOP RWM-DR-014 – Development of a Sampling and Analysis Plan. Although not required to be included in the SAP, (as outlined in SOP RWM-DR-014), an assessment of the existing data should be conducted, a site reconnaissance completed, a conceptual site model developed, and data quality objectives determined as part of planning to assure the SAP will meet the goals of the sampling.

The SAP itself should include the goal of the sampling, end use of data, data quality objectives, schedule, sampling methodology, sampling locations, media to be sampled, analytical parameters, and QA/QC samples. Additionally, a site-specific health and safety plan may be necessary (see SOP-DR-014) depending on the scope of the sampling event. For example, collection of samples in a large or moving water body, or as part of large sampling effort

involving drilling rigs and/or excavation equipment would require a health and safety plan; residential well or routine monitoring well sampling would not.

3.2 SAMPLING METHODOLOGY/EQUIPMENT

A description of the sampling methodology will be included in the SAP. Generally, reference to an appropriate SOP for the sample methodology will be sufficient. The Division has developed multiple SOPs for sample collection of most media; please refer to the Division of Remediation's Quality Assurance Plan - Attachment B – Data Collection SOPs for a list of all data collection standard operating procedures.

3.2.1 Sampling Methodology

Sampling for PFAS will follow the standard procedures as outlined in the specific sampling method SOPs. In addition, the following task must be included in the SAP and field staff must perform the task as described below to prevent the introduction of contamination during collection of the sample:

> "Prior to sampling each location the sample handler must wash their hands and don nitrile gloves. This is particularly important when driving between locations or carrying pumps and other equipment between sample points. PFAS contamination during sample collection can occur from several common sources, including food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will help to minimize this type of accidental contamination of the samples."

It should be noted that samples collected for PFAS analysis do not have to be headspace free.

3.2.2 Sampling Equipment/Supplies/Personal Protective Equipment (PPE)

The low detection limits required for PFAS water analysis and their common occurrence in frequently used items warrant attention to equipment and PPE used for sampling. A sampling equipment list for PFAS projects should follow the material guidelines in Table 1 of Attachment A, avoiding use of LDPE and any Teflon-lined equipment or tubing. If field decontamination of submersible pumps or large non-disposable equipment is necessary, washing with a PFAS-free soap solution, rinsing with DI water and then a rinse with laboratory-supplied PFAS-free water is recommended. Small field equipment such as scoops or bowls can omit the DI rinse. New nitrile gloves should be used between locations and activities. For water sampling where there is adequate separation between the sample point (for example a kitchen tap) and sampler footwear then boot restrictions and PPE such as chicken boots may not be needed. Other recommended clothing and PPE requirements are noted in Table 1 of Attachment A.

3.3 Media Sampled/Analytical Parameters

A chart outlining the media collected and sample analysis methodology will be included in the SAP.

PFOA and PFOS are common potential contaminants of concern (COCs) at PFAS sites, but a wider suite of PFAS must be considered when evaluating a site. Laboratory reporting lists typically include approximately 20 PFAS compounds depending upon method and laboratory, and the DEP PFAS analytical services request required that laboratories report a list of 24 compounds PFAS. Until additional USEPA methods are finalized or unless otherwise required specifically for the project, the standard analysis for drinking water and groundwater will be Modified Method 537 using isotope dilution with the standard DEP reporting list from the most recent contract.

For sites where potential unidentified PFAS precursors are a concern, additional analyses such as the total extractable fluorinated compounds (TOP analysis) can be followed by analysis of specific compounds, to assess the presence of precursors in environmental media that are not captured by the compound specific methods. USEPA has also released a newer drinking water method (Method 533) with a longer standard list of compounds, but as of this revision few labs are offering this method.

Parameters will be identified by either laboratory analysis methodology number, or generally accepted name of analysis. Given the different methods currently available for sampling PFAS, there must be a clear understanding between the project manager and the laboratory providing the analysis as to what the media sampled, test methodology, and detection levels will be.

Table 1 provides the current standard methods with their associated media, other methods may be appropriate based on the data quality objectives of the sampling project:

Other methods may be appropriate based on the data quality objectives of the sampling project.

The contracted analytical laboratory must be Maine certified to perform any method for which Maine provides certification. The contract lab must be able to accommodate the sample load and perform the analyses within holding times. The contract lab must be able to achieve PQLs, for all analyses, which are below the associated regulatory guideline value. The contract lab must also provide electronic data deliverable (EDD) results for all samples.

Deviations can be made from the laboratory method on a site or event specific basis, based on the goals of the sampling, end use of the data, and the data quality objectives. Rationale for deviations from these methods should be described in the SAP and/or the final report.

All parameters, containers, preservation, and holding times will be as recommended by the laboratory providing analytical services. Special or out of the ordinary containers or preservation should be noted in the SAP.

TABLE 1
Media/Analytical Methodology

MEDIA	LABORATORY METHOD	HOLD TIME*/ PRESERVATION	ANALYSIS TIME	Reporting List
Public Drinking Water Supply **	USEPA Method 537.1	14 days to extraction/Trizma***	28 days after extraction	Method specific
Groundwater and Private Water Supplies	Modified Method 537 (Isotope Dilution)	14 days to extraction/<6°C	28 days after extraction	DEP Minibid list ****
Surface Water	Modified Method 537 (Isotope Dilution)	14 days to extraction/<6°C	28 days after extraction	DEP Minibid list ****
Soil/Sediment/sludge	Modified Method 537 (Isotope Dilution)	14 days to extraction/<6°C	28 days after extraction	DEP Minibid list ****
Other (vegetation…)	Modified Method 537 (Isotope Dilution)	Lab specific	Lab specific	DEP Minibid list ****
Water or Soil	TOP or other total fluorinated analysis	Lab specific/<6°C	Lab specific	Method specific

* Hold time of 14 days is specified by DEP
** USEPA 537.1 is currently the only Maine certified method for drinking water, others such as Method 533 will be offered in the future
*** Trizma needed for samples that may contain residual chlorine from treated water sources
*** Longer reporting lists may vary between laboratories, generally the DEP mini-bid list can be used for all projects

3.4 FIELD QC SAMPLES

Sample collection for PFAS analysis does not require specific field QC samples outside the normal requirements.

General recommendations for all sampling include one aqueous field blank, per field event, to be analyzed for PFASs to determine if water samples have been contaminated by sources unrelated to the project area, and to assess the overall field procedures. The field blank is typically one bottle of PFAS-free water supplied by the laboratory, which is uncapped and poured to a second bottle. For multi-day events, one blank per day should be considered. If non-dedicated or non-disposable equipment is used a PFAS-free water equipment blank is warranted to check field decontamination procedures.

4.0 PFAS SPECIFIC TEMPLATE

In the instances of a PFAS only sampling event, in which samples are being collected from a project which has a history of sampling for other analytes and a well-developed conceptual site

model and/or an SAP already exists, a PFAS sampling specific template has been developed which provides the general requirements of a sampling plan. This template can be found in Attachment A of this Addendum.

5.0 REPORT GENERATION

As stated in SOP RWM-DR-014, A Sampling Event Trip Report (SETR) will be developed for every sampling event (see MEDEP/DR SOP# RWM-DR-013). The staff person responsible for developing the SETR will be stated in the SAP. Data obtained as part of the SAP will be assessed in the final report for which the data has been collected.

ATTACHMENT A
PFAS SAMPLING AND ANALYSIS PLAN FORM TEMPLATE

1.1 INTRODUCTION

The introduction will state the objectives of the sampling plan which include:

- Goals of the sampling plan;
- End use of data.

2.0 BACKGROUND INFORMATION

A BRIEF explanation of the background of the Site and/or conceptual site model (CSM) and reason for sampling for PFAS will be presented.

3.0 SITE SPECIFIC HEALTH AND SAFETY PLAN

If determined necessary, a Site-Specific Health and Safety plan (HASP) will be developed and attached.

4.1 SAMPLING METHODOLOGY/ EQUIPMENT

A description of the sampling methodology will be included in the SAP. In instances where a MEDEP/DR SOP is available, reference to SOPs by either name or document number is sufficient.

Currently, the MEDEP/DR QAP has SOPs for the following sample collection tasks which may be pertinent to PFAS sampling:

- 001-Water-Sample-Colllection-From-Water-Supply-Wells;
- 002-Groundwater-for-Site-Investigation;
- 003-Low-Flow-Groundwater-Sampling;
- 004-surface-water-sediment;
- 006-soil-sampling;
- 010-Container-Sampling;
- 015-Incremental-sample-methodology;
- 023-Pore-Water-Sampling.

Other SOPs may be utilized on a project specific basis if MEDEP/DR does not have a current SOP for sampling a particular media or situation. Prior Department approval is necessary.

Prior to sampling each location the sample handler must wash their hands and don nitrile gloves. PFAS contamination during sample collection can occur from a number of common sources, including food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will help to minimize this type of accidental contamination of the samples, particularly when moving pumps, generators or other equipment between sample points.

Some sampling equipment, field supplies, field clothing and personal protective equipment are prohibited when sampling for PFAS. Table 1 outlines the prohibited items. This table must be included in the SOP and field staff informed as to what equipment is allowed.

Table 1: Summary of Prohibited and Acceptable Items for Use in PFAS Sampling

Prohibited Items	Acceptable Items
Field Equipment	
Teflon® containing materials. Aluminum foil.	High-density polyethylene (HDPE) and stainless steel materials
Storage of samples in containers made of LDPE materials	Acetate direct push liners
Teflon® tubing	Silicon or HDPE tubing
Waterproof field books. Water resistant sample bottle labels.	Loose paper (non-waterproof). Paper sample labels covered with clear packing tape, or lab-applied labels.
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum or Masonite field clipboards
	Sharpies®, pens
Post-It Notes	
Chemical (blue) ice packs	Regular ice
Excel Purity Paste TFW Multipurpose Thread Sealant Vibra-Tite Thread Sealant	Gasoils NT Non-PTFE Thread Sealant Bentonite
Equipment with Viton Components (need to be evaluated on a case by case basis, Viton contains PTFE, but may be acceptable if used in gaskets or O - rings that are sealed away and will not come into contact with sample or sampling equipment.)	
Field Clothing and PPE	
New clothing or water resistant, waterproof, or stain treated clothing, clothing laundered with fabric softeners, clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed 6 or more times after purchase, made of synthetic or natural fibers (preferable cotton). Cotton coveralls are one option that reduces the need for specialized personal clothing.
Clothing laundered using fabric softener	No fabric softener
Boots containing Gore-Tex™	Boots made with polyurethane and PVC for wet conditions, or rubber overboots (“chicken boots”)
	Reflective safety vests, Tyvek®, Cotton clothing, synthetic under clothing, medical braces

No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	**Sunscreens** - sunscreens that are "free" or "natural", or UV blocking clothing **Insect Repellents** - Sawyer permethrin clothing treatment, Deep Woods Off, Insect Shield pre-treated clothing (1)
Sample Containers	
LDPE, glass containers or passive diffusion bags.	HDPE (any media) or polypropylene (only for EPA Method 537.1 samples)
Teflon®-lined caps	Lined or unlined HDPE or polypropylene caps
Rain Events	
Gore-Tex™ or similar breathable coated waterproof or resistant rain gear	Polyurethane, vinyl, wax or rubber-coated rain gear. Gazebo tent that is only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90	Alconox® and/or Liquinox®
Water from an on-site well	Potable water from municipal drinking water supply (if tested as PFAS-free); Lab-supplied PFAS-free water
Food Considerations	
All food and drink, with exceptions noted on the right	Bottled water and hydration drinks (i.e. Gatorade® and Powerade®) to be brought and consumed only in the staging area

(1) Bartlett SA, Davis KL. Evaluating PFAS cross contamination issues. *Remediation*. 2018;28:53–57.

It is recommended that all water samples will be collected using dedicated or disposable sampling equipment where possible. Any re-usable equipment, such as plumbing fittings, that may be needed in certain cases to obtain a sample from the pressure tank tap, should be deconned using Alconox/Liquinox soap and rinsed with PFAS-free water prior to use and between locations.

5.0 Sample Locations

A map showing planned sampling locations will be included in the sampling plan. If locations are not pre - determined, the method that samples will be chosen and collected (field observations, random, etc.) will be outlined in the SAP. Field or laboratory compositing procedures will also be described, if applicable.

This section should also indicate sampling collection priority and order, to assure that the most important samples are obtained, and that sampling is generally done from low areas of contamination to higher levels of contamination. It is recommended that critical samples be collected in duplicate.

6.0 Media Sampled

A chart outlining the media collected and sample analysis will be included in the SAP. Table 2 provides several current methods with their associated media:

TABLE 2
Media/Analytical Methodology

MEDIA	LABORATORY METHOD	HOLD TIME*/ PRESERVATION	ANALYSIS TIME	Reporting List
Public Drinking Water Supply **	USEPA Method 537.1	14 days to extraction/Trizma***	28 days after extraction	Method specific
Groundwater and Private Water Supplies	Modified Method 537 (Isotope Dilution)	14 days to extraction/<6°C	28 days after extraction	DEP Minibid list ****
Surface Water	Modified Method 537 (Isotope Dilution)	14 days to extraction/<6°C	28 days after extraction	DEP Minibid list ****
Soil/Sediment/sludge	Modified Method 537 (Isotope Dilution)	14 days to extraction/<6°C	28 days after extraction	DEP Minibid list ****
Other (vegetation…)	Modified Method 537 (Isotope Dilution)	Lab specific	Lab specific	DEP Minibid list ****
Water or Soil	TOP or other total fluorinated analysis	Lab specific/<6°C	Lab specific	Method specific

* Hold time of 14 days is specified by DEP
** USEPA 537.1 is currently the only Maine certified method for drinking water, others such as Method 533 will be offered in the future
*** Trizma needed for samples that may contain residual chlorine from treated water sources
**** Longer reporting lists may vary between laboratories, generally the DEP mini-bid list can be used for all projects

Other methods may be appropriate based on the data quality objectives of the sampling project.

The contracted analytical laboratory must be Maine certified to perform any method for which Maine provides certification. The contract lab must be able to accommodate the sample load and perform the analyses within holding times. The contract lab must be able to achieve PQLs, for all analyses, which are below the associated regulatory guideline value.

Containers, preservation, and holding times will be as recommended by the laboratory providing analytical services. Special or out of the ordinary containers or preservation should be noted in the SAP.

7.0 FIELD QC SAMPLES

The specific needs for QC samples for the project will be outlined. General requirements for PFAS sampling events include one aqueous field blank, per field event, to be tested for PFASs to determine if water samples have been contaminated by sources unrelated to the project area, and to assess the overall field procedures. The field blank is typically

one bottle of PFAS-free water supplied by the laboratory, which is uncapped and poured to a second bottle. An equipment blank should be collected if non-dedicated equipment is used. For multi-day events, one blank per day should be considered, and for large events one blank per 10 or 20 samples is warranted, depending upon the project requirements. All blanks should be collected with laboratory supplied PFAS-free water. A source-water blank is handled like a trip blank, and assesses the laboratory supplied water and sample containers. This blank may be warranted depending on DEP experience with the laboratory or sensitivity of the project.

Additionally, any QC samples that will be collected in the field that are required as part of laboratory QC requirements and to allow data validation will be outlined.

4.9 REPORT GENERATION

A Sampling Event Trip Report (SETR) will be developed for every sampling event (See MEDEP/DR SOP# RWM-DR-013). Staff person responsible for developing the SETR will be stated.

COVER SHEET
STANDARD OPERATING PROCEDURE

OPERATION TITLE: **DEVELOPMENT OF A SAMPLING AND ANALYSIS PLAN**

ORIGINATOR NAME: **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*
Bill Longfellow — *Signature*
12/20/16 — *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/DRs requirements for the development of a Sampling and Analysis Plan (SAP). Prior to conducting investigative field work, routine monitoring, post closure sampling or any data gathering project, a SAP will be developed that outlines the goals of the activity and methodology to achieve that goal. A well-developed SAP that is reviewed by all field activity team members should assure that the goals are obtainable, the methodology is consistent, and the data generated will meet the Data Quality Objectives (DQOs) for the project.

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 GUIDELINES AND PROCEDURES

4.1 INTRODUCTION

A SAP may be developed as a narrative document or staff may use the standard sampling and analysis form found as attachment A to this SOP. A SAP will, at a minimum, contain the following elements.

4.2 ASSESSMENT OF EXISTING DATA

The project manager for the site will ensure the review of any existing information on the site. Analytical data will be analyzed for completeness, quality and usability.

4.2.1 Site Reconnaissance

Prior to sampling events, particularly large multi - day events or multi media events, it is recommended that a site reconnaissance be conducted to work out any logistical problems that may arise during sampling. This would include site access issues, physical impediments to sampling, access issues with surface water sampling, etc. Any logistical issues discovered

during the site reconnaissance should be mentioned in the SAP along with recommendations for overcoming these issues.

4.2.2 Conceptual Site Model

The first step in developing any sampling plan is to develop a conceptual site model (CSM). ASTM defines a CSM as "*a written or pictorial representation of an environmental system and the biological, physical and chemical processes that determine the transport of contaminants from, sources through environmental media to environmental receptors within the system.*" The CSM is a dynamic tool to be updated as new information becomes available, and therefore it should be amended, as appropriate, after each stage of investigation.

The CSM should be site-specific and take into consideration the following information:

- What are the Contaminants of Concern (COCs) associated with the site?
- How were COCs released into the environment? Where are the sources located? Was the release due to a surface spill of a liquid, a subsurface spill from piping or a tank, improper storage of materials such as chemical soaked filters at a drycleaner, through a floor drain to the subsurface beneath a building, or through a floor drain to a surface location? Is there a non-aqueous phase liquid (NAPL)?
- What are the chemical characteristics that will influence how the COCs will act in the environment? Do they dissolve readily in water? Are they very volatile or less volatile? How much was released? Do they degradein the subsurface?
- How does the geology, preferential pathways, groundwater flow, depth to groundwater, proximity to impermeable surfaces, and chemical attenuation influence contaminant migration?
- Where are the potential receptors and how might contaminants reach them? Have all of the migration pathways been identified? Has future construction been considered?

4.3 TITLE SECTION

The title section of an SAP will contain the name and town of project, the name and title of the person developing the SAP, and the expected date of the field work and field personnel.

4.4 INTRODUCTION

The introduction will state the DQOs which include:

- Goals of the sampling plan;
- End use of data.

4.5 BACKGROUND INFORMATION

A brief explanation of the background of the Site will be presented.

4.6 SITE SPECIFIC HEALTH AND SAFETY PLAN

A Site Specific Health and Safety plan (HASP) will be developed and included with the SAP. The MEDEP/Bureau of Remediation and Waste Management HASP form, which contains the minimum requirements for a HASP, can be found as Attachment B of this SOP.

If below grade sampling is part of the SAP, Dig - Safe must be notified at least 3 working days prior to the sampling event. Sample locations must be marked on the ground prior to calling Dig-Safe.

4.7 SAMPLING METHODOLOGY/EQUIPMENT

A description of the sampling methodology will be included in the SAP. In instances where a MEDEP/DR SOP is available, reference to SOPs by either name or document number is sufficient.

4.8 SAMPLES AND PARAMETERS

4.8.1 Sample Locations

A map showing planned sampling locations shall be included in the sampling plan. If locations are not pre - determined, the method that samples will be chosen and collected (field observations, random, etc.) will be outlined in the SAP. Also outlined will be any composite procedures, if applicable.

This section should also indicate sampling collection priority and order, to assure that the most important samples are obtained, and that sampling is generally done from low areas of contamination to higher levels of contamination. It is recommended that critical samples be collected in duplicate.

4.8.2 Media Sampled

A chart outlining the media collected and sample analysis will be included in the SAP. Generally, the media sampled will be:

- Soil;
- Groundwater (via monitoring wells and residential wells);
- Pore water;
- Soil gas and/or sub-slab soil gas;
- Indoor air;
- Surface Water;
- Sediment;
- Neat waste material.

4.8.3 Analytical Parameters

Parameters will be identified by either laboratory analysis methodology number, or generally accepted name of analysis.

Containers, preservation, and holding times will be as recommended by the laboratory providing analytical services. Special or out of the ordinary containers or preservation should be noted in the SAP.

4.8 FIELD QC SAMPLES

The specific needs for QC samples for the project will be outlined; including, but not limited to:

- Background samples;
- Field duplicates;
- Trip blanks; and
- Equipment blanks

4.9 REPORT GENERATION

A Sampling Event Trip Report (SETR) will be developed for every sampling event (See MEDEP/DR SOP# RWM-DR-013). Staff person responsible for developing the SETR will be stated in the SAP. Data obtained as part of the SAP will be assessed in the final report.

ATTACHMENT A
SAMPLING AND ANALYSIS PLAN FORM

MEDEP DIVISION of REMEDIATION
SAMPLING and ANALYSIS PLAN

SITE NAME:

DATE of SAMPLING:

MEDEP PERSONNEL: (list names, titles and roles such as person responsible for ordering containers and completing trip reports)

OTHER PERSONNEL: (list name affiliation, title and role)

CONCEPTUAL SITE MODEL:
(ASTM defines a CSM as "*a written or pictorial representation of an environmental system and the biological, physical and chemical processes that determine the transport of contaminants from, sources through environmental media to environmental receptors within the system.*" The CSM is a dynamic tool to be updated as new information becomes available, and therefore it should be amended, as appropriate, after each stage of investigation.) All active sites in the Division of Remediation should have a CSM. Staff should work with their geologist to develop and update this as necessary. Provide the following information for the site from the CSM.

Hydrogeologic Setting: (prepare a narrative describing what is known about the site-specific geology and hydrology with respect to its effect on contaminant distribution and migration.
Contaminants of Concern: (list contaminants and their chemical properties that will influence how they act in the environment)
Method of Release: (look at all releases)
Migration/Exposure Pathways: (groundwater, soil, surface water and or air)
Receptors: (list potential receptors and describe the risk to the receptor posed by contamination).

EVALUATION OF PREVIOUS DATA and DATA GAP ANALYSIS:
(Review previous data to determine the environmental and physical conditions existing at the site. For example, if wells are present, well diameter and depth to water will govern the type of sampling equipment that is necessary to sample the wells. Other information such as whether it is necessary to filter samples may also be available. If samples were previously collected, were they analyzed for the appropriate parameters? In addition, previous studies may indicate there is a high degree of confidence with data that has been collected in one portion of the site, but not the other. In order to avoid or fill data gaps, all available data should be assessed and compared to the current CSM. This will result in an efficient and complete site assessment.)

SITE RECONNAISSANCE:
(Depending on the objectives of the sampling and the date of the last site visit staff may need to visit the site prior to conducting the sampling. List the date of last site visit or reconnaissance)

INVESTIGATION PURPOSE and DATA QUALITY OBJECTIVES:
(fill out and attach forms for the pathway which will be sampled)

___ Groundwater Sampling
___ Soil Sampling
___ Surface Water/Sediment Sampling
___ Air Sampling

ADDITIONAL ATTACHMENTS:

___Sample SUMMARY OF SITE INVESTIGATION Table- (example attached)
___Sample location map
___Container list
___HASP
___Equipment Checklist
___Previous "flow sheets"

GROUNDWATER SAMPLING:

DQOs:

- ☐ To determine if contamination onsite has impacted groundwater
- ☐ To determine if contamination in groundwater poses a risk to receptors
- ☐ To determine if concentrations of contaminants have changed
- ☐ To determine if groundwater is discharging to surface water
- ☐ Other_____

Sample Point:

- ☐ Existing monitoring wells (list date last sampled, attach previous "flow sheets")
- ☐ Wells which will be installed (with _____)
- ☐ Pore water
- ☐ Residential Wells
- ☐ Other:_____

Regulatory Standards/Guidelines that will be used for comparison:

- ☐ MEGs/MCLs
- ☐ Background

Sample Method:

- ☐ Low Flow
  - ☐ Peristaltic Pump
  - ☐ Submersible Pump
- ☐ Other:_____

Field Screening:

- ☐ pH
- ☐ eh
- ☐ conductivity
- ☐ turbidity
- ☐ DO
- ☐ Temperature
- ☐ Water level
- ☐ Flow rate
- ☐ Other:_____

Analytical Method: (list the method and make sure the method meets the objective)

- ☐ VOCs:
- ☐ Metals (field filtered for dissolved, unfiltered for total):
- ☐ Pesticides/Herbicide:
- ☐ SVOCs:

- ☐ Petroleum:
- ☐ Other:_____

SOIL SAMPLING:

DQOs:

- ☐ To determine if a release of contaminants has occurred
- ☐ To determine if contaminants pose a risk to residential/recreational receptors
- ☐ To determine if contaminants pose a risk to commercial and/or construction workers
- ☐ To determine the lateral and vertical extent of contamination
- ☐ Determining disposal criteria
- ☐ Other:_____

Regulatory Standard/Guideline:

- ☐ RAGs:
- ☐ Waste Disposal Criteria:
- ☐ Background:
- ☐ Other:_____

Sample Method: **(CALL DIG SAFE)**

- ☐ Shovel/trowel
- ☐ Geoprobe
  - ☐ Hand
  - ☐ Drill Rig
- ☐ Excavator
- ☐ Other:_____

Field Screening:

- ☐ PID
- ☐ FID
- ☐ XRF
- ☐ Other:_____

Analytical Method: (list the method and make sure the method meets the objective)

- ☐ VOCs:
- ☐ Metals:
- ☐ Pesticides/Herbicide:
- ☐ SVOCs:
- ☐ Petroleum:
- ☐ PCBs:

SURFACE WATER/ SEDIMENT SAMPLING

DQOs:

- ☐ To determine if contaminants from the site are discharging to surface water
- ☐ To determine the extent of contamination in surface water
- ☐ To determine if contamination in the surface water body exceeds regulatory standards
- ☐ To determine if contamination in sediments exceeds ecological toxicity criteria
- ☐ Other:_____

Media:

- ☐ Surface water
- ☐ Pore water
- ☐ Sediment

Regulatory Standard/Guideline:

- ☐ AWQC
- ☐ SQIRT
- ☐ PEC/TEC
- ☐ Background
- ☐ Other:_____

Sample Methods:

- ☐ Shovel/Trowel
- ☐ Ponar
- ☐ Beta/Kemmerer
- ☐ Peristaltic pump:
- ☐ Other:_____

Field Screening:

- ☐ PID
- ☐ XRF
- ☐ DO
- ☐ Eh
- ☐ pH
- ☐ Conductivity
- ☐ Temperature
- ☐ Other:_____

Analytical Method: (list the method and make sure the method meets the objective)

- ☐ VOCs:
- ☐ Metals:
- ☐ Pesticides/Herbicide:
- ☐ SVOCs:
- ☐ Petroleum:
- ☐ PCBs:
- ☐ Other:_____

AIR SAMPLING

DQOs:

- ☐ To determine if vapors are present in soil gas at levels that pose a threat to receptors.
- ☐ To determine how vapors are migrating from the site.
- ☐ To determine if vapors are present in indoor air at levels that pose a risk to receptors.
- ☐ To determine if landfill gases are present at a site.
- ☐ Other:_____

Sample Point:

- ☐ Soil gas
- ☐ Preferential pathway
- ☐ Subslab

- ☐ Indoor Air
- ☐ Ambient air
- ☐ Other:_____

Regulatory Guideline:

- ☐ Ambient Air Guideline
- ☐ Indoor Air Target
  - ☐ Residential 1 compound
  - ☐ Residential Multiple compounds
  - ☐ Commercial 1 compound
  - ☐ Commercial multiple compounds
  - ☐ Residential sub chronic
  - ☐ Commercial sub chronic
- ☐ Soil Screening level (this assumes an attenuation factor for soil gas to indoor air)
- ☐ Other:_____

Sample Method:

- ☐ Tedlar bag
- ☐ Summa canister
- ☐ Other:_____

Field Screening:

- ☐ PID (ppm or ppb)
- ☐ FID
- ☐ Oxygen (%)
- ☐ Carbon Dioxide (ppm)
- ☐ Hydrogen Sulfide
- ☐ Methane (% LEL)
- ☐ Other:_____

Analytical Method:

- ☐ Mobile lab
- ☐ TO-15
- ☐ TO-17
- ☐ APH
- ☐ Other:_____

ATTACHMENT B
HEALTH AND SAFETY PLAN FORM

DEP Limited Operation Site Safety & Health Plan

SITE INFORMATION			
SITE NAME:		JOB/FILE/SPILL #	
SITE LOCATION (ADDRESS):		TOWN:	
DIRECTIONS TO SITE:			
WORK OBJECTIVE:			
MAP/DIAGRAM (SKETCH ON LAST PAGE) MUST INCLUDE:	SITE MAP (DETAIL WHERE THIS PLAN APPLIES ☐ WORK ZONES (EXCLUSION, HAZARD REDUCTION, SUPPORT & CLEAN) ☐ ESCAPE ROUT FROM WORK AREAS & REFUGE AREA/OFF SITE CHECK IN AREA ☐ BASIC SITE TOPOGRAPHY ☐		
ENVIRONMENTAL CONDITIONS:	TEMPERATURE:	CLOUD COVER	
	WIND DIRECTION:	WIND SPEED:	

EMERGENCY RESPONSE PLAN			
FIELD STAFF TO EXIT SITE IN CASE OF EMERGENCY (NOT RESPOND) ☐		FIELD STAFF TO RESPOND IN EMERGENCY ☐	
RESPONDING FIRE DEPT:		TEL #:	
RESPONDING RESCUE SERVICE:		TEL #:	
ON-SITE CONTRACTOR(S):		TEL #:	
ON-SITE CONTRACTOR(S):		TEL #:	
ON-SITE CONTRACTOR(S):		TEL #:	
POLICE:		TEL #:	
HOSPITAL:		TEL #:	
AMBULANCE SERVICE:		TEL #:	
PRIMARY FIRST AID ATTENDANT:		TEL #:	

MEDICAL TREATMENT BY DEP STAFF IS LIMITED TO BASIC FIRST AID

RESCUE PERSONNEL (WHILE EXITING AREA, RESCUE PERSONNEL WILL ASSIST OTHERS REQUIRING ASSISTANCE OR AS DESIGNATED IN ATTACHED REQUIRED PERMITS. OTHER RESCUE WILL BE BY OFF-SITE RESCUE SERVICE:	
SITE SAFETY COORDINATOR (RESPONSIBLE TO ACCOUNT FOR PERSONNEL FROM THE SITE AT CHECK-IN AREA; TO COORDINATE ON-SITE EMERGENCY ACTIONS & WITH OFF-SITE RESPONDERS):	

DEP LIMITED OPERATION SITE SAFETY & HEALTH PLAN CONTINUED

SITE SUPERVISOR (RESPONSIBLE TO COORDINATE NON-EMERGENCY ON-SITE ACTIVITIES; TO INITIATE CALL FOR OFF-SITE EMERGENCY PERSONNEL AS APPROPRIATE THROUGH OFF-SITE COMMUNICATION SYSTEM):				
ALARM SYSTEM:	VOICE ☐	3 BLAST AUTO HORN ☐	OTHER (SPECIFY):	
COMMUNICATIONS (ON-SITE):	WALKIE TALKIE ☐	HEADSET RADIO ☐	SIGNALS ☐	
COMMUNICATIONS (OFF-SITE:	RADIO ☐	SITE TEL #:		

OTHER EMERGENCY TELEPHONE NUMBERS:	
DEP REGIONAL OFFICES:	AUGUSTA: (207) 287-7800
	BANGOR: (207) 941-4570
	PORTLAND: (207) 822-6300
	PRESQUE ISLE: (207) 764-0477
	DEP SAFETY DIRECTOR, LINDA DORAN: (207) 287-7867
	NATIONAL RESPONSE CENTER: (800) 424-8802
	POISON CONTROL CENTER: (800) 222-1222

SITE OPERATIONAL RISKS			
CHEMICAL RISKS (ATTACH MSDS):		CONCENTRATION HAZARD (INCLUDE PEL & LEL):	
CHEMICAL RISKS (ATTACH MSDS):		CONCENTRATION HAZARD (INCLUDE PEL & LEL):	
CHEMICAL RISKS (ATTACH MSDS):		CONCENTRATION HAZARD (INCLUDE PEL & LEL):	
CHEMICAL RISKS (ATTACH MSDS):		CONCENTRATION HAZARD (INCLUDE PEL & LEL):	

PHYSICAL RISKS				
CONFINED SPACES (ATTACH CONFINED SPACE ENTRY PERMIT OR NON-HAZARD DECLARATION) ☐		ELECTRICAL HAZARD (LOCK OUT/TAG OUT REQUIRED FOR DEACTIVATED EQUIPMENT; 1O FT FROM HIGH VOLTAGE) ☐		
TRENCHING/EXCAVATION (ENTRY CONSIDERED CONFINED IF SPACE IS GREATER THAN 4 FT.) ☐		UTILITIES CONTACTED ☐	DIG SAFE CALLED (800) 344-7233 ☐	
HEAVY EQUIPMENT ☐	DRUM HANDLING/SAMPLING ☐	HEAT/COLD ☐	ANTICIPATED TEMP RANGE:	
ELEVATED AREA/FALL HAZARD (GREATER THAN 6 FT) ☐	NOISE (HEARING PROTECTION REQUIRED IF POSSIBILITY OF OVER 85 DECIBELS) ☐		VEHICULAR TRAFFIC ☐	
OTHER (SPECIFY): ☐				

WORK PRACTICE/ENGINEERING CONTROLS				
AREA/SPACE VENTILATION ☐	EXPLOSION-PROOF FAN (S) ☐	MARK OFF AREA SIGNS/TAPE ☐		
VEHICULAR CONTROLS ☐	CONES ☐	BARRICADES ☐	FLAG PERSON ☐	
EXCAVATION TRENCH ☐	SLOPED ☐	SHORED ☐	BARRICADES ☐	
SEAL OFF/POLY OFF WORK AREA ☐	ELECTRICAL ☐	LOCK OUT/TAG OUT ☐	SHIELD/INSULATE ☐	MAINTAIN 10 FT SEPARATION ☐

DEP LIMITED OPERATION SITE SAFETY & HEALTH PLAN CONTINUED

IGNITION SOURCES SECURED ☐	EQUIPMENT BONDED & GROUNDED ☐	SPARK RESISTANT TOOLS ☐	CLEAN AREA ESTABLISHED FOR EATING/RESTING ☐

SPILL/ACCIDENT CONTROL				
FIRE EXTINGUISHER(S) ☐	TYPE(S):			
CONTAINMENT ☐	SORBENT ☐	OVER-PACK DRUMS ☐	BOOMS ☐	BARRIER MATERIAL ☐
PREVENTION PROCEDURES (DESCRIBE):				
HAZARD RECOGNITION (DESCRIBE):				

ADDITIONAL SAFETY EQUIPMENT		
FIRST AID KIT ☐	FIRE BLANKET ☐	SAFETY EYEWASH/SHOWER ☐
ESCAPE LADDERS ☐	BODY HARNESS & LIFELINE ☐	TRIPOD WINCH ☐

SITE MONITORING (ATTACH DAILY AIR MONITORING LOGS)							
THERMOMETER ☐	C ☐	CA ☐	P ☐	INTERVAL IF PERIODIC:		ACTION LEVELS:	
HYGROMETER ☐	C ☐	CA ☐	P ☐	INTERVAL IF PERIODIC:		ACTION LEVELS:	
WIND SOCK ☐	C ☐	CA ☐	P ☐	INTERVAL IF PERIODIC:		ACTION LEVELS:	
CGI ☐	C ☐	CA ☐	P ☐	INTERVAL IF PERIODIC:		ACTION LEVELS:	
OXYGEN METER ☐	C ☐	CA ☐	P ☐	INTERVAL IF PERIODIC:		ACTION LEVELS:	
PID (LAMP) ☐	C ☐	CA ☐	P ☐	INTERVAL IF PERIODIC:		ACTION LEVELS:	
FID ☐	C ☐	CA ☐	P ☐	INTERVAL IF PERIODIC:		ACTION LEVELS:	
OTHER (SPECIFY) ☐		C ☐	CA ☐	P ☐	INTERVAL IF PERIODIC:	ACTION LEVELS:	
OTHER (SPECIFY) ☐		C ☐	CA ☐	P ☐	INTERVAL IF PERIODIC:	ACTION LEVELS:	
COLOROMETRIC ☐	TUBE USED:					ACTION LEVELS:	

C = CONTINUOUS CA = CONTINUOUS WITH ALARM P = PERIODIC

PERSONAL PROTECTIVE EQUIPMENT: RESPIRATORY					
TASK(S):		LEVEL:		RESPIRATOR USED (CARTRIDGE & TYPE):	
TASK(S):		LEVEL:		RESPIRATOR USED (CARTRIDGE & TYPE):	
TASK(S):		LEVEL:		RESPIRATOR USED (CARTRIDGE & TYPE):	

PERSONAL PROTECTIVE EQUIPMENT: CHEMICAL PROTECTIVE CLOTHING					
TASK(S):		LEVEL:		CLOTHING USED:	
TASK(S):		LEVEL:		CLOTHING USED:	
TASK(S):		LEVEL:		CLOTHING USED:	

PERSONAL PROTECTIVE CLOTHING: GLOVES					
TASK(S):		INNER (TYPE & MATERIAL):		OUTER (TYPE & MATERIAL):	
TASK(S):		INNER (TYPE & MATERIAL):		OUTER (TYPE & MATERIAL):	
TASK(S):		INNER (TYPE & MATERIAL):		OUTER (TYPE & MATERIAL):	
PERSONAL PROTECTIVE EQUIPMENT: BOOTS					
TASK(S):		INNER (TYPE & MATERIAL):		OUTER (TYPE & MATERIAL):	
TASK(S):		INNER (TYPE & MATERIAL):		OUTER (TYPE & MATERIAL):	
TASK(S):		INNER (TYPE & MATERIAL):		OUTER (TYPE & MATERIAL):	
OTHER EQUIPMENT					
TASK(S):		EQUIPMENT:		DESCRIPTION:	
TASK(S):		EQUIPMENT:		DESCRIPTION:	

DECONTAMINATION	
PERSONNEL	*PROTOCOL*
BETWEEN TASKS:	
LEAVING SITE:	
EMERGENCY DECONTAMINATION:	
RESPIRATOR	*PROTOCOL*
BETWEEN TASKS:	
FIELD DECONTAMINATION:	
FINAL SANITIZATION:	
PROTECTIVE CLOTHING	*PROTOCOL*
BETWEEN TASKS:	
FIELD DECONTAMINATION:	
FINAL WASH:	
EQUIPMENT	*PROTOCOL*
BETWEEN TASKS:	
FIELD DECONTAMINATION:	
FINAL DECONTAMINATION:	

DEP LIMITED OPERATION SITE SAFETY & HEALTH PLAN CONTINUED

I have read/understand the contents of this plan, supporting material referenced, and have completed field certification to perform tasks as called for in this plan.

SITE SUPERVISOR SIGNATURE:				DATE:	
SITE SAFETY COORDINATOR SIGNATURE:				DATE:	
OTHER (SPECIFY):		SIGNATURE:		DATE:	
OTHER (SPECIFY):		SIGNATURE:		DATE:	
OTHER (SPECIFY):		SIGNATURE:		DATE:	
OTHER (SPECIFY):		SIGNATURE:		DATE:	

COVER SHEET
STANDARD OPERATING PROCEDURE

Operation Title: **INCREMENTAL SAMPLE METHODOLOGY FOR SITE INVESTIGATION AND RISK ASSESSMENT**

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

APPROVALS:

Division of Remediation Director:

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

Bureau of Remediation and Waste Management Director:

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

QMSC Chair:

Bill Longfellow — *Print name*
Bill Longfellow — *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 procedure for utilizing Multi-Incremental Sampling (MIS), also known as Incremental Sampling Methodology (ISM), for investigation and assessment of chemical concentrations in soil or other media.

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 Decision Unit (DU): The predefined 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.
4.2 DQO : Data Quality Objective
4.3 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.
4.4 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.
4.5 SAP: Sampling and Analysis Plan
4.6 Sample Unit (SU): a defined area to be sampled as an individual ISM sample.

5.0 GUIDELINES AND PROCEDURES

5.1 INTRODUCTION

Multi-Incremental Sampling (also referred to as "Incremental Sampling Methodology") is a sampling method for obtaining a representative mean concentration of a contaminant across a predefined area (area of concern, exposure unit, or decision unit). Soil, sediment and even groundwater can be sampled using MIS. For risk assessment or MEDEP RAGs risk calculator purposes, if 3 or more replicate MIS 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 DQOs, but yields a 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 predefined 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 other document.

5.2 PLANNING

A well-developed Conceptual Site Model (CSM) is imperative for effective use of this technique. 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 MIS 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

5.3.1 OVERVIEW

Field methodology and laboratory procedures are two significant components to MIS 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 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. The laboratory processing component involves some combination of drying, sieving, grinding and sub-sampling to reduce the laboratory error related to selection of the small mass of soil actually analyzed. The method is easily applied to surface soils, but can also be applied to deeper soil intervals using hand augers or direct-push technology to obtain sub-surface increments, or to collect shallow groundwater sample increments if desired.

The method is particularly useful where there is a heterogeneously distributed contaminant that limits the value of discrete sample approaches. Large areas can also be characterized without collecting (and paying for) an excessive number of laboratory samples. For example, the MIS approach may be used on properties where source areas have been targeted for removal and the remaining property needs to be assessed for risk evaluation. MIS can also be applied to soil piles or landspread soils where a mean value for the bulk soil 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 nothing is understood of the release mechanisms and potential source areas, as there would be a potential for missing source areas if decision units are too large.
The site conceptual model also is 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.

5.3.2 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 subsampled without a grinding step, to avoid lab contamination of samples.

MIS/ 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 are 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 show units are similar and combining units meets 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 2012 Technical Guidance document, and in the other references listed below.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

Data quality objectives should be stated in the SAP. Quality Assurance/Quality Control (QA/QC) samples may be collected if needed to meet DQOs. Typical types of QA/QC samples that may be collected or prepared at the laboratory include replicate MIS samples to allow determination of a UCL for the DU, laboratory control blank spikes, and analysis of reference material containing known concentrations of the target analytes. All analytical data should be reviewed and assessed to determine if DQOs have been met. If review indicates DQOs have not been met, corrective action will be recommended by the reviewer.

7.0 REFERENCES

ITRC Technical and Regulatory Guidance, Incremental Sampling Methodology, February 2012. Table 3-1 ITRC 2012 guidance summarizes the factors the project team should consider. Figure 4-1 outlines the decision tree for the overall approach of the investigation. Figure 5-1 illustrates

a flowchart for field sample method considerations. http://www.itrcweb.org/ism-1/pdfs/ISM-1_021512_Final.pdf

Recent studies of metals analysis and soil grinding issues have been published by the US Army Corps of Engineers, focused on small arms ranges, but applicable to other site types:

Incremental Sampling Methodology (ISM) for Metallic Residues, ERDC-TR-13-5, August 2013;
Cost and Performance Report of Incremental Sampling Methodology for Soil Containing Metallic Residues, ERDC-TR-13-10, September 2013;

Evaluation of Sampling and Sample Preparation Modifications for Soil Containing Metallic Residues, ERDC-TR-12-1, January 2012.

Guidance from other states where this method is used extensively:

Alaska Department of Environmental Conservation draft Guidance on Multi Increment Sampling, March 2009. http://dec.alaska.gov/spar/csp/guidance/multi_increment.pdf

Hawaii Department of Health Technical Guidance Manual Notes: Decision Unit and Multi-increment Sample Investigations, March 2011. Contains bullet list of considerations for sample processing, field methods, and data analysis when using incremental sampling. http://hawaiidoh.org/references/HDOH%202011b.pdf

Use of Decision Unit and Incremental Sampling Methods To Improve Site investigations, 2015 M2S2 Webinar Series; http://www.clu-in.org/conf/tio/m2s2fy15-1_121014/slides/M2S2-MC-Mow.pdf

COVER SHEET
STANDARD OPERATING PROCEDURE

Operation Title: **REQUIREMENTS FOR THE DEVELOPMENT OF A SITE SPECIFIC QUALITY ASSURANCE PROJECT PLAN TO MEET USEPA HRS REQUIREMENTS**

Originator: **Brian Beneski**
Quality Assurance Coordinator
Division of Remediation
Bureau of Remedation 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:

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

Department Commissioner:

PAUL MERCER — *Print name*
Signature
1-3-2017 — *Date*

DISTRIBUTION;

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

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1.0 PURPOSE

The purpose of this document is to describe the MEDEP/DR procedure for developing a Site Specific Quality Assurance Project Plan (QAPP) for site activities where a QAPP is deemed necessary.

A QAPP will be generated for field work conducted specifically for an HRS. Additionally, a QAPP may be generated for a specific site if the QAC, the MEDEP/DR project manager and supervisor, and/or the appropriate project personnel at USEPA Region I determine one is necessary. Examples in which a site specific QAPP may be generated would a Site which is will in all likelihood be listed on the National Priority List (NPL), or a site in which there is a possibility of litigation.

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.

The Quality Assurance Coordinator (QAC) will review and provide comments to the QAPP as necessary to assure that the requirements for a QAPP are met and assure consistency between QAPPs generated by MEDEP/DR. Appropriate peer review from USEPA Region 1 is also required for QAPPs generated for USEPA funded projects.

4.0 DEFINITIONS/ACRONYMS

4.1 MEDEP/DR - Maine Department of Environmental Protection's Division of Redemption
4.2 QAPP - Quality Assurance Project Plan
4.3 HRS - Hazard Ranking System
4.4 QAC - Quality Assurance Coordinator
4.5 QAM - Quality Assurance Manager
4.6 USEPA - United States Environmental Protection Agency, Region I
4.7 DQO - Data Quality Objectives

4.8 SOP - Standard Operating Procedure
4.9 QC - Quality Control

5.0 GUIDELINES AND PROCEDURES

5.1 INTRODUCTION

This procedure outlines the minimum specific requirements that must be included in a QAPP. It is intended to assure that the data generated will meet the Data Quality Objectives that are required (and identified in the QAPP) for a specific project and/or site.

5.2 GUIDELINES

Prior to developing a QAPP MEDEP/DR staff will develop Data Quality Objectives as described in the QAP section 5.0.

A QAPP must have the following elements.

5.2.1 TITLE PAGE

The following elements shall be included on the title page: title of plan, site name, program authority, and name of organization implementing the plan. Additionally, include names, titles and signatures of staff completing the QAPP and any approving officials, including dated signed.

5.2.2 TABLE OF CONTENTS

This section should list all sections, figures, tables, references and appendices, along with page numbers indicating location of each.

5.2.3 INTRODUCTION

5.2.3.1 Project Organization

The Project Organization must identify data generators, data-users and decision makers, as well as specific organizations, job categories, and job responsibilities. Also authorities associated with the QAPP, relationship between organizations, and lines of communication should be defined.

5.2.3.2 Project Goal and Data Use

The goal of the project and the end use of the data as described in the DQO section of the QAP will be stated in the introduction. The regulatory or exposure situation that determined the need for the project will be described in this section.

5.2.4 BACKGROUND

This section will include site historical and background information.

5.2.5 PROJECT DESCRIPTION

An identification of all measurements proposed, including physical measurements and characteristics, chemical analyses, and a schedule for performance of the activities will be contained in this portion of the document.

5.2.6 SAMPLING PROCESS DESIGN (EXPERIMENTAL DESIGN)

This section will present the rationale for sampling design. Sampling design can include the elements of sample location, sample matrices, measurement parameters, geographical spacing, sampling methods and equipment, monitoring device design and installation (e.g. Monitoring wells), sampling intervals (vertical, horizontal and time), sample documentation, corrective action and schedule of work.

This section should provide the justification for the measurements and activities proposed in the project description to meet the project DQOs.

5.2.7 SAMPLING METHODS REQUIREMENTS

Standard Operating Procedures (SOPs) or site-specific procedures for performance of field sampling activities should be provided in this section (reference MEDEP/DR SOPs and/or USEPA procedures used for collecting samples).

Description of the sample collection devices and procedures for decontamination of equipment and materials should be outlined in this section.

5.2.8 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

A description of the documentation, sample packaging, and shipping procedures will be contained in this section. All observations regarding sample location will be recorded in a field logbook or log sheets.

5.2.9 ANALYTICAL METHOD REQUIREMENTS

The methods used to analyze both field and laboratory samples are cited or described in this section. In the case of laboratory methods a reference to the identification number and source of the method must be stated, the method itself need not be reproduced.

If several analyses are proposed, a table identifying each analysis for each sample location and medium is recommended.

5.2.10 QC REQUIREMENTS

This section refers to both the number of QC samples that will be collected in the field and the QC samples analyzed in the Laboratory to allow data validation. Field QC samples such as field replicate and rinsate blanks are collected at a rate of 5 percent, or at least one per sampling event. The procedures indicated below in Sections 4.12 and 4.13 of this document are to be performed where appropriate.

5.2.11 FIELD QC

The sampling component of the QAPP shall include:

A. Procedures for documenting and justifying any field actions contrary to the QAPP;

B. Documentation of all pre-field activities such as equipment check-out, calibrations, and container storage and preparation;

C. Documentation of field measurement QC data;

D. Documentation of field activities;

E. Documentation of post-field activities including sample shipment and receipt, field team de-briefing and equipment check-in; and

F. Generation of QC samples including duplicate samples, field blanks, equipment blanks, and trip blanks. Table 1 shows the frequency and number of QC samples that should be collected during a sampling event.

5.2.12 INSTRUMENT CALIBRATION AND FREQUENCY

A description of the calibration procedures and frequency for field instruments used must be included in this section. For instruments that have an approved DR SOP which includes a description of calibration of the instrument the SOP number will be included here. At a minimum, calibration procedures and frequency must meet the manufacturer's requirements. The manufacturer's instructions for calibration may be included as an attachment to the QAPP. Calibration of laboratory equipment used for sample analysis will be described in the laboratory SOPs. If the analytical method selected prescribes the calibration procedures and frequency, citation of the method number is adequate in the QAPP.

TABLE 1
Guidelines for Minimum QA/QC Samples
For Field Sampling Programs

Medium	Replicates[3]	Field Blanks[2]	Trip Blanks[4]	Rinsate Blanks[3]	Background Samples
Aqueous	One in twenty	As conditions necessitate.	One per shipping container with VOC samples	One per 20 decontamination procedures	Minimum of one per sampling event per medium
Soil, sediment	One in twenty	As conditions necessitate.	One per shipping container with VOC samples	One per 20 decontamination procedures	Minimum of one per sampling event per medium
Air	One in twenty		One per shipping container with VOC samples	One per decontamination procedures	Minimum of one per sampling event per medium
Source material	One in twenty	As conditions necessitate.		One per 20 decontamination procedures	

Notes: 1) QA/QC requirements on a site-specific basis may dictate a more stringent frequency. Laboratory blanks and spikes are method-specific and are not included in this table. However, as a minimum, 10% of laboratory analyses must be QC samples.

2) Field Blanks are required when background contamination of the breathing zone is detected. One should be collected from each different industrial or functional area sampled during the most active time of day.

3) Replicate and rinsate samples are collected at the minimum rate of 1 per 20 samples/decontamination procedures. If fewer than 20 samples are collected, one replicate and one rinsate sample must be collected.

4) Trip blanks are prepared in the laboratory or at another off-site location from de-ionized water. They are never prepared on-site, or from soils or other solid material.

5.2.13 ASSESSMENT AND RESPONSE ACTIONS

Assessments required for most projects include:

A. Management systems reviews;
B. Technical systems audits; and
C. Performance evaluation samples.

Reviews and audits are conducted periodically to check that activities described in the field QAPP and in the QA Program Plan have been appropriately conducted and documented.

In addition to describing the components of each type of review/audit, the section must describe how appropriate response actions for non-conformance will be addresses and documented, and who is responsible for implementing corrective actions The QACC or QAM may conduct management systems reviews or technical systems audits at any time during the course of a project.

5.2.14 DATA REVIEW, VALIDATION AND VERIFICATION REQUIREMENTS

5.2.14.1 Data Review

This section should state the criteria used by the project manager to review and validate data; (i.e., accept, reject or qualify data). Additionally, the following questions should be answered: What recovery and other standards must the lab meet? How much precision and accuracy are desired/required of the analytical data to be acceptable? What percent of the data must be laboratory analytical data for it to be acceptable? The project DQOs should be considered when all data is reviewed.

5.2.14.2 Validation and Verification Methods

This section will describe how the data reviews identified above will be conducted. The equations for precision, accuracy and completeness are included in the general QAP, and equations for any other DQOs evaluations will be included in the QAPP.

This section should also describe how the data are handled if the described criteria are not met, and answer the following questions: At what point is the data rejected? At what point is it qualified? What types of qualifiers are applied? When is re-analysis by the lab required if the standards are not met? What are the consequences if adequate sample is not available, and/or holding times have been exceeded?

5.2.15 RECONCILIATION WITH DQOs

After each phase or major portion of a sampling event or project, the results must be compared with the quantitative and qualitative DQOs and project objectives identified in the QAPP. Any limitations on the data, the usefulness of the data, and changes to DQOs as a result of any limitations must be addressed. Applicable uses of the data that have been qualified will be compared to the original uses desired (DQOs). Additional data collection activities may be required if the usability of the data is not satisfactory. This section should identify the criteria for determining that additional data collection is needed.

5.2.16 DISTRIBUTION LIST

At a minimum, the following people will receive and/or review copies of a QAPP:

- MEDEP/DR Site Project Manager
- MEDEP/DR QAC
- Site Geologist
- Project Field Staff
- USEPA Project Manager

Anyone else determined necessary by the Site Project Manager, QAC, or USEPA Project Manager. A distribution list stating the names of persons receiving copies and/or reviewing the QAPP and their position will be included in the QAPP.

5.2.17 SPECIALIZED TRAINING

Need for specialized training will be stated in the QAPP. Documentation of staff attending training will be placed in the project file upon completion of said training.

5.2.18 DOCUMENTATION

All field notes will be kept as stated in MEDEP/DR SOP DR#013 - Documentation of Field Notes and Development of a Sampling Event Trip Report. Sample chain of Custody procedures for the project will be as stated in MEDEP/DR SOP DR#012 - Chain of Custody Protocol. Any variations or modifications to documentation procedure will be stated in the QAPP. All documentation will be placed in the Site file as a permanent repository, in accordance with Section 11.0 - Document Control, of the MEDEP/DR QAP.

5.2.19 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Equipment used for projects will be inspected, maintained, and calibrated, in accordance with manufacturer's instructions and/or as outlined in the MEDEP/DR protocol stated in Section 7.0 - Equipment of the MEDEP/DR QAP. Documentation of such activities will be in accordance with Section 7.0 of the MEDEP/DR QAP.

5.2.20 INSPECTION OF SUPPLIES AND CONSUMABLES

A list of expected consumable supplies will be included in the QAPP. All consumable supplies will be inspected upon their receipt, and again prior to being taken into the field by field staff. Any supplies that are determined not acceptable will not be used for the project. If it becomes necessary to use material that may not meet specifications, this shall be stated in the field notes of the person conducting the inspection.

5.2.21 FINAL REPORT(S)

A final report will be generated at the end of the project that will summarize the data generated during the project by the project manager. Included in this report will be a recommendation for additional work, and the appropriate entity to conduct the additional work. If no additional work is determined to be necessary, a "no further action" conclusion will be stated, with the rationale for such a conclusion.

COVERSHEET
STANDARD OPERATING PROCEDURE

Operation Title: **EQUIPMENT DECONTAMINATION PROTOCOL**

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:

Bin 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 MEDEP/DR procedure for decontamination of equipment.

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 GUIDELINES AND PROCEDURES

4.1 INTRODUCTION

Decontamination is an essential part of a successful field operation. This procedure is intended to ensure that field equipment is properly and adequately decontaminated in order to preserve the integrity of data collected with that equipment in the field as well as to protect staff working with the equipment from exposure to contaminants.

In addition to this guideline, personnel using a specific piece of equipment for the first time should also review the manufacturer's user manual for any equipment specific decontamination procedures recommended by that manufacturer.

4.2 PLANNING

Prior to conducting any type of sampling or other field work, a sampling and analysis plan (SAP), or in the case of remedial activities, a work plan and a health and safety plan (HASP), must be developed. Protocol for the development of a Sampling and Analysis Plan can be found in BRWM/DR SOP RWM-DR-014 – Development of a Sampling and Analysis Plan. A conceptual site model (CSM) which includes expected contaminants to be encountered is part of a SAP. Specific chemicals, particularly when sampling containers or tanks, may require the use of neutralizing agents or other specialty decontamination procedures. The need for special decontamination agents for chemicals expected to be found at a site must be outlined in the SAP and HASP.

Decontamination procedures should be completed with an appropriate level of personnel protection. PPE required for staff conducting decontamination must also be indicated in the SAP/ HASP.

4.3 DECONTAMINATION EQUIPMENT

Equipment required for decontamination may include:

- Brushes, scrapers, sponges;
- Spray bottles;
- Water, tap or deionized;
- Soap, such as liquinox;
- Paper towels;
- Methanol or other solvent wash (as needed).

Other specialty decontamination equipment, such as a powered high pressure wash or special neutralizing chemicals, may be required, and must be described in the SAP.

4.4 PROCEDURES

Decontamination generally involves three steps: 1) gross contamination removal; 2) field decontamination; 3) secondary decontamination.

4.4.1 GROSS CONTAMINATION REMOVAL

Gross contamination removal involves the removal of large dirt and mud chunks or clods, and other visible contamination, from the object being decontaminated, and prevents washwater from becoming contaminated by mud and dirt.

If a piece of equipment is grossly contaminated, use appropriate tools/equipment (for example, scraper, bristle brush, sponge, etc.) to remove the excess soil, sludge, and other obvious contamination. While removing the contamination, spray the items of equipment with water or a detergent/water solution. Such spraying (especially from a high pressure sprayer) may loosen the contamination with a minimal amount of effort. Remember that each item used for the decontamination of equipment may also become contaminated and must be appropriately handled, stored, and either decontaminated itself or disposed of.

In addition, the decontamination of equipment generates contaminated rinse liquids, sludges, etc., that potentially may need to be containerized onsite until proper disposal arrangements are made. In many instances, the levels of contamination may be sufficiently low and disposal at a hazardous waste facility may not be necessary. Disposal of wash and rinse fluids will be outlined in the SAP, Work Plan, and/or HASP.

Certain items that become grossly contaminated and cannot be practically decontaminated (i.e. small tools and tools with wooden handles) should be disposed of properly. In some instances it is more practical and sensible to dispose of these items properly than to attempt decontamination. Such decisions will be made by the field personnel performing the work activities at the site.

4.4.2 FIELD DECONTAMINATION

Once the gross contamination has been removed from a piece of equipment, a more thorough cleaning involving detergents (such as Liquinox®) and rinses should be done. The primary steps to take when performing field decontamination of equipment are dependent on what item of equipment is being decontaminated; however, these steps will generally be followed:

1) Disassemble the equipment (if applicable), and place in a bucket or suitable sized basin filled with a deionized or tap water and Liquinox® (or other appropriate detergent);
2) Scrub the equipment thoroughly with a suitable sized brush;
3) Rinse the inside and outside of the equipment with deionized or tap water;
3A) Rinse equipment with methanol solvent wash (if determined necessary, see below);
4) Inspect equipment to assure proper decontamination.

In some instances, an additional wash with methanol may be required. The need for a methanol solvent (or other solvent, or chemical neutralizing agent) wash will be determined on a project by project basis, and if required, outlined in the project's SAP. A methanol solvent wash may be necessary in the case of sampling in high levels of contamination, or when sampling particularly difficult to clean contamination such as coal tar.

Instruments such as pH meters, conductivity meters, and other instruments which are immersed in a medium also need field decontamination. In many cases, these instruments do not come into contact with the actual "material" that will be collected for analysis. An example would be collection of groundwater samples using "low flow" methodology (Low flow methodology is outlined in SOP# RWM-DR-003). In instances such as this, a thorough rinsing of the instrument probes would suffice, with additional decontamination to follow after the sampling event in a controlled indoor environment, when greater care can be taken so the instrument is not damaged.

If the equipment to be decontaminated is delicate, such as a photoionization detector (PID) or a Combustible Gas Indicator (CGI), care must be taken when decontaminating so the equipment is not damaged. The best way to avoid the need to decontaminate items such as these is to prevent contact with contamination in the first place. Develop a method of wrapping/bagging these instruments in polyethylene sheeting/bags so that contact with contamination is minimized but the performance of the instrument is not adversely affected.

4.4.3 SECONDARY DECONTAMINATION

It is recommended that all field equipment be decontaminated again upon the end of a project in a controlled environment (i.e., indoors, with uninterrupted water delivery) to assure that it as been properly decontaminated and is still working before its next use. Procedures for secondary decontamination would mimic field decontamination, however the availability of uninterrupted water under pressure, plus counter space and being indoors, would allow for greater care taken during decontamination.

4.4.4 LARGE EQUIPMENT DECONTAMINATION

For site work involving large equipment, such as backhoes, bulldozers, drill rigs, etc., a site specific decontamination procedure will be required in the Site specific work plan. As a guideline, a thorough brushing, scraping, washing and/or steam cleaning should be completed. Such maximum contact points as tires, treads, buckets, blades, and drill pipe/bits, should be thoroughly decontaminated in an effort to prevent migration of contaminants off the site. At sites where equipment becomes highly contaminated, provisions to collect rinsate water/solutions may have to be made.

4.5 DECONTAMINATION ALTERNATIVES

Decontamination is, by its nature, an arduous and painstaking task which is often better to avoid. By eliminating contact with contamination and/or using disposable equipment, decontamination of equipment may be avoided. Such alternatives are:

1) Dedicating specific equipment to a specific site (e.g. specific bailers to specific wells) when economically feasible;
2) Using disposable equipment when applicable (e.g. disposable tubing), and;
3) Wrapping monitoring equipment in plastic bags(or other materials) to protect from contamination.

It is important to keep monitoring equipment such as PIDs or CGIs from contacting soil or liquids at hazardous substance sites. However, if an instrument becomes contaminated it must be decontaminated, regardless as to how protected the equipment was. Additionally, all equipment should be inspected and decontaminated at the end of the project even if protected from contamination.

5.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Data quality objectives (DQOs) must be determined prior to sampling, and outlined in the SAP. **Equipment blanks** are samples obtained from equipment rinsate and may be collected to assure decontamination is effective, and preventing cross contamination. Equipment blanks should be collected at a rate of 5%, or as stated in the SAP to meet DQOs.

5.1 EQUIPMENT BLANK COLLECTION PROCEDURE

1) Procure appropriate water for equipment blank and store in clean area;
2) decontaminate equipment;
3) Rinse equipment again with blank water, and collect into sample containers for laboratory analysis. Try to drain rinse water directly into containers; however, it may be necessary to utilize a rinsate collection trough, or a funnel. Be sure to decontaminate trough or funnel prior to using for collection of blank.
4) Store/preserve samples with other samples, and submit to laboratory following standard chain of custody protocol.

5.1.1 Equipment Blank Water

Equipment blank water should consist of de-ionized water procured from the laboratory conducting the analysis. However, tap water may be used if metals and trihalomethanes are not contaminants of concern. Source of equipment blank water will be stated in the SAP, and documented in the field notes of the sampling event.

6.0 DOCUMENTATION

Documentation of decontamination activities, including collection of equipment blanks, should be conducted as outlined in BRWM/DR SOP# RWM-DR-013, Documentation of Field Activities and Development of a Trip Report, and the SAP.

COVER SHEET

STANDARD OPERATING PROCEDURE

OPERATION TITLE: **PROTOCOL FOR THE USE OF PORTABLE AIR MONITORS**

ORIGINATOR NAME: **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*
David Burns — *Signature*
12/4/16 — *Date*

QMSC Chair:

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

Department Commissioner:

PAUL MERCIER — *Print name*
[signature] — *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 use field portable organic and inorganic air monitors (PAMs), including photo ionization (PID) and multi-gas detectors.

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.

The **User Group Monitoring Equipment Coordinator (UGMEC)** is the staff person that is responsible for coordinating maintenance of the PAMs, determining the staff who have demonstrated sufficient training and proficiency of the equipment, and for maintaining the list of individuals who have demonstrated such proficiency and can therefore use the PAM for Site Monitoring and for soil field screening.

The Unit Leaders and Division Director, with input from the UGMEC, are responsible for determining which positions will be required to be a "user" of the Division's PAMs. The Unit Leaders will be responsible for providing the funding and allowing staff the time necessary to attend the training and testing requirements for use of the PAMs.

All staff designated as "users" of the PAMs are responsible for attending the training and completing the testing requirements for use of the PAMs. Staff, whether they are designated as a "user" or not, will not be allowed to use the PVM until they have demonstrated there proficiency as outlined in Section 5 and received approval from the UGMEC.

4.0 GUIDANCE AND PROCEDURES

4.1 EQUIPMENT OVERVIEW

The three uses of a PAM in the investigation and remediation of sites are: 1) for monitoring the potential presence, levels of, or absence, of hazardous contaminants and environmental conditions that could effect the health and safety of workers; 2) utilizing the "headspace"

technique, in which soils are "screened" for the possible presence of contamination. For more information about using PID for jar or bag headspace technique, see MEDEP/DR SOP# RWM-DR-011 – Field Screening of Soil Samples Utilizing Photoionization and Flame-Ionization Detectors. This SOP outlines the protocol for using a PAM for these tasks.

The MEDEP/DR has several types of PAMs that may be used for Site Monitoring. These currently include:

- RAE Instruments MiniRAE 3000 PIDs;
- RAE Instruments ppbRAE 3000 PIDs;
- RKI Eagle and Eagle II Portable Gas Detectors; and
- MSA Altair 5 Multi-Gas Detector.

For full specifications of detection capabilities and limitations of these instruments, please refer to equipment-specific manuals, which are kept with the instrument.

4.2 THE PHOTOIONIZATION DETECTOR

Currently, the MEDEP/DR has two types of PID; RAE Instruments MiniRAE 3000s (MiniRAEs) and RAE Instruments ppbRAE 3000s (ppbRAEs). The MiniRAE is capable of sampling and measuring the concentration of certain organic and inorganic vapors at concentrations of 0.1 to 15,000 parts per million by volume (ppmv). The ppbRAE is capable of sampling and measuring the concentration of certain organic and inorganic vapors at concentrations of 1 part per billion by volume (ppbv) to 10,000 ppmv.

It should be noted that all chemicals of potential concern (COPCs) have different ionization energies and correction factors on the PIDs. Before determining that a PID is an appropriate device for sampling or monitoring, users should consult the manufacturer's technical note on response factors to determine if the COPC is detectable with the 10.6 eV lamp that these instruments use, and what the appropriate correction factor for that COPC is when the instrument is calibrated to an isobutylene standard. **All users of PIDs must review the manual and understand the instrument completely before use.**

If site work is to be conducted in which the PID is to be used as a monitoring device, a site and event specific Health and Safety Plan and a Filter Respirator Selection Guide must be completed, reviewed and approved by an MADEP/DR Oil and Hazardous Materials Specialist or by the BRWM Safety and Training Unit prior to conducting the work.

A more detailed technical discussion of the theory of operation of these PIDs, along with the operation and maintenance instructions, can be found in each instruments' respective manual. A copy of the instruments' manual is kept with each instrument. Copies of the instruction manual will be kept with the UGMEC, and can also be found online at the RAE Instruments web site.

The PID's most basic use is the measurement of organic and inorganic vapors in air. From this, two specific tasks can be completed:

1) Atmospheric monitoring to determine the potential presence, levels of, or absences of hazardous contaminants and environmental conditions that could affect the health and safety of workers at a field site.

2) Screening of soil for the presence of volatile organic compounds (VOCs) in the field utilizing the "Jar Headspace Technique" (See BRWM/DR SOP# RWM-DR-011 - Field Screening of Soil Samples Utilizing Photoionization and Flame-Ionization Detectors).

3) Additionally, the PID may be used as a general screening tool for the presence of VOCs when investigating hazardous substance sites.

4.2 THE RKI INSTRUMENTS EAGLE AND EAGLE II

The **Eagle I** and **Eagle II** are portable instruments designed to measure combustible gas or vapor content and the level of oxygen in air. Combustible gas is measured in percent of lower explosive limit (LEL). Oxygen is measured in percent. The meters have audible alarms to provide a warning of a change in conditions at a preset action levels.

In addition to combustible gas and oxygen, the **Eagle I** owned by the MEDEP/DR also has methane, hydrogen sulfide, and carbon monoxide meters. The methane and hydrogen sulfide function can be useful for landfill investigations, and the carbon monoxide meter for screening during use of generators, or the use of other combustion engines. Operation of these functions can be found in the instruction manual.

In addition to combustible gas and oxygen, the **Eagle II** owned by the MEDEP/DR also has a PID and carbon dioxide meters. The PID and CO2 functions are particularly useful for soil and sub-slab vapor sampling. Operation of these functions can be found in the instruction manual.

As with all field monitoring equipment, the Eagles have limitations. For example, they will not indicate the combustible gas content in an inert gas background, atmospheres containing less than 10% oxygen, or a reducing atmosphere. The limitations and other general warnings and cautions for the Eagle use can be found in the instruction manual.

A more detailed technical discussion of the theory of operation of the Eagle and Eagle II, along with their operation, can be found in their respective instruction manuals. A copy of the manual is kept with each instrument. Additional copies of the instruction manual will be kept with the UGMEC, and can also be found online at the manufacturers (RKI Instruments) web site. **All users of the Eagle must review the manual and understand the instrument completely before use.**

If site work is to be conducted in which the Eagle is to be used as a monitoring device, a site and event specific Health and Safety Plan and a Filter Respirator Selection Guide must be completed, reviewed and approved by an MEDEP/DR Oil and Hazardous Materials Specialist or by the BRWM Safety and Training Unit prior to conducting the work.

4.2 THE MSA ALTAIR 5 MULTI-GAS METER

The **MSA Altair 5 IR** is a portable instrument designed to monitor hazardous conditions in air: combustible gas, expressed in percent of lower explosive limit (LEL); oxygen is measured in percent by volume; and carbon dioxide in percent by volume. The meters have audible alarms to provide a warning of a change in conditions at a preset action levels.

As with all field monitoring equipment, the Altair 5 IR has limitations. For example, it will not indicate the combustible gas content in an inert gas background, atmospheres containing less than 10% oxygen, or a reducing atmosphere. It is not approved for use in oxygen-rich atmospheres above 21.5%. The limitations and other general warnings and cautions for the Altair 5 IR use can be found in the instruction manual.

A more detailed technical discussion of the theory of operation of the Altair 5 IR along with its operation can be found in the instruction manual. A copy of the manual is kept with the instrument. Additional copies of the instruction manual will be kept with the UGMEC, and can also be found online at the manufacturers (MSA Safety) web site. **All users of the Altair 5 IR must review the manual and understand the instrument completely before use.**

If site work is to be conducted in which the Altair 5 IR is to be used as a monitoring device, a site and event specific Health and Safety Plan and a Filter Respirator Selection Guide must be completed, reviewed and approved by an MEDEP Oil and Hazardous Materials Specialist or by the BRWM Safety and Training Unit prior to conducting the work.

5.0 TRAINING

5.1 TRAINING REQUIREMENTS

In order to be a designated user of any portable air monitoring equipment, each user must undergo the following training:

- SARA 40 hour hazardous materials site training;
- Annual 8 hour refresher training; and
- Training specific to the instrument to be used, either as part of the annual field equipment training as offered jointly by MEDEP/DR and MEDEP/BRWM Division of Technical Services, or other training approved by the UGMEC.

5.2 TESTING REQUIREMENTS

Additionally, all users must undergo a "User Proficiency Test" given by the UGMEC annually. This test will consist of each user conducting, at a minimum, the following tasks:

- Turning on the PAM;
- Preparing the PAM for use;
- Calibrating the PAM;

- Demonstration that the user knows the use and limitations of the instrument and will be able to unsure safe conditions at a site with the instrument, and
- Turning off the unit, and hooking up to the charger.

The UGMEC will be responsible for maintaining a list of staff that have demonstrated proficiency. This list will be updated annually.

6.0 STORAGE LOCATION

The PAMs will be kept in the MEDEP/DR storage room at the BRWM Storage Warehouse in the equipment storage room. A sign-out sheet for reserving PAMs and other equipment is maintained by the UGMEC, and users are responsible for signing out any equipment they intend to use.

7.0 MAINTENANCE

Once a month the UGMEC (or their designee) will conduct a maintenance check of the PVM, in which the PVM will be:

- Turned on;
- Calibrated;
- Tested to assure that PAM is working properly;
- Run for several hours to discharge batteries; and
- Recharged.

Instructions for calibration and troubleshooting for the PAMs can be found in instrument's respective manual.

The UGMEC (or their designee) shall return the PAMs to its manufacturer or other authorized service center every three years, at a minimum, for cleaning, testing, and calibration. As with all maintenance and repair activities, a record of such work shall be kept with the UGMEC.

If during the course of maintenance or use the PAM is not functioning correctly and cannot be fixed to the satisfaction of the UGMEC, the instrument will be tagged with a "Do Not Use, Broken" tag, until it has been fixed and/or has otherwise been determined that the PAM is working appropriately.

All monthly maintenance checks will be logged in a monitoring equipment log book kept with each individual instrument.

8.0 USE OF PORTABLE VAPOR MONITORS

8.1 PLANNING/PREPARATION

As with any sampling event, a sampling and analysis plan (SAP) and a health and safety plan (HASP) must be developed. Protocol for the development of a SAP and HASP can be found in MEDEP/DR SOP# RWM-DR-014 – Development of a Sampling and Analysis Plan.

If the PAMs are to be used for environmental monitoring, included in the SAP/HASP will be a description of the monitoring procedures to be used to monitor the presence and concentration of hazardous contaminants potentially on site. Health safety levels of chemical vapors can be found in various OSHA, NIOSH, and USEPA websites and guidebooks, and manufacturers of respiratory protection equipment. Up to date information must be obtained to assure appropriate respiratory protection decisions are made. The need and requirements for respiratory protection must be addressed in the sampling plan; reference and guidance documents for determining levels of respiratory protection must be included.

The PAMs will be included with the other MEDEP/DR equipment sign out; all use of the PVMs will require signing out the equipment beforehand.

8.2 FIELD USE

Use of the PAMs and their various features are described in the Instruction Manual. These manuals are found with the instrument itself, and an additional copy is kept by the UGMEC. Please refer to instruments manual for specific instructions on using these instruments.

8.2.1 Calibration

The PVMs shall be calibrated, as described in the Instruction Manual, prior to any use. This calibration shall be documented in the official field notebook for the event for which it is to be used (Documentation protocol for field calibration and all field activities can be found in MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report). After calibration, the instrument should be allowed to "sniff" a substance that will cause it to react to assure that it is working properly (a "Sharpie" type magic marker for a PID, for example). If the instrument does not appear to be working IT MUST NOT BE USED FOR HEALTH MONITORING PURPOSES. Another instrument must be used, or the work not conducted until functioning monitoring equipment is available. All problems with the functioning of the instrument shall be reported to the UGMEC.

During the course of the work day, the instrument should be recalibrated after all long work stoppages (such as lunch break). Additionally, the PAM's response should be periodically tested by challenging it with calibration gas. If the instrument does not read within 15% of the calibration gas, it should be recalibrated. All recalibration and meter challenges must be documented in the field notebook.

8.2.2 Monitoring

Use of the PAMs for environmental monitoring in the field will be as outlined in the SAP/HASP for the specific project. Any deviations from the SAP/HASP will be documented in field notes.

If the PAM is being used for Headspace Screening of soil, refer to MEDEP/DR SOP# RWM-DR-011 – Field Screening of Soil Samples Utilizing Photoionization and Flame-Ionization Detectors.

8.2.3 End of Site Work

At the end of the day, the instrument will be decontaminated, if necessary, and the batteries recharged. Decontamination procedures can be found in MEDEP/DR SOP# RWM-DR-017 – Equipment Decontamination Protocol; additional decontamination procedures may also be outlined in the SAP/HASP. Once the instrument is no longer needed and its batteries charged, the instrument will be returned to its storage location. If problems were encountered during use of the PAM, the users will inform the UGMEC who will evaluate the need for possible corrective action.

9.0 DOCUMENTATION

9.1 USERS LIST

The UCMEG will keep a list of qualified users for the PAM, and recorded in the instrument log book. Users will be updated on an annual basis.

9.2 MAINTENANCE

All maintenance activities, including monthly calibration checks, repairs, and factory/authorized service center work shall be recorded in the Instrument's Log book. All use shall be recorded in the Instruments log book.

9.3 FIELD DOCUMENTATION

All sampling activities must be documented as outlined in MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report. Due to the nature of environmental monitoring, it may be necessary (or just easier) to develop specific forms or use forms generated EPA, contractors, or other agencies for record keeping. Use of forms not bound by field books is discussed in MEDEP/DR SOP# RWM-DR-013. Specialized forms should be outlined in the SAP. Specialized forms should be printed on waterproof paper to prevent damage during field use.

COVER SHEET
STANDARD OPERATING PROCEDURE

OPERATION TITLE: **PROTOCOL FOR GROUNDWATER/SURFACE WATER INTERFACE SAMPLING USING A PORE WATER SAMPLER**

ORIGINATOR NAME: **Brian Beneski**
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12/1/2016 — *Date*

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12/30/16 — *Date*

Department Commissioner:

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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 standard operating procedure (SOP) for collecting groundwater samples using a pore water sampler.

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 GUIDANCE AND PROCEDURES

4.1 INTRODUCTION

It is often difficult to determine the extent and origin of contamination using solely surface water sampling techniques. In some cases, a surface water body may be clean but the groundwater beneath it may be contaminated. Thus, sampling the groundwater prior to its discharge to a surface water body may lead to a better understanding of the extent and origin of contamination. This can be accomplished by using a pore water sampler.

Underlying this procedure is the assumption that surface water bodies are common discharge points for groundwater. Thus, a sample of the water beneath a stream or riverbed would be characteristic of the groundwater in the area. This SOP identifies sampling protocols to be followed when collecting samples using a pore water sampler.

4.2 PLANNING

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

4.3 EQUIPMENT

The following is a list of equipment utilized for collecting groundwater samples using the pore water sampler method.

- Peristaltic Pump
- Tubing – Two types of tubing are needed for this sampling technique. Low Density Polyethylene (LDPE) tubing with an inside diameter (ID) of 0.17-inch or 0.25-inch is the standard size tubing used with pore water samplers. Note that the 0.25-inch ID tubing fits over the top opening of the pore water sampler. Using 0.17-inch ID tubing requires a small piece of 3/8-inch outer diameter (OD) silicone tubing to connect with the pore water sampler. The same silicone tubing must be used with a peristaltic pump to collect a pore water sample.
- A knife or other tool to cut tubing to desired lengths will be required.
- Field Parameter Instruments – devices for measuring dissolved oxygen (DO), conductivity and pH of pore water and surface water.
- Turbidity Meter – If testing for dissolved metals turbidity must be measured to determine whether the sample must be field-filtered prior sample collection.
- Sample Filters – 0.2 to 0.45 micron (µm) in-line filters are appropriate for dissolved metals.
- Power Supply – A power supply will be necessary to operate the peristaltic pump.
- GPS Unit – To record geospatial locations of pore water samples.
- Life Preservers – when working around or near waters.
- Hip Waders – This sampling method will likely require the sampler to wade into stream or river in order to insert pore water sampler in a suitable location.
- Boat – Depending on the depth and size of a water body, a boat may be required to access sample points. Even if sample points are accessible by wading, boats and canoes can also act as equipment barges to help transport equipment between sample locations.
- Pore Water Samplers – A pore water sampler comes in two parts, a strengthening rod and the pore water sampler itself, both made of stainless steel. The pore water sampler is basically a hollow tube with narrow slits at the tip that allow groundwater to percolate through. The strengthening rod slides into the pore water sampler, and while in place, blocks all water from entering pore water sampler. Both pieces are placed in a PVC

sheath for protection. Although the pore water sampler is fairly sturdy, exercise caution during use, as once either piece becomes bent, the equipment is useless. Bring at least as many pore water samplers as there are sampling locations, as onsite decontamination is difficult and not recommended. Once pore water samplers have been used **do not** re-insert the strengthening rod until after the sampler has been decontaminated and cleared of sediment.

- Permanent Pore Water Samplers – A pore water sampler modified for long-term deployment. This may be necessary for silty and/or organic rich sediments where low turbidity samples are required and traditional pore water samplers will not meet the DQOs for the site.

- Sample Collection Containers – These will be provided by the lab, and will vary depending on parameters to be sampled.

4.4 PORE WATER SAMPLER PROCEDURES

4.4.1 MOBILIZATION/ RECONNAISSANCE

Prior to sampling, suitable access points to pore water sampling locations should be identified and reviewed to assure safe sampling. Surface water body flow data should be consulted prior to sampling if available, and pore water sampling should not be conducted during a flood stage. Stream flow information for some sites within the State of Maine can be found at the following USGS website:

http://me.water.usgs.gov/

4.4.2 SAMPLING PROCEDURE

Upon arriving at the site, collect field parameter measurements from the surface water body or bodies that are either being recharged by or recharging site groundwater. This will provide some comparative data to field parameter measurements of pore water samples.

Once an appropriate sampling location has been determined, carefully insert a pore water sampler into the river/streambed to desired depth. Do not remove the strengthening rod until the sampler has been securely placed into the sediment. The pore water sampler should be inserted deep enough as to ensure the sample collected will contain only groundwater and no surface water. Typically, this depth is at least 8 inches. Once this has been accomplished, remove the strengthening rod from the pore water sampler and connect the pore water sampler to a peristaltic pump using appropriate tubing described in Section 6.0 of this SOP. Turn the pump on and purge for several minutes until purge water is relatively clear. Record field parameter measurements of the purge water prior to collecting the sample. If the purge water is not visually free of sediment, it should be documented in field notes (see MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report).

If sampling for metals, it is recommended that turbidity be measured. If turbidity is above 20 NTUs, it is recommended that an additional sample be collected that has been filtered through a 0.2-0.45 μm inline particulate filter.

After water has been sufficiently purged, decrease pumping rate if necessary (e.g., to fill 40ml VOA vials) and begin collecting sample. Pumping rate should be low enough to ensure that surface water is not drawn into the sample. A low flow purging and sampling protocol is not required, but if desired, refer to MEDEP/DR SOP# RWM-DR-003 - Groundwater Sampling Using Low Flow Purging and Sampling for Long-term Monitoring. In general, coarse sediments (sands) are the most transmissive; with experience, samplers can actually "feel" the type of sediment as the pore water sampler is advanced. If the formation intercepted by the sampler screen is not transmissive enough for collection of sample, gently advance and/or pull back the sampler in an attempt to find a more transmissive zone. If the formation does not allow adequate transmission of water, it may require a change in sampling location. This change is made at the discretion of the sampler and should be documented in the field notes (see MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of a Trip Report).

Neither the tubing nor the pore water sampler should be reused at subsequent sampling locations without appropriate decontamination. Do not put the strengthening rod back into a pore water sampler after the sample has been collected, as sediment in the sampler must be flushed out first. Rather, place both pieces separately into the plastic sheath.

If pore water sampling is to be repeated, use of permanent pore water samplers should be considered. Repeatable sampling points should be marked with a grade stake or similar method of marking a location. Additionally, all points should be located and identified with GPS.

4.5 DECONTAMINATION

Decontamination procedures generally follow MEDEP/DR SOP# RWM-DR-017 – Equipment Decontamination Protocol. Additionally, it should be noted that in the course of sampling, sediment will build up in sampler that must be carefully flushed out. For this reason, it is best if decontamination is conducted with a large amount of water available for continuous flushing. If possible, bring as many pore water samplers as there are sampling locations, as onsite decontamination can be difficult.

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 porewater sample collection.

5.1 EQUIPMENT BLANKS

If unable to used dedicated equipment, 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 pore water evaluation. Background sample requirements should be outlined in the SAP.

5.4 TRIP BLANKS

Trip blanks are recommended when collecting samples for volatile organic compound analysis (e.g. EPA 8260).

7.0 DOCUMENTATION

Documentation is one of the most important aspects of any 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 it was conducted originally. During the sampling event or immediately upon the completion of the event, diagram a map of the area and locate sampling points (and corresponding sample container numbers) on the map. Be sure to also record observational data concerning the groundwater such as the approximate depth of the screen when the sample was collected, detection of odor or contamination, color and turbidity. The sampler should record in the field book any and all information that is pertinent to the sample. All deviations from the procedures in the Site SAP and/or outlined in this or in any other SOP followed for groundwater sampling using a pore water sampler must be documented in field notes. 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, observations made and other comments. A trip report package should also be completed for the event, as outlined in MEDEP/DR SOP# RWM-DR-013.

When checking in samples at the laboratory for analysis, a Chain of Custody (COC) form must be completed. Refer to MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol for requirements for COC protocol.

8.0 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 cannot 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.

All personnel should be aware of the potential dangers associated with this particular sampling method. These dangers include, but are not limited to, strong water currents, slippery substrate, roots or sharp objects beneath the water's surface that may cause a fall or other personal injury. If sampling in water that is greater than three feet deep, or when otherwise working where drowning may be a hazard, all DEP personnel are required to wear life jackets (see SOP No. LW-WRR-001-, Use, selection, and maintenance of Personal Floatation Devices and Anti-Exposure Clothing. All necessary precautionary measures should be heeded when performing this sampling technique.

9.0 REFERENCES

USEPA SOP #EH-03, Sediment Pore Water Sampling using a Micro Push Point, September 2003.

USEPA SESDPROC-513-R2, Pore Water Sampling, February 2013.

COVERSHEET
STANDARD OPERATING PROCEDURE

Operation Title: **PROTOCOL FOR COLLECTING DATA USING AN INNOV-X FIELD PORTABLE X-RAY FLUORESCENCE SPECTROMETER FOR CERTAIN METALS IN SOLID MEDIA**

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

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Department Commissioner:

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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 procedure for collecting data using a Innov-X portable x-ray fluorescence spectrometer (XRF) for certain metals in solid media, paint and dust wipe samples.

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.

*Additionally, before any person is allowed to use the Innov-X XRF they **MUST:** have completed a training course on use of the Innov-X XRF, and have 8 hours of supervised field use with the instrument by approved Division of Remediation staff.* Safety procedures are described in detail in the Health and Safety Section of this SOP.

A current list of qualified supervisors and operators will be maintained by the MEDEP/DR Oil and Hazardous Materials Specialist who provides the training.

4.0 INTRODUCTION

This standard operating procedure (SOP) is designed to be a guideline for data collection with Innov-X XRF for solid media (e.g. soil, sediment and sludge), lead in painted surfaces and dust wipe samples. This is a field screening method used for: profiling an area, locating sources of contamination, determining the horizontal or vertical extent of contamination or collecting preliminary data that will be used to design a sampling plan. Samples can be analyzed either by in-situ methods or by intrusive sample preparation methods. This SOP will outline collecting data using both methods.

5.0 GUIDELINES AND PROCEDURES

5.1 PREPARATION

Prior to conducting any sampling event, a sampling plan should be developed (see SOP DR#014 - Development of a Sampling and Analysis Plan). Clean containers must be used for each sampling event unless in-situ sampling is to be performed.

An evaluation of the site and the metal elements of concern should be made prior to using the XRF on a site. Then determine if the XRF can analyze for the elements of concern and if the detection limits are acceptable to meet the Data Quality Objectives for the project.

Before sampling, a decision must be made whether to test the material:
- in-situ (in-place),
- as bagged samples (or for sludge, in cups) with a minimum of preparation, or
- in an XRF cup after preparation as described in Section 5.4.

If the primary objective of the sampling event is to determine whether an element is present (rather than accurately measuring how much is present), in-situ or bagged samples are the quickest, simplest way to proceed. (Note: Preparing a sample by drying, milling and sieving will yield greater accuracy.) Even if the objective is to collect samples and prepare them prior to analysis, preliminary direct measurements can help to survey the site.

5.2 EQUIPMENT

Equipment required for this SOP may include:

-- **XRF** – Innov-X X-Ray Fluorescence Spectrum Analyzer
  a) XRF
  b) Batteries and charger
  c) Standardization clip
  d) Sample test stand
  e) In-situ sample test stand
  f) Standards
  g) Grinder
  h) Mortar and pestle
  i) Various size sieves

-- **Sampling implements** - This includes shovels, Geoprobe® soil boring system, dredges, etc, as outlined in the site specific sampling plan. Please refer to the appropriate MEDEP/DR SOPs for using this equipment,

-- **Sample containers** – Whirl pack bags, zipper locking bags or sample cups.

5.3 GENERAL INFORMATION

5.3.1 Radiation Sources

The Innov-X XRF does not contain a radioactive source, which would constantly emit ionizing radiation. The Innov-X has an x-ray tube which can only emit ionizing radiation when the instrument is powered. The instrument will not power the x-ray tube without the battery or handheld computer installed.

5.3.2 Radiation License and Training Requirements

Only MEDEP/DR staff who have completed XRF training may use the XRF. Additionally, staff using the XRF must have 8 hours of supervised field use by approved MEDEP/DR OHMS.

5.3.3 Detection Limits

An element will only be shown as detected by the XRF if the measured concentration of the sample is at least three times the standard deviation of the measurement. This detection limit will depend on the composition of the sample.

Detection limits depend on several factors: the analyte of interest, times the sample is irradiated, physical matrix effects, chemical matrix effects, and inter-element spectral interferences. For more of an explanation of detection limits see Attachment A "EPA Method 6200". Detected elements are displayed as in the Measurement screen. Non-detected elements are shown as **< xx**, where **xx** is the detection limit for that sample. The detection limit for each element is calculated from each sample.

5.3.4 Interferences

Physical matrix interferences result from variations in the physical character of the sample. These variations may include such parameters as particle size, uniformity, homogeneity, and surface condition.

Moisture content may affect the accuracy of analysis of soil and sediment sample analyses. When the moisture content is between 5 and 20 percent, the overall error from moisture may be minimal. However, moisture content may be a major source of error when analyzing samples of surface soil or sediment that are saturated with water. This error can be minimized by drying the samples in a convection or toaster oven.

Inconsistent positioning of samples in front of the probe window is a potential source of error because the x-ray signal decreases as the distance from the radioactive source increases. This error is minimized by maintaining the same distance between the window and each sample. For the best results, the window of the probe should be in direct contact with the sample, which means that the sample should be flat and smooth to provide a good contact surface.

Chemical matrix effects result from differences in the concentrations of interfering elements. These effects occur as either spectral interferences (peak overlaps) or as x-ray absorption and enhancement phenomena.

When present in a sample, certain x-ray lines from different elements can be very close in energy and, therefore, can cause interference by producing a severely overlapped spectrum.

5.3.5 Precision

The measurement precision for each element displayed appears to the right of the measured concentration, under the heading "**+-**". The **precision** of each measurement is three times the standard deviation.

5.3.6 Maintenance

If there are any problems with how the XRF is working, stop using the instrument and report the problem to the DR's Site Assessment and Support Unit Staff. **Do not attempt to fix the XRF yourself.** Opening the instrument may expose the user to the radiation and will void the warrantee.

5.4 GENERAL PROCEDURE FOR OPERATING THE INNOV-X XRF

Refer to the Innov-X User Manual for additional information and figures showing the features of the instrument.

5.4.1 Place a battery in the unit and install the iPAQ. Turn on both the iPAQ (top left hand side) and the XRF (back of the unit).

5.4.2 Make sure the date and time are set correctly on the iPAQ. Data is stored on the instrument by date.

5.4.3 On the iPAQ drop down menu, located at the top left hand side of the screen, choose Innov-X. Note the red light on the end of the instrument will be on when the instrument is on and ready for use. It will flash once the trigger is pulled which indicates the instrument is emitting radiation.

5.4.4 Choose the test mode (soil, paint or dust wipe) from the menu.

5.4.5 The instrument will require you to perform the standardization test at this point. The instrument will not operate without passing this test. Place the standardization clip securely over the sample window, and tap the instruction box on the screen. A small red light on the end of the XRF will begin to flash. This indicates the instrument is operating and emitting radiation. This test will take approximately 1 minute. ***KEEP ALL YOUR***

BODY PARTS AWAY FROM THE END OF THE INSTRUMENT. MAKE SURE THE INSTRUMENT IS NOT POINTED AT ANYONE AT ANYTIME. **All reasonable measures, including labeling, and the concepts of time, distance and shielding should be implemented to limit radiation exposure to as low as reasonably achievable (ALARA).**

Once the standardization is complete, the results will be shown on the screen. If the resolution result is within tolerance limits proceed to the next step. Otherwise run the standardization test again. If the test fails again, turn off the instrument and try again. If the instrument fails a third time you will be prompted to perform a soft restart on the iPAQ. If this fails replace the battery and try again. If you still do not pass call Innov-X customer support (781-938-5005).

5.4.6 Once the instrument has passed the standardization you are ready to begin testing samples.

5.4.7 A padlock icon is also shown on the bottom of the screen. This indicates if the software has been locked or is ready to test. The software will automatically lock when the instrument has not been used for several minutes. This will prevent anyone from inadvertently activating the instrument. To unlock the software, tap on the icon.

5.4.8 If you will be sampling in the soil mode see section 6.0 Soil Sampling and Analysis Procedure below.

6.0 SOIL SAMPLING AND ANALYSIS PROCEDURE

6.1 SOIL ANALYSIS MODEL

6.1.1 After completing the procedure described in section 5.4 there are two buttons shown on the bottom of the touch screen "Start" and "Info". Tap on the Info button to enter information specific to the samples you are analyzing. In soil mode there are preset options such as Operator, Sample method, Sample Number, Sample Depth and Comment. These can be customized to projects when necessary. Fill in the information for the sample before analysis. The analysis will be stored with this information. You need to change the information as necessary, prior to each sample that is run.

6.1.2 The bottom menu on the screen shows 4 options: File, Edit, View, Options and Help. From these menus the operator can change the settings for the method of analysis (Standard or LEAP) and the time interval for testing. For a complete description of these menus and how to change the settings, see Attachment B.

6.1.3 To begin testing a sample the operator either taps the start button at the bottom of the screen or pulls the trigger. *Note: the software lock may have to be disabled if the instrument has not be used for more than 5 minutes.*

Warning: Always treat radiation with respect. Do not put your hand or any other body part on or near the sample window of the XRF while samples are being analyzed. Never

point the XRF at yourself or anyone else. ALARA objectives must be considered whenever staff are using an XRF.

The operator is responsible for controlling access in the area in which the XRF is being used. When possible use signs, barricades or caution tape to restrict access. Never allow anyone to enter within 5 feet of the x-ray path.

6.1.4 The XRF saves data from each sample run to the iPAQ. For quality assurance, and to protect against data loss or sample ID confusion, it is a best practice to maintain hand-written notes of all relevant results from each sample.

6.1.5 Check the XRF's calibration with testing standards before using the XRF to analyze samples, use standards that are closest to the levels of elements that are expected onsite. Recheck the standards at least once per hour during testing and after analysis has been completed for the day.

EPA Method 6200 Field Portable X-Ray Fluorescence spectrometry for the determination of elemental concentrations in soil and sediment (Attachment A) provides additional information regarding acceptable testing procedures and may be used in place of the procedure described below.

6.2 IN-SITU ANALYSIS

6.2.1 Clear the area selected for analysis of any surface debris or vegetation. Level the area so the XRF sample window will contact the area evenly. Keep in mind that a finer and more homogeneous material will yield more accurate the results. Increased accuracy can be obtained by loosening the soil and letting it dry in the sun before testing.

6.2.2 Hold the XRF on the ground and pull the trigger or place the XRF in the in-situ test stand and pull the trigger. The stand will allow the instrument to stand on its own. If the deadman trigger lock is engaged the trigger must be held for the duration of the analysis. If the deadman trigger has been disengaged then the analysis will run for the preset time period. The test can be stopped by pulling the trigger again.

6.2.3 Watch the results on the display screen to decide when the test has reached the desired level of accuracy or let the analysis run for the allotted time. NOTE: if the instrument is set to run both standard and LEAP analysis consecutively and the test is ended during the standard analysis mode and before the LEAP analysis has begun your data will not be stored.

6.2.4 The XRF saves data from each sample run to the iPAQ. For quality assurance, and to protect against data loss or sample ID confusion, it is a best practice to maintain hand-written notes of all relevant results from each sample.

6.3 IN-SITU DEPTH PROFILING

An in-situ XRF soil test examines only the top few millimeters of soil. To profile the depth of contamination, remove a vertical slice of soil and test several samples from different depths.

6.4 ANALYSIS OF BAGGED SOLID SAMPLES

Depending on the data quality objectives for your site it may be convenient to screen samples collected in plastic bags and analyze them without preparation. Because samples are tested through a bag, test results will tend to be 5-10% lower than test results obtained from direct analysis.

6.4.1 Place 50-100 grams of sample in a clean whirl pack or zipper locking bag. Remove any large stones or debris. Keep in mind that finer and more homogeneous material will yield more accurate results. Increased accuracy can be obtained by letting the sample dry in the sun before testing. Mix the sample thoroughly by kneading the bag.

6.4.2 The accuracy of measurements will be limited by the thickness of the plastic in the bag used. 1 mil-thick polyethylene bags offer a reasonable compromise between accurate readings and bag durability.

6.4.3 Flatten the bag of soil to form a continuous uniform layer of at least 1 cm. (0.4 inch) thickness. Place the sample window flat against the bag and pull the trigger. **Do not hold bagged samples in your hand during testing.**

6.4.3 If you are analyzing many samples at one time the easiest way to analyze samples is to set up the test stand. See Attachment B for directions on how to set up the test stand.

6.4.4 When the XRF is in the test stand all operations are conducted from the iPAQ. The red light on top of the test stand will operate in the same way as the red light on top of the XRF. When the instrument is on and capable of emitting radiation the red light will be on constantly. When the light is flashing the instrument is emitting radiation. The instrument cannot emit radiation while the cover is open. The stand is constructed so that all radiation is absorbed by the stand, however, no one should stand behind the test stand while the XRF is being used. The deadman trigger lock cannot be used while the instrument is in the test stand.

6.4.5 Place the sample over the XRF sample window so that the sample is indirect contact with the window. Start the test from the iPAQ.

6.4.6 Watch the display screen results to decide when the test has reached the desired level of accuracy and stop the test through the iPAQ or the test will automatically stop when the preset time has expired. NOTE: if the instrument is set to run both standard and LEAP analysis consecutively and the test is ended during the standard analysis mode and before the LEAP analysis has begun your data will not be stored.

6.4.7 The XRF saves data from each sample run to the iPAQ. For quality assurance, and to protect against data loss or sample ID confusion, it is a best practice to maintain hand-written notes of all relevant results from each sample.

6.5 ANALYSIS OF PREPARED SAMPLES

Prepared sample analysis is the most accurate method for determining the concentration of elements in a solid media. Sample preparation minimizes the effects of moisture, large particle size and variations in particle size.

Following this protocol for preparing and testing samples is vital for achieving a level of accuracy comparable with laboratory results. See Attachment A for EPA's approved method for analyzing samples using and XRF (EPA 6200). MEDEP has developed the following preparation method for samples to be analyzed by an XRF.

6.5.1 Collect 50-100 grams of sample to insure that there is enough sample to be representative and unbiased after mixing, grinding, and sieving it. You must have enough sample to half fill the XRF sample cup.

6.5.2 Place the sample in a clean bowl and mix the sample thoroughly by stirring and by rotating the bowl. Gently break up any dirt clods. Don't shake the sample because the sample may become stratified by weight.

6.5.3 If the sample is moist it should be dried. To best prepare a sample for analysis the material should be dry and well homogenized. Ideally, the entire sample should be dried to constant weight, sieved to remove gravel and debris, and ground or milled to a fine powder.

The sample can be dried in several ways:

- Oven dry the sample for approximately 2 hours at 150° C., until the sample reaches a constant weight;
- air dry the sample overnight at room temperature in a shallow pan;
- gently stir and warm the sample in a pan over a hot plate or burner.

Oven, hot plate or burner drying is inappropriate when volatile compounds may be present in the sample. For example, lead present as tetraethyl lead would be driven off by the heat of drying. Some forms of mercury and arsenic are volatile. If mercury is to be analyzed the sample must be air dried.

6.5.4 Sieve the dried sample with the #10 (2mm) mesh and separate out the larger pieces (stones, organic matter, metallic objects).

6.5.5 Grind the sample with a mortar and pestle or electric grinder until the soil particles are fine and homogenous.

6.5.6 Sieve at least 10 grams of the sample through #60 (250 um) and #120 (125 um) mesh. Re-grind the unpassed material until the required fraction is able to pass. Mix the resulting sample.

6.5.7 Place the sample in a sample cup. To assemble a sample cup: *1)* place a circle of mylar film on top of an XRF sample cup. The window goes on the end of the cup with the indented ring. *2)* Secure the film with the collar. The flange inside the collar faces down and snaps into the indented ring of the cup. Inspect the installed film window for continuity and smooth, taut appearance. *3)* Set the cup, window-side down, on a flat surface. Fill it with at least three grams of the prepared sample (no more than half-full). Take care that there are no voids or layering. *4)* Placing the cup film-side down on a flat surface, tamp the sample into the cup. *5)* Fill the cup with polyester fiber stuffing to prevent sample movement. Use aquarium filter or pillow filling as stuffing. A small supply of stuffing comes with the bulk sample kit. *6)* Fasten the cap on the cup.

6.5.8 Analyze the sample with the XRF. The easiest way to analyze samples in cups is to set up the test stand. See Attachment B for directions to set up the test stand.

6.5.9 When the XRF is in the test stand all operations are conducted from the iPAQ. The red light on top of the test stand will operate in the same way as the red light on top of the XRF. When the instrument is on and capable of emitting radiation the red light will be on constantly. When the light is flashing the instrument is emitting radiation. The instrument cannot emit radiation while the cover is open. The stand is constructed so that all radiation is absorbed by the stand, however, no one should stand behind the test stand while the XRF is being used.

6.5.10 Place the sample cup over the XRF sample window so that the cup is indirect contact with the window. Start the test from the iPAQ.

6.5.11 Watch the display screen results to decide when the test has reached the desired level of accuracy and stop the test through the iPAQ or the test will automatically stop when the preset time has expired. NOTE: if the instrument is set to run both standard and LEAP analysis consecutively and the test is ended during the standard analysis mode and before the LEAP analysis has begun your data will not be stored.

6.5.12 The XRF saves data from each sample run to the iPAQ. For quality assurance, and to protect against data loss or sample ID confusion, it is a best practice to maintain hand-written notes of all relevant results from each sample.

7.0 LEAD PAINT ANALYSIS AND PROCEDURE

7.1 LEAD PAINT ANALYSIS MODE

7.1.1 After completing the procedure described in section 4.4 there are two buttons shown on the bottom of the touch screen "Start" and "Info". Tap on the Info button to enter information specific to the samples you are analyzing. In there are preset options such

as Operator, Location and Comment. These can be customized to projects when necessary. Fill in the information for the sample before analysis. The analysis will be stored with this information. You need to change the information prior to each sample that is run.

7.1.2 The bottom menu on the screen shows 4 options: File, Edit, View, Options and Help. From these menus the operator can change the settings for the method of analysis (Inspection or Fixed time). For a complete description of these menus and how to change the settings, see Attachment B.

7.1.3 Inspection mode automatically ends the test when the analyzer reaches a "Positive" or "Negative" determination with 95% confidence. This is based on a preset action level (the default is 1.0 mg/cm^2).

7.1.4 Fixed time mode always test up to the preset time (default 15 seconds). This returns actual results as opposed to the positive or negative results in the inspection mode.

7.1.5 To begin testing a sample the operator either taps the start button at the bottom of the screen or pulls the trigger. Note the software lock may have to be disabled if the instrument has not been used for more than 5 minutes.

7.1.6 Check the XRF's calibration with testing standard before using the XRF to analyze samples. Recheck the standards at least once every 4 hours during testing and after analysis has been completed for the day.

7.1.7 Hold the analyzer up to the sample to be analyzed. Make sure the sample window is as flat as possible against the sample. Start the analysis either from the iPAQ window or with the trigger. The red light on top of the instrument will flash while the analysis is performed and the instrument is emitting radiation. When at all possible use the instrument with the deadman trigger engaged. This means the operator must hold the trigger during the entire analysis. If the deadman trigger is not engaged the test can be stopped by pulling the trigger again or depending on the test mode the instrument will end the test when a positive or negative result is reached or the preset time period has elapsed.

7.1.8 The XRF saves data from each sample run to the iPAQ. For quality assurance, and to protect against data loss or sample ID confusion, it is a best practice to maintain hand-written notes of all relevant results from each sample.

8.0 DUST WIPE ANALYSIS AND PROCEDURE

8.1 DUST WIPE TEST MODE

8.1.1 After completing the procedure described in section 4.4 there are two buttons shown on the bottom of the touch screen "Start" and "Info". Tap on the Info button to enter information specific to the samples you are analyzing. There are preset options such as Operator, Location and Comment to choose from. These can be customized to projects when necessary. Fill in the information for the sample before analysis. The analysis will

be stored with this information. You need to change the information prior to each sample that is run.

8.1.2 The bottom menu on the screen shows 4 options: File, Edit, View, Options and Help. From these menus the operator can change the settings for the analysis (e.g. 4 or 8 tests per wipe, area of wipe (default $1ft^2$.)) For a complete description of these menus and how to change the settings, see the Innovex Instruction manual, which is kept with the instrument.

8.2 SAMPLE PREPARATION

8.2.1 Conduct wipe sample according to MEDEP/DR SOP #___ Dust Wipe Collection Protocol". However, instead of packaging the wipe for analysis at a laboratory continue as follows.

8.2.2 For best results dry the wipe before analysis.

8.2.3 Fold the wipe so that it will fit into the dust wipe holder. Center the filter in the holder and secure the holder with tape.

8.3 ANALYZING THE DUST WIPE

8.3.1 The XRF can be set to analyze the dust wipe in either 4 or 8 positions on the wipe. If 4 positions are set then they are analyzed in four quadrants of the wipe on the same side. For 8 positions, four quadrants on each side are analyzed.

8.3.2 Place the dust wipe on a flat surface and position the sample window in 1 quadrant of the filter. Pull the trigger. The red light on top of the instrument will flash during analysis indicating the instrument is emitting radiation. When the first position is complete the iPAQ will prompt for the additional readings. Reposition the XRF and tap ok on the screen. Note: If you cancel instead of saying ok the wipe measurement will be aborted and no results will be saved. If you stop the test before any position reading has been completed, no results will be saved.

8.3.3 After the last reading has been completed the analyzer will open the results screen and display an average of the readings taken on the dust wipe.

8.3.4 The XRF saves data from each sample run to the iPAQ. For quality assurance, and to protect against data loss or sample ID confusion, it is a best practice to maintain hand-written notes of all relevant results from each sample.

9.0 DOWNLOADING DATA FROM THE XRF

9.1 DOWNLOADING DATA

The Innov-X XRF stores thousands of measurements plus their spectra. This can be downloaded to a computer for reporting in a spreadsheet format. From the Innov-X menu screen choose view on the bottom and then choose results. This will open the last result entered into the iPAQ. Choose "File" on the bottom of the screen them choose "export results". From this screen you can choose the date and analysis mode for the results (analytical results are saved on the iPAQ by date). After these options have been chosen, click "OK" at the bottom of the screen. The next screen allows you to enter a file name and location to save the file to. The file can then be downloaded to your desk top computer by synchronizing the iPAQ with your computer and saving the data file in an excel format. You must have the iPAQ software installed on your computer. See Attachment B for complete directions on downloading data.

Note: Downloading data does not erase readings. To make room for the next set of data, erase readings after verifying that the data was downloaded successfully.

9.2 ERASING READINGS

Once your data has been downloaded from the i-PAQ the file should be erased. From the Innov-X menu screen choose "view" then "results". This will open the last analysis saved to the iPAQ. Choose "file" at the bottom of the screen then "erase readings". You must enter the administrator password (lower case z). Choose which readings you would like to delete then click "OK". Make sure your data has successfully transferred to your desk top prior to deleting data. See Attachment B for complete directions on erasing data.

10.0 DECONTAMINATION

Decontamination of equipment will follow the MEDEP DR SOP DR#017 - "Decontamination Procedures Protocol". Additionally the following methods may be used in the field:

The mortar, pestle, and grinding mill may be cleaned with dry paper towels. Water will also clean the mortar, pestle, and the mill's container, but be sure each is absolutely dry before they are used for another sample. The mortar and pestle may be cleansed by grinding clean dry sand in the mortar. Use the short bristle brushes (included in the Bulk Testing Kit) to clean the sieves.

11.0 CHAIN OF CUSTODY

For confirmatory samples that are submitted to a fixed laboratory, procedures for chain of custody outlined in MEDEP/DR SOP DR#012 - "Chain of Custody" must be followed.

12.0 DOCUMENTATION

All sampling activities must be documented as outlined in MEDEP/DR SOP DR#013 – "Documentation of Field Activities and Development of a Trip Report". Each sample location will be given a unique sample number. This number will be entered into the XRF with the optical pen and or recorded in the field notes. If no number is entered into the XRF, the default number shown on the XRF screen for that sample will be recorded in the field notes.

13.0 QUALITY ASSURANCE/QUALITY CONTROL

13.1 QUALITY ASSURANCE SAMPLES

Depending on the DQO's for a project the following QA samples may be collected. Any QA sample analyzed will be documented in field notes or in a written report. Calculations for QA samples will also be documented and if QA samples are re analyzed the results of will be documented.

13.1.1 Energy Calibration Check

To determine whether the XRF is operating within resolution and stability tolerances, an energy calibration check should be run. Generally, this is run at the beginning of each working day, after the batteries are changed or the instrument is shut off, at the end of each working day, and at any other time when the instrument operator believes that drift is occurring during analysis.

13.1.2 Blank Samples

Two types of blank samples should be analyzed for XRF analysis: instrument blanks and method blanks. An instrument blank is used to verify that no contamination exists in the spectrometer or on the probe window.

13.1.2.1 Instrument Blank

The instrument blank can be silicon dioxide, a Teflon block, a quartz block, "clean" sand, or lithium carbonate. This instrument blank should be analyzed on each working day before and after analyses are conducted and once per every twenty samples. An instrument blank should also be analyzed whenever contamination is suspected by the analyst. The frequency of analysis will vary with the data quality objectives of the project.

13.1.2.2 Method Blank

A method blank is used to monitor for laboratory-induced contaminants or interferences. The method blank can be "clean" silica sand or lithium carbonate that undergoes the same preparation procedure as the samples. A method blank must be analyzed at least daily. The frequency of analysis will depend on the data quality objectives of the project. To be acceptable, a method blank must not contain any analyte at a concentration above its method detection limit. If an analyte's concentration exceeds its method detection limit, the cause of the

problem must be identified, and all samples analyzed since the last acceptable method blank check must be reanalyzed.

13.1.3 Calibration Verification Checks

A calibration verification check sample is used to check the accuracy of the instrument and to assess the stability and consistency of the analysis for the analytes of interest. A check sample should be analyzed at the beginning of each working day, during active sample analyses, and at the end of each working day. The frequency of calibration checks during active analysis will depend on the data quality objectives of the project. The check samples used by the DR will be NIST or other SRM that contains the analytes of interest. These will verify the accuracy of the instrument. The measured value for each target analyte should be within +/-20 percent (%D) of the true value for the calibration verification check to be acceptable. If a measured value falls outside this range, then the check sample should be reanalyzed. If the value continues to fall outside the acceptance range, the instrument should be re-calibrated, and the batch of samples analyzed since the last acceptable calibration verification check must be reanalyzed.

13.1.4 Precision Measurements

The precision of the method is monitored by analyzing a sample with low, moderate, or high concentrations of target analytes. The frequency of precision measurements will depend on the data quality objectives for the data. A minimum of one precision sample should be run per day. Each precision sample should be analyzed 7 times in replicate. It is recommended that precision measurements be obtained for samples with varying concentration ranges to assess the effect of concentration on method precision. A precision sample is analyzed by the instrument for the same field analysis time as used for other project samples. The relative standard deviation (RSD) of the sample mean is used to assess method precision. For FPXRF data to be considered adequately precise, the RSD should not be greater than 20 percent with the exception of chromium. RSD values for chromium should not be greater than 30 percent.

The equation for calculating RSD is as follows: RSD = (SD/Mean Concentration) x 100
where: RSD = Relative standard deviation for the precision measurement for the analyte
SD = Standard deviation of the concentration for the analyte, Mean Concentration = Mean concentration for the analyte.

14.1.5 Confirmatory Samples

The comparability of the XRF analysis is determined by submitting XRF-analyzed samples for analysis at a laboratory. The method of confirmatory analysis must meet the project and XRF measurement data quality objectives. The confirmatory samples must be splits of the well homogenized sample material. In some cases the prepared sample cups can be submitted. A minimum of 1 sample for each 20 XRF-analyzed samples should be submitted for confirmatory analysis. This frequency will depend on data quality objectives. The confirmatory analyses can also be used to verify the quality of the XRF data. The confirmatory samples should be selected from the lower, middle, and upper range of concentrations measured by the XRF. They should also include samples with analyte concentrations at or near the site action levels. Acceptance criteria for comparison of field and lab samples will be 20% difference of sample results or stated in the site specific QAPP or sampling plan. If the acceptance criteria is exceeded the

project manager will evaluate the results to determine if they meet the data quality objectives for the project. If the data quality objectives are not met samples will be re-run or collected again for analysis.

14.2 DEVIATIONS FROM SOPS

All deviations from the procedures outlined in the SAP and/or this or in any other SOPs followed for XRF sampling must be documented in field notes.

15.0 HEALTH AND SAFETY

Because ionizing radiation is produced while operating the instrument, safety precautions must be taken so the operator or nearby workers are not exposed. As recommended by the manufacturer's manual, for the first year of use, dosimeter badges or rings were worn during operation of the XRF. Development of these dosimeters never revealed any exposure, and the DR has determined that training on the proper, safe use of the equipment provides adequate safety margins without dosimetry.

15.1 TRAINING AND MONITORING REQUIREMENTS

15.1.1 Prior to using the Innov-X XRF staff must attend training for the instrument and have 8 hours of supervised field use by a trained Division of Remediation Oil and Hazardous Materials Specialist.
15.1.2 All operators must have certification that they attended a 40 hour OSHA HAZWOPER training and annual 8 hour safety refresher courses.
15.1.3 All users must be enrolled in the Division's health monitoring program.

15.2 INNOV-X SAFETY FEATURES:

15.2.1 Deadman trigger

When this is set on the instrument the trigger must be held for the duration of the test. This requires that a person is present for the duration of the test while x-rays are emitted. This feature should be used whenever practicable. If this feature is not on while using the instrument extra precautions must be taken to ensure that nearby workers are aware of the dangers posed by the XRF. The operator is responsible for insuring that no person enters within 5 feet of the x-ray path while the instrument is being used. This mode cannot be used when the instrument is used in the test stand.

15.2.2 Software trigger

The XRF software will automatically lock the trigger when the instrument is not in use.

When this is set the operator must tap on the lock icon located on the lower right hand corner of the handheld computer screen before the instrument will operate. The user will then have to

confirm they want to unlock the trigger. When the instrument has not been used for 5 minutes the automatic trigger lock will reactivate. This safety feature will remain active at all times.

15.2.3 Software Proximity sensor

The software requires that a sample be present in front of the sample window. This prevents the accidental exposure of bystanders to an open beam. If the analyzer does not detect a sample it will abort the test and shut off the x-rays two seconds after the test is started. The operator must keep in mind the instrument is just looking for a solid object in front of the window. This means if a body part is in front of the window it will think it is a sample.

15.3 HEALTH AND SAFETY DURING USE

15.3.1 Operators will visually inspect the instrument for damage prior to use. If there is damage the instrument will not be used until it has been inspected and repaired by the manufacturer. At no time will staff dismantle the instrument.

15.3.2 The instrument is not waterproof and should not be used in heavy rain. The instrument can be used in light rain inside a large ziplock bag to limit the exposure.

15.3.3 All users will take care while using the Innov-X XRF so that no one, including the operator, will be exposed to radiation. The instrument will not be pointed at any person at anytime. The user will take care to keep all of their body parts away from the sample window while analyzing samples. ALARA (as low as reasonably achievable) objectives for radiation exposure will be used by the operator when using the instrument.

15.3.4 Operators will use distance time and shielding principles when using the XRF. This includes minimizing time around the instrument when it's energized, maximizing the distance from the instrument window and shooting into high density materials whenever possible.

15.3.5 The instrument shall be used in accordance with the manufacturer's instructions provided in the training course and the user's manual.

15.3.6 When the instrument is set up in the test stand a controlled area will be established by posting signs indicating x-rays are being used. If the instrument is used on a site without the test stand only personnel who have 40 hour OSHA safety training will be allowed on the site while the instrument is in operation. The operator is responsible for controlling entry to an area while the instrument is in use. This means keeping people at least 5 feet from the instrument x-ray path while the instrument is in use.

15.3.7 The instrument will be stored and transported without the batteries or hand held computer installed.

15.3.8 - When not in use the instrument will be stored at the Division's locked room at the warehouse and the hand held computer will be stored at the Ray Building. The instrument must be signed out through the assigned Division of Remediation OHMS.

The instrument may only be signed out to Department employees who have been trained in the use of the instrument.

15.3.9 - If the instrument is left in a vehicle unattended for any period of time the vehicle must be locked. The instrument must not be left in a vehicle overnight.

16.0 REFERENCES

- EPA Method 6200 Field Portable X-Ray Fluorescence Spectrometry For the Determination of Elemental Concentrations in Soil and Sediment.
- Innov-X User Manual for Alpha Series XRF.

COVERSHEET
STANDARD OPERATING PROCEDURE

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

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Division of Remediation
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QMSC Chair:

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

Department Commissioner:

Paul Mercer		1-3-2017
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 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 procedure for collecting soil gas samples.

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 GUIDANCE AND PROCEDURES

4.1 SAMPLING PLAN

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

When evaluating vapor transport it is important to identify preferential vapor pathways that are created by relatively permeable non-native fill associated with site development. Utility trenches are of particular importance because they can facilitate transport of both vapor and groundwater. At a minimum a CSM should identify potential site sources (e.g. current and former USTs, petroleum dispensers, dry cleaning machines, and ventilation hoods), preferential pathways (and interrelationships), surface water drainage patterns (both natural and man made or influenced), and closest receptors in all directions from the site.

In certain situations sewer utilities may be secondary vapor sources as a result of chemical handling and disposal and the age of the sewer. Vapor samples from the utility corridor will provide information on the strength of the secondary source.

4.2 SCHEDULING

It should be noted that sampling during times when soil pores are water filled (spring thaw, extended rain events, or heavy short duration rain events greater than 0.25 inches over an 8 hour period) may negatively affect collection of soil gas samples. For this reason rain dates should be planned in the proposed field work schedule. The exception may be when the site is located in an area with little exposed soils and adequate storm water drainage that restrict soil pores from becoming water filled.

4.3 EQUIPMENT

4.3.1 EQUIPMENT LIST

The Equipment used for the collection of soil gas samples when following with this this SOP may include:

- Direct push probing equipment and soil gas collection system (Geoprobe[tm])
- Hand Tool equipment (cordless hand hammer rotary drill, slam bar, push point samplers)
- Vacuum pump, such as peristaltic;
- Bentonite clay or modeling clay;
- Cold patch (for pavement penetrations)
- Differential Pressure Gage (optional);
- Polyethylene tubing (see Section 5.2.3)
- Photo-ionization Detector (ppb level);
- Multi-gas meter for oxygen and carbon dioxide;
- Soil gas sampling field sheet (updated as of Effective Date or newer);
- Camera;
- Teflon lined tubing (see Section 5.2.3);
- Containers and flow controlers (Summa Canister or Tedlar Bags, see Section 5.2.1)

4.3.2 Specific Container and Tubing Considerations for Soil Gas Sampling

Due to the nature of soil gas sampling, additional planning must be undertaken in order to assure the appropriate sample collection/analysis methods and appropriate containers for a sampling event. Two types of sample containers are described in this SOP, Summa Canisters and Tedlar Bags. When deciding which container to use, staff should consider the data quality objectives (DQOs) for the sample and the availability of a laboratory capable of analyzing the sample that is both State certified and capable of reaching required detection limits. Additional container types will be considered on a case-by-case basis.

4.3.2.1 Summa Canisters

A Summa canister is a clean metal container sealed with a vacuum; this vacuum is then used to draw in the gas sample. Summa canisters must be ordered from a laboratory in advance of the sampling event and are available from a limited number of labs. Samples from Summa

canisters are analyzed by certified labs only, and by methods which have been approved by EPA and have detection limits that generally meet the ambient air guidelines. On a case-by-case basis non-certified laboratories with appropriate quality control procedures may be used for screening soil gas samples for the presence or absence of VOCs.

Summa canister samples can collect two types of samples; grab, and time elapsed. Grab samples are collected utilizing the vacuum of the canister for a sample with a collection time of less than 30 minutes. Time elapsed are samples collected utilizing the vacuum of the canister over an extended period of time, up to and beyond 24 hours. Both sample types require a regulator between the tubing and canister to control the length of time the sample is collected. The regulator will be provided and calibrated by the laboratory conducting the analysis of the sample. The type and duration of sample should be indicated as part of the SAP.

The laboratory certifies the summa canister has been appropriately cleaned prior to shipment. Laboratory certification can be done on individual canisters or from one representative can in a batch. **For soil gas sample collection personnel may use either individually certified clean canisters or batch certified clean canisters depending on the DQOs for the project.**

Clean Summa canisters must be obtained from the laboratory providing the analysis for each sampling event. Unused canisters will be sent back to the laboratory. The laboratory will need to be informed as to the sample collection method used and the duration of collection time prior to shipping the Summa canisters and regulators for the sampling event.

4.3.2.2 Tedlar Bag

A tedlar bag is a bag manufactured from Tedlar (Polyvinyl fluoride) with a two way valve. Tedlar bag samples require less time for planning because they can be ordered in advance and kept on hand until they are needed. However, the bags must be stored in a clean location. Laboratories capable of analyzing these samples are even more limited than the Summa Canisters. Holding time for tedlar bag samples is 48 hours. However, tedlar bags can be analyzed in the field with a mobile laboratory (that is capable of providing the analysis), providing real time data. Due to detection limits for this analytical method (generally 10 times the indoor air standard for most compounds), tedlar bag collection is most often used for screening purposes. There is not an USEPA approved method; samplers using tedlar bag collection must communicate with the laboratory conducting the analysis, prior to sampling, to be sure (DQOs) will be met. Due to the potential for cross-contamination each group of tedelar bags that are stored together for more than 1-hour should be accompanied with a zero-VOC field blank and at least one field duplicate. The field blank and duplicate should be analyzed after all the other environmental samples in the group.

4.3.2.3 Tubing Selection

Certain volatile chemicals (especially those found in petroleum products) may interact with certain types of tubing used for collecting samples. Tubing used for vapor sampling is usually a flexible, polyethlene based tubing. These interactions will affect the quality of sample results, and may require a contaminant specific tubing, such as a Teflon lined tubing (e.g. when sampling for petroleum vapors). Therefore, contaminants of concern for the site should be

determined before collecting samples (refer to the Site's CSM). If tubing interaction is a concern, the laboratory and /or the DEP Chemist in the DEP's Division of Technical Services should be consulted prior to sample collection to assure appropriate tubing is used. The type of tubing used should be noted in the field notes of the samplers.

4.3.2.4 Sample Collection Duration/Rate

The sample collection duration and rate will depend on the DQO for the project. Subslab soil gas sample rates should not exceed 200 mL/min. In general, the collection of subslab samples usually takes less than 30-minutes.

4.4 SAMPLE COLLECTION

Soil gas samples should be collected as follows:

1) Drill a hole in soil and set soil gas sampler using one of the following methods:
    a. Using direct push equipment (e.g. Geoprobe^{tm}) and steel rods with post run tubing (PRT);
    b. Using hand held tools, such as a hammer drill, slam bar, and/or tile probe, then inserting push point sampler (PPS) to desired depth;
    c. Using direct push or other hand held tools to install soil gas implant device and attached tubing;
2) Apply surface seal around sampling device using bentonite or modling clay
3) Connect appropriate sample tubing to sample device
4) Purge sample tubing and device with pertistaltic pump for approximately 1-minute per foot
5) Record sample data on updated Soil Gas Sample Field Sheet, including: ambient O_2, CO_2, PID (optional): pre-sample PID, O_2, and CO_2
6) Connect Sample Device. Record initial vacuum, start time, canister ID, and controller ID as appropriate.
7) Sketch accurate sample location using available landmarks and site features so others not present can find the sample location with ease.
8) When appropriate, stop sample collection with -1 to -4 in.H_20 pressure in canister and record final vacuum and sample end time.
9) Record post-sample O_2, CO_2, PID (optional)
10) Remove Sampler or secure permanent sampler and backfill as appropriate using sand, bentonite, and cold patch where pavement penetration is completed.

4.5 QUALITY CONTROL

Due to cross contamination and carry-over issues inherent with air collection and analysis, more rigorous quality control sampling may be required then the sampling of other media. 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 should be collected as part of the QA/QC program for

soil gas sample collection. For an additional discussion of QA/QC, please refer to the MEDEP/DR Quality Assurance Plan.

4.5.1 EQUIPMENT BLANKS

When tedlar bags are used equipment blanks should be collected at a rate of 5%, which is equivalent to one equipment blank every twenty samples collected. The equipment blank will consist of purging a complete drive rod and closed point system with zero air and collecting the air for analysis in a Tedlar bag.

4.5.2 DUPLICATE SAMPLES

It is recommended that duplicate samples be collected at a rate of 10% to assess sample location variability.

4.5.3 BACKGROUND/AMBIENT AIR SAMPLES

Depending on data quality objectives, one to two ambient air samples per day should be collected at the sampling locations to assess ambient air conditions.

4.5.4 TRIP BLANK

A trip blank should be collected when utilizing tedlar bags as sample containers. The trip blank will consist of a tedlar bag filled from a canister of zero air.

4.5.5 TRACER GAS DISPERSION

This SOP relies on the use of carbon dioxide and to a lesser degree oxygen as tracer gases for surface leakage. Under normal situations, ambient air concentrations of carbon dioxide are an order of magnitude less (~500 ppm) than soil gas carbon dioxide concentrations (5,000+ ppm). The contrast between ambient air concentrations and soil gas concentrations in addition to pre-sample and post-sample soil gas concentrations provides sufficient information on leakage from the surface into the soil gas. Under certain situations a helium shroud may be used to in lieu of carbon dioxide to determine the level of leakage.

4.6 SYSTEM DECONTAMINATION

In an effort to provide the most representative soil vapor samples possible, all tooling and materials in contact with the site soils will be cleaned with a detergent wash and potable water rinse prior to re-use, as outlined in MEDEP/DR SOP# RWM-DR-017 –Equipment Decontamination Protocol. Additional cleaning of the tooling with steam cleaning may be warranted depending on the site contamination.

New, flexible tubing (i.e. dedicated) will be used at each different sample location, regardless as to the type of tubing used.

5.0 DOCUMENTATION/CHAIN OF CUSTODY

All sampling activities must be documented as outlined in MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of a Trip Report. The Soil Gas Sampling Field Sheet (updated as of the effective date of this SOP) should be used each time a soil gas sample is collected. Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol. Samplers should contact the selected laboratory to determine the most appropriate method for avoiding carry-over of highly contaminated samples during the laboratory analyses. Due to the nature of soil gas sampling, attention should be made to the following:

1) Weather conditions particularly precipitation within past 3 days;
2) Depth of sample collection;
3) Possible sources of off site contamination (gas stations, dry cleaners, automotive body shops, etc.) in the vicinity of the investigation field work;
4) Possible sources of cross contamination (fueling vehicles/equipment, etc)
5) Length of time of sample collection.

6.0 REFERENCES

1. Geoprobe Soil Vapor Sampling, Standard Operating Procedure, Technical Bulletin No. 93-660, 9/21/93.
2. USEPA, Environmental Response Team, Soil Gas Sampling, SOP #2042, 6/1/96.
3. Geoprobe Systems, Direct Push Installation of Devices for Active Soil Gas Sampling and Monitoring. Technical Bulletin NO. MK3098. Prepared May, 2006.

COVERSHEET
STANDARD OPERATING PROCEDURE

Operation Title: **PROTOCOL FOR COLLECTING SUB SLAB SOIL GAS SAMPLES**

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

APPROVALS:

Division of Remediation Director:

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

Bureau of Remediation and Waste Management Director:

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

QMSC Chair:

Brij Longfellow		12/30/16
Print name	*Signature*	*Date*

Department Commissioner:

PAUL MERCER		1-3-2017
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 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 procedure for collecting soil vapor samples from the interstitial spaces immediately beneath the concrete floors of buildings.

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 GUIDELINES AND PROCEDURES

4.1 SAMPLING PLAN

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

It should be noted that sub slab sampling will involve the drilling of a hole in the basement floor of the building. The owner of the property of the sampling must made fully aware and approve of the sampling event, and any follow-up monitoring planned. Work with the Office of Commissioner and Attorney General's Office to gain access when you can not obtain landowner permission. Additionally, the owner/ operator of the building should identify any sub slab utilities, foundation/column footings, vapor barriers, radon sub slab depressurization systems, and any other foundation structures that might impact the results or collection of sub slab soil gas samples.

If collection of soil gas will become part of a routine monitoring program, it is recommended that permanent monitoring points, such as Geoprobe® soil gas implant system, be utilized.

4.2 SCHEDULING

It should be noted that sampling during times when soil pores are water filled (spring thaw, extended rain events, or heavy short duration rain events greater than 0.25 inches over an 8 hour period) may negatively affect collection of soil gas samples. For this reason rain dates should be planned in the proposed field work schedule. The exception may be when the site is located in an area with little exposed soils and adequate storm water drainage that restrict soil pores from becoming water filled.

4.3 EQUIPMENT

4.3.1 EQUIPMENT LIST

The Equipment used for the collection of soil gas samples when following this this SOP may include:

- Cordless hand hammer rotary drill
- Extension cord(s) (if necessary)
- Masonry drill bit, 3/8 to 5/8 inch diameter x 8-10 inches long
- Appropriate tubing (see Section 5.2.3)
- Geoprobe Soil Gas Implant system (Optional if placing a permanent monitoring point),
- Vacuum pump, such as peristaltic;
- Bentonite clay or modeling clay;
- Photo-ionization Detector (ppb level);
- Multi-gas meter for oxygen and carbon dioxide;
- Indoor air/subslab sampling field sheet (updated as of Effective Date or newer)
- Camera
- Hydraulic cement
- Containers and flow controllers (Summa Canister or Tedlar Bags, see Section 5.2.1 and 5.2.2)

4.3.2 Specific Container and Tubing Considerations for Soil Vapor Sampling

Due to the nature of sub slab soil gas sampling, additional planning must be undertaken in order to assure the appropriate sample collection/analysis methods and appropriate containers for a sampling event. Two types of sample containers are described in this SOP, Summa Canisters and Tedlar Bags. When deciding which container to use, staff should consider the data quality objectives (DQOs) for the sample and the availability of a laboratory capable of analyzing the sample that is both State certified and capable of reaching required detection limits.

4.3.2.1 Summa Canisters

A Summa canister is a clean metal container sealed with a vacuum; this vacuum is then used to draw in the gas sample. Summa canisters must be ordered from a laboratory in advance of the sampling event. Samples from Summa canisters are analyzed by certified labs only, and by methods which have been approved by EPA and have detection limits that generally meet the ambient air guidelines.

Summa canister samples can collect two types of samples; grab, and time elapsed. Grab samples are collected utilizing the vacuum of the canister for a sample with a collection time of less than 30 minutes. Time elapsed are samples collected utilizing the vacuum of the canister over an extended period of time, up to and beyond 24 hours. Both sample types require a regulator between the tubing and canister to control the length of time the sample is collected. The regulator will be provided and calibrated by the laboratory conducting the analysis of the sample. The type and duration of sample should be indicated as part of the (SAP).

The laboratory certifies the summa canister has been appropriately cleaned prior to shipment. Laboratory certification can be done on individual canisters or from one representative can in a batch. **For subslab soil gas sample collection personnel may use either individually certified clean canisters or batch certified clean canisters depending on the DQOs for the project.**

Clean Summa canisters must be obtained from the laboratory providing the analysis for each sampling event. Unused canisters will be sent back to the laboratory. The laboratory will need to be informed as to the sample collection method used and the duration of collection time prior to shipping the Summa canisters and regulators for the sampling event.

4.3.2.2 Tedlar Bag

A tedlar bag is a bag manufactured from Tedlar (Polyvinyl fluoride) with a two way valve. Tedlar bag samples require less time for planning because they can be ordered in advance and kept on hand until they are needed. However, the bags must be stored in a clean location. Laboratories capable of analyzing these samples are even more limited than the Summa Canisters. Holding time for tedlar bag samples is 48 hours. However, tedlar bags can be analyzed in the field with a mobile laboratory (that is capable of providing the analysis), providing real time data. Due to detection limits for this analytical method (generally 10 times the indoor air standard for most compounds), tedlar bag collection is most often used for screening purposes. There is not an USEPA approved method; samplers using tedlar bag collection must communicate with the laboratory conducting the analysis, prior to sampling, to be sure (DQOs) will be met. Due to the potential for cross-contamination each group of tedelar bags that are stored together for more than 1-hour should be accompanied with a zero-VOC field blank and at least one field duplicate. The field blank and duplicate should be analyzed after all the other environmental samples in the group.

4.3.2.3 Tubing Selection

Certain volatile chemicals (especially those found in petroleum products) may interact with certain types of tubing used for collecting samples. Tubing used for vapor sampling is usually a flexible, polyethylene based tubing. These interactions will affect the quality of sample results, and may require a contaminant specific tubing, such as a Teflon lined tubing (e.g. when sampling for petroleum vapors). Therefore, contaminants of concern for the site should be determined before collecting samples (refer to the Site's CSM). If tubing interaction is a concern, the laboratory and/or the DEP Chemist in the DEP's Division of Technical Services should be consulted prior to sample collection to assure appropriate tubing is used. Type of tubing used should be noted in the field notes of the samplers.

4.3.2.4 Sample Collection Duration/Rate

The sample collection duration and rate will depend on the DQO for the project. Subslab soil gas sample rates should not exceed 200 mL/min. In general, the collection of subslab samples usually takes less than 30-minutes.

4.4 SAMPLE COLLECTION

If the sampling point is for one time use, utilizing tubing inserted into the hole drilled in the slab will be sufficient. However, if the sampling is to be part of a long term monitoring program, a more robust sampler, such as Geoprobe Systems permanent soil gas implantcan be used.

1) Drill hole into concrete slab floor. Using the hammer rotary drill and 3/8 to 5/8 inch diameter drill bit, drill a hole through the cement floor slab of the building. If dust prevention is necessary, cover the location with a towel/ cloth and drill through a pre cut hole in the cloth or use water where appropriate.

2) Place tubing or implant into hole. After drilling the hole through the concrete slab, evaluate and note the subslab conditions. The conditions and data quality objectives will determine the appropriate intake depth(s) for the subslab sample(s). Conditions to be noted include the presence of bedrock, groundwater, pipes, underdrain, void spaces, soil conditions (native, backfill), and general soil type (silt, clay, sand, gravel) Sample tubing can be placed directly into the subslab environment or tubing can be attached to an anchor (implant) to hold the tube in place beneath the cement slab.

Care should be taken to reduce cross contaminating subslab soil vapor and indoor air vapors. This may be done by backfilling the intake with filter sand below the slab and sealing the sample point with modeling clay or pre-mixed hydrated bentonite clay to the top of the cement slab

3) Purge sample tubing and device with pertistaltic pump for approximately 1-minute per foot
4) Record sample data on updated Soil Gas Sample Field Sheet, including: ambient O_2, CO_2, PID (optional): pre-sample PID, O_2, and CO_2

5) Connect Sample Device, record initial vacuum, start time, canister ID, and controller ID as appropriate
6) Sketch accurate sample location using available landmarks and site features so others not present can find the sample location with ease
7) When appropriate, stop sample collection with -1 to -4 in.H_20 pressure in canister and record final vacuum, sample end time
8) Record post-sample O_2, CO_2, PID (optional)
9) Remove Sampler or secure permanent sampler, backfill as appropriate using sand, bentonite, and seal floor using hydrated cement.

4.5 QUALITY CONTROL

Due to cross contamination and carry-over issues inherent with air collection and analysis, data quality objectives(DQOs) should be stated in the sampling and analysis plan (SAP). 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 should be collected as part of the QA/QC program for soil gas sample collection. For an additional discussion of QA/QC, please refer to the MEDEP/DR Quality Assurance Plan, Sections 4 and 8.

4.5.1 EQUIPMENT BLANKS

When tedlar bags are used equipment blanks should be collected at a rate of 5%, which is equivalent to one equipment blank every twenty samples collected. The equipment blank will consist of purging a complete drive rod and closed point system with zero air and collecting the air for analysis in a Tedlar bag.

4.5.2 DUPLICATE SAMPLES

It is recommended that duplicate samples be collected at a rate of 10% to assess sample location variability.

4.5.3 BACKGROUND/AMBIENT AIR SAMPLES

Depending on data quality objectives for the sampling event, background/ ambient air samples may or may not be appropriate to assess ambient air conditions. If background/ ambient air samples are determined necessary, the rationale should be outlined in the SAP.

4.5.4 TRIP BLANK

A trip blank should be collected when utilizing tedlar bags as sample containers. The trip blank will consist of a tedlar bag filled from a canister of zero air.

4.5.5 TRACER GAS DISPERSION

This SOP relies on the use of carbon dioxide and to a lesser degree oxygen as tracer gases for surface leakage. Under normal situations, ambient air concentrations of carbon dioxide are an order of magnitude less (~500 ppm) than soil gas carbon dioxide concentrations (5,000+ ppm). The contrast between ambient air concentrations and soil gas concentrations in addition to pre-sample and post-sample soil gas concentrations provides sufficient information on leakage from the surface into the soil gas.

4.6 SYSTEM DECONTAMINATION

In an effort to provide the most representative soil vapor samples possible, all tooling and materials in contact with the site soils will be cleaned with a detergent wash and potable water rinse prior to re-use, as outlined in MEDEP/DR SOP# RWM-DR-017 –Equipment Decontamination Protocol. Additional cleaning of the tooling with steam cleaning may be warranted depending on the site contamination.

New, flexible tubing (i.e. dedicated) will be used at each different sample location, regardless as to the type of tubing used.

5.0 DOCUMENTATION/CHAIN OF CUSTODY

All sampling activities must be documented as outlined in MEDEP/DR SOP# RWM-DR-013 - Documentation of Field Activities and Development of a Trip Report. The Indoor Air/Subslab Sampling Field Sheet (updated as of the effective date of this SOP) should be used each time a soil gas sample is collected. Sample custody must be followed as outlined in MEDEP/DR SOP# RWM-DR-012 – Chain of Custody Protocol. Samplers should contact the selected laboratory to determine the most appropriate method for avoiding carry-over of highly contaminated samples during the laboratory analyses. Due to the nature of soil gas sampling, attention should be made to the following:

- Weather conditions particularly precipitation within past 3 days;
- Depth of sample collection;
- Subslab conditions;
- Modifications to the procedure;
- Possible sources of off site contamination (gas stations, dry cleaners, automotive body shops, etc.) in the vicinity of the investigation field work;
- Possible sources of cross contamination (fueling vehicles/equipment, etc);
- Length of time of sample collection.

As with all sampling events, any deviations from the sampling plan or SOPs must be documented in field staff's field notes.

6.0 REFERENCES

1. Geoprobe Soil Vapor Sampling, Standard Operating Procedure, Technical Bulletin No. 93-660, 9/21/93.
2. USEPA, Environmental Response Team, Soil Gas Sampling, SOP #2042, 6/1/96.
3. Geoprobe Systems, Direct Push Installation of Devices for Active Soil Gas Sampling and Monitoring. Technical Bulletin NO. MK3098. Prepared May, 2006.

COVER SHEET
STANDARD OPERATING PROCEDURE

Operation Title: **MONITORING WELL MAINTENANCE AND DEVELOPMENT**

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*
David A Burns — *Signature*
12/4/16 — *Date*

QMSC Chair:

Bill Longfellow — *Print name*
Bill Longfellow — *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 procedure for maintaining and developing groundwater monitoring wells. Groundwater monitoring wells that are not part of an active monitoring program must be sealed in accordance with the bureau *Guidance for Well and Boring Abandonment* (January 7, 2009) unless the well is to be kept viable for possible future use. This SOP specifies the procedures to be followed by to maintain monitoring wells (actively part of a long term monitoring program and those not part of a program) that are not actively being sampled, but are to be kept for possible future use. Additionally, if sampling time period is greater than 3 years for an active monitoring program, the wells should be maintained annually following this procedure. Periodic maintenance of monitoring wells is necessary to preserve the ability to collect representative samples.

This document also specifies the procedure for development of wells that have been unused or not maintained prior to the collection of samples from them. Wells that have not been used as monitoring points for a time period of greater than 3 years should be developed prior to collecting groundwater samples following this procedure.

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 procedure. MEDEP/DR staff reviewing data by outside parties are responsible for assuring that the procedure (or an equivalent) was utilized appropriately.

5.0 DEFINITIONS

5.1 MONITORING WELL. "Monitoring well" means a well installed for the purpose of monitoring groundwater quality at a facility regulated by the department. Generally a monitoring well consists of the following components:

- A screened interval, meaning the section of the well surrounded by a filter pack to allow infiltration and monitoring of groundwater at a specific depth within an aquifer;

- A solid riser pipe extending from the top of the screened interval to the ground surface. Depending on the well design the riser pipe may terminate just below the ground surface or extend above the ground surface; and

- A protective casing. For riser pipes ending just below the ground surface, the casing typically consists of a locking steel road box; for riser pipes extending above the ground surface, the casing generally consists of a steel pipe with a locking cap. Protective casings are sealed into the ground surface using cement or a mixture of bentonite and cement to prevent infiltration of surface water into the well.

5.2 INACTIVE MONITORING WELL. "Inactive monitoring well" means a monitoring well that, pursuant to department recommendation or approval, is not routinely sampled as part of an active groundwater monitoring program but is to be maintained for possible sample collection at a future date.

6.0 GUIDELINES AND PROCEDURES

6.1 MONITORING WELL INSPECTION

All monitoring wells must be inspected annually and repaired as necessary to maintain their viability for possible future use. The following steps must be taken and documented as part of the annual inspection.

NOTE re: HEALTH AND SAFETY: If the well is contaminated above drinking water standards, the following steps must be performed by personnel who are trained and certified to work on sites contaminated by hazardous substances. Appropriate personnel protective equipment must be used.

6.1.1 Assess the ability to access and identify the well. The well must be kept unobscured by vegetation or other obstructions so that it can be easily found. The well cap or casing must be clearly marked to avoid any confusion as to its identity within the monitoring well network.

6.1.2 Assess of the condition of the protective casing including the surface seal and lock. Replace the lock if it is missing or broken and note any deficiencies in the protective casing. If the well casing and riser are damaged, determine if repairs are feasible and if the well remains viable or should be abandoned.

6.1.3 Measure and record the depth to water in the well and the total depth of the well. To avoid cross contamination of other wells in the monitoring network, be sure to follow standard decontamination protocols when using non dedicated equipment.

6.2 MONITORING WELL MAINTENANCE AND DEVELOPMENT

Monitoring well screens can become clogged with sediment, precipitation of dissolved inorganics, and/or by biologically mediated reactions if not used regularly. The following steps must be taken and documented as part of monitoring well maintenance to keep the well screens in hydraulic connection with the groundwater surrounding the well.

6.2.1 Measure and record the depth to water in the well and the total depth of the well. To avoid cross contamination of other wells in the monitoring network, be sure to follow standard decontamination protocols when using non dedicated equipment.

6.2.2 Aggressively purge a minimum of three well volumes of water from the well, or until the well is completely evacuated, using a bailer or submersible pump. Take care not to introduce contaminants to the well by following standard decontamination procedures if using non dedicated equipment. Note the amount of water purged, final water level and any indication of contamination, such as color, odor or foaming.

6.2.3 Measure and record the depth to water in the well and the total depth of the well. To avoid cross contamination of other wells in the monitoring network, be sure to follow standard decontamination protocols when using non dedicated equipment.

6.2.3 Secure the well and document its final condition.

7.0 DOCUMENTATION

All site work, including well maintenance and development, must be documented as described in the SOP# RWM-DR-013 - Documentation of Field Activities and Development of A Trip Report. Use of specialized sampling forms is allowed, following the procedure outlined in DR-013. Recommendations for well maintenance, repair, or abandonment should be communicated to the well owner for implementation.

Maine Department of Environmental Protection

COVERSHEET

APPROVAL ROUTING FORM

STANDARD OPERATING PROCEDURE

Operation Title: Division of Remediation SOPs

Originator Name: Brian Beneski

Attached are the final Division of Remediation SOPs for signature. As part of the five year review of the Divisions' Quality Assurance Plan (QAP), as required by USEPA and MEDEP's QMP, all of the Division SOPs were reviewed and updated by Division of Remediation and Division of Technical Services staff during 2015. In the Spring of 2016, the draft, updated SOPs were circulated to the Division Director, Bureau Director, Quality Assurance Manager, and Commissioner's office for review. The SOPs were returned to the originator with no comments. The draft SOPs were then sent to USEPA for review (as required by USEPA as part of their grant requirements), and returned to the originator with a few minor comments that were addressed.

Therefore, the SOPs have been finalized and are being circulated for signature. Please sign, forward, and return to the originator once fully signed. Please call or email me with any questions.

Division Director:

David Wright — Print Name

David Wright — Signature — Date: 12/1/2016

Bureau Director:

DAVID BURNS — Print Name

David C Burns — Signature — Date: 12/4/16

Quality Assurance Manager:

Bill Longfellow — Print Name

Signature — Date: 12/30/16

Commissioner:

Paul Mercer — Print Name

Signature — Date: 1-3-2017

ATTACHMENT C

QUALITY ASSURANCE PLAN
Maine Department of Environmental Protection
Division of Site Remediation

MEDEP/DR Standard Operating Procedure Manual,
Work Practices

COVER SHEET
STANDARD OPERATING PROCEDURE

OPERATION TITLE: **PROJECT RECORDS RETENTION PROTOCOL**

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

Standard Operating Procedure: **RWM-DR-WP001**
Revision: **00**
Date: **February 8, 2010**
Written by: **Brian Beneski**
Reviewed by: **David Wright**

Five Year Review No Changes Needed:

Print Name: _____ Signature: _____ Date: _____

Print Name: _____ Signature: _____ Date: _____

Print Name: _____ Signature: _____ Date: _____

Print Name: _____ Signature: _____ 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 (MEDEP/DR).

2.0 PURPOSE

MEDEP/DR is responsible for the investigation and remediation of hazardous substance, petroleum, and landfill sites throughout Maine. The goal of this SOP is to ensure that the BRWM file room in Augusta will have, or know the location of and be able to retrieve, all documents pertaining to site specific activities undertaken by the MEDEP/DR. Another goal is to ensure that the files are complete, but do not include unnecessary notes, duplicates, initial drafts, etc. that take up valuable file room space. All documents generated as part of the investigation and remediation of MDDEP/DR sites are considered public records, and must be maintained in an organized manner to facilitate review by MEDEP staff and by the public. As stated in Section 5.2. – "Document and Record Storage" of the MEDEP Quality Management Plan (QMP), "File maintenance is the responsibility of all MEDEP employees. Each Division or program area, as appropriate, establishes documented protocols for file maintenance." This SOP's purpose is to meet this requirement, and outline MEDEP/DR protocols for project file development and maintenance. This SOP is for Project Files only; Program files will be addressed in SOP RWM-DR-WP002 – Program File Protocol.

3.0 DEFINITIONS

- Project Manager – The project manager is the staff person in MEDEP/DR which is the primary contact for a given site. This person generally orchestrates investigation and clean-up activities at the site.
- Public Record - all documents, papers, letters, maps, books, tapes, photographs, films, sound recordings, or other material regardless of physical form or characteristics made or received pursuant to law or ordinance or in connection with the transaction of official business by the MEDEP/DR

4.0 RESPONSIBILITIES

- All MEDEP/DR staff are required to follow this procedure.
- Project managers are responsible for maintaining file content and ensuring that the file room knows where all documents pertaining to a site are located, and ensure that they can be retrieved by the file room when they are not located in the file room. They are responsible for ensuring that project files that are not in the possession of the file room are not removed, altered, or destroyed except in accordance with this policy.
- All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this procedure.
- File Room staff is responsible for storing, locating and retrieving project files in its possession, and for ensuring that visitors that are reviewing documents do not remove or alter the documents.

- The Bureau Director is responsible for certifying that copies of site files are true copies for court proceedings.

5.0 INTRODUCTION

The MEDEP/DR is a Division within the MEDEP's Bureau of Remediation and Waste Management (BRWM) that administers several different programs, all related to investigation and cleanup of hazardous substance, petroleum, and landfill Sites. An outline of these programs can be found in Section 6.1.1. MEDEP/DR staff in the course of investigating and remediating sites must generate public records (as defined above) that document the activities of these programs in addressing the environmental issues at these Sites.

Project files are public documents, therefore they are the property of the State, and must be maintained in a manner that keeps them available for review by the public. Project files must be updated with all documents as they are submitted to the MEDEP within a reasonable timeframe of receiving them. The File Room must be kept informed of all new projects assigned to MEDEP/DR. All documents pertaining to a project must be included in the project file in order to keep a current record of projects for public file reviews. The project manager must alert the file room when a project file at its desk is active, such that additional documents will likely be added to the file, so that the file room will be able to locate and provide these files should another person wish to review them.

It is possible for a project to have multiple program involvement within MEDEP/DR. For example, a project may start out in the Uncontrolled Sites program, have site assessments conducted as part of the Brownfields program, and be remediated under the VRAP program. Each program staff member will be responsible for maintaining the file for a project that corresponds to their program. The file room maintains files with a different color code for each program. Duplicate documents should not be filed for projects with more than one color code; if a document is filed in the 00 Gray file, a copy does not need to be filed in the 00 Blue file.

6.0 PROCEDURE

The MEDEP/BRWM File Room is the custodian of MEDEP/DR project files. MEDEP/DR project files are a subset, based on the project's "category" (See Section 6.1.1 File Color Codes) of the MEDEP/BRWM file system. MEDEP/BRWM "codes" files by color based on their program(s) involved with the project.

6.1 Initial File Development

Upon assignment of a new project, the project manager will arrange to have the appropriate files developed by the MEDEP/BRWM File Room. The project manager will inform the File Room Staff:

- Name of the Site;
- Location of the Site (City or Town);
- Appropriate color code (See Section 6.1.1);
- Categories of files; and
- An estimate of the amount and size of file folders that will be required, as well as the required categories (see 6.1.2). [Note: additional files and categories can and should always be added as soon as possible during the life of the project}.

It is imperative that the file room be informed of a newly assigned site as soon as possible, as well as that new records are available for review on active sites. The file room can make the additional file folders for the new records. This will assure that the file room provides all appropriate files to the general pubic when the project files are requested for public review, for both generic file reviews, for conducting due diligence reviews for real estate property transfers, and for requests for information under the Freedom of Access Act (FOAA). If the file room is not informed of new sites and all files available, the file room will not be able to provide complete information to the public, which, at a minimum, may give the appearance of withholding information, and may increase the liability of the State at remediation sites.

6.1.1 File Color Codes

Each program has a specific file color code as stated below. Records will be filed in the appropriate color coded project file type based on the program conducting the tasks.

- Uncontrolled Sites – This program investigates and remediates hazardous substance contamination under the states Uncontrolled Hazardous Substance Sites Law. Projects conducted under this program will utilize the Light Blue ("LBL") Uncontrolled Sites Program file type color code.
- Federal Facilities – This program provides State oversight of remedial activities at National Priority List (NPL) Sites. This program also works with the Department of Defense (DOD) in addressing hazardous substance contamination at Federal Facility Sites and other sites considered to be formerly used defense sites (FUDS). Projects conducted under this program will utilize the Light Blue – ("LBL") Uncontrolled Sites Program file type color code.
- Petroleum Remedial Site Management – This program manages mitigation activities at long-term leaking underground storage tank and other petroleum contaminated Sites. Projects conducted under this program will utilize orange ("ORA"). All records pertaining to activities conducted under the oversight of the Petroleum Remediation Program file type color code.
- Voluntary Response Action Program (VRAP) – This program oversees voluntary investigative and remedial activities of hazardous substance and petroleum contaminated sites. All records pertaining to activities conducted under the oversight of the Gray ("GRY") Voluntary Response Action Program file type color code.
- The Federal Site Assessment Program – This program conducts pre-remedial investigative activities at Sites that are on CERCLIS, the list of sites being investigated for inclusion on the NPL. Projects conducted under this program will utilize the Light Blue ("LBL") Uncontrolled Sites Program file type color code.
- The Brownfields Program – This program conducts investigative and remedial activities at Federal and State funded Brownfield Assessment projects. It also provides state regulatory oversight to municipalities and other quasi - municipal entities that receive funding through EPA's Brownfields program. Projects conducted under this program will utilize the Brown ("BRO") Brownfields Program file type color code.
- Land for Maine's Future Site Review Program – This program reviews sites as referred from the State of Maine's Land for Maine's Future Program (LMFP) for possible hazardous substance and petroleum contamination issues, and solid waste issues. Projects conducted under this program will utilize the Blue ("BLU") LMFP DOC/IFW Sites Program file type color code.

- Landfill Closure – This program oversees the closure and long term maintenance of municipal landfills throughout the State. This program does not utilize the same color/category code as all the other programs, and will be discussed in a Section 6.1.3 – Landfill Closure Program Filing.

6.1.2 Project File Categories

Project Files are further subcategorized by type of document; these different categories are assigned numbers. The categories that are relevant to the MEDEP/DR are as follows:

"00" – General correspondence. All general correspondence is filed in the 00 file. This specifically includes, but not limited to: all letters, all memoranda, trip reports, telephone logs, printed emails, newpaper articles, etc. Cover letters specific to reports, laboratory results, etc. may be included in the file with that document, but only one copy should be included the entire file (no duplicate records).

"01" - Results. All Laboratory analytical data that is otherwise not included in any report are to be filed on O1. If results are included in EGAD, a note to this effect should be included in the results file & how to obtain the results.

"02 – Non Paper Media. A list of all non paper media (floppy discs, CD data disks, video tapes, cassette sound tapes, etc.) for a project will be kept in file 02 or in appropriate places within the other files. The file room will maintain a storage location for this material.

"03" - Reports. All reports are to be filed in the 03 file. This includes site assessments, Phase I/ Phase II Environmental Site Assessments, remedial action reports, etc.

"04" - Contracts. All project specific contracts are to be filed in the 04 file.

"05" - Expenses. All project specific bills, invoices, purchase orders, etc.

"08" - Decisions. All documents outlining a MEDEP/DR decision. This includes, but is not limited to Certificate of Completion, No Further Action Assurance Letter, Records of Decision, Decision Documents, etc.

"09" – Financial Information. All documents and records pertaining to a potentially responsible parties ability to pay for investigation and remediation costs.

"10" - Potential Responsible Parties. All information regarding potential responsible parties, including responses to "Notification of Potential Liability and Information Requests", are to be filed in "10".

"22" - Confidential. Records, reports, opinions, information, and statements required to be kept confidential by federal or state law, rule, rule of court, or regulation by state statute. This includes documents labeled as Confidential Business Information and Enforcement Confidential Documents. Additionally, any draft HRS Worksheets developed as part of EPA's pre-remedial assessments that are over 28.5 are to be confidential.

6.1.3 Landfill Closure Program Filing

Project files for the Landfill closure program are organized by the Town in which the landfill is located, and license number. The landfill file is then broken down into three categories:

Reimbursements - "RE". All records regarding requests from municipalities for reimbursements. A new sub category folder is added sequentially (1,2,3, etc) for each request of additional funding.

Evaluation - "EV" All records regarding geological and engineering evaluation. A new subcategory is added sequentially for each new phase of investigation.

Closure Application – "CP". All records regarding closure application, with the following sub categories:

- "0" – General Information;
- "1" – Pre-application;
- "2" – Determination of Approval or denial;
- "3" – Condition Compliance;
- "4" – Grant Agreements;
- "5" – Construction Documents;
- "6" – Closure Certification;
- "7" – Misc.

6.2 Document Filing

As stated above, all documents defined as a "public record" pertaining to MEDEP/DR projects are to be kept in BRWM Project File, except for active project files. However, all active project files must be signed-out of the file room, and the project manager must inform the file room when additional documents may be added to an active project file, such that the file room will know to gather this information when providing documents to file reviewers. All documents are to be kept in the appropriate category file as defined above. Some documents have specific filing requirements, as discussed below. Due to space limitations of the file room, duplicate material in a project file is to be avoided. In addition to taking up valuable space in the file room, duplicate material in project files make it unnecessarily complicated for the public to review. Many of these issues discussed below are means of eliminating duplicate material.

Project files can reside in two locations only; the BRWM Project file room, and once signed out following file room protocol, a MEDEP staff person work space. Project files are not to be taken into the field and for the most part should not be removed from the Ray Building. The project manager is responsible for ensuring that any files and associated documents removed from the Ray Building are replaced if damaged or destroyed. Project files can, and generally do, stay in the work space of the project manager while the project is ongoing. Records are added to the file by the project manager while the project manager has custody of the file. If existing folders are filled during the time the project file is residing with the project manager, the project manager must request the creation of additional folders from the File Room. This will allow the file room to plan for enough space for the file when the project is complete, and allow the file room to inform file reviewers of the size of a file prior to their arrival to view a project file.

If a project file is in the custody of the file room, records can be added to the file by MEDEP/DR staff by completing the "Filing Form" sheet, attaching to the record, and submitting the record with the completed "Filing Form" to BRWM File Room Staff.

The MEDEP/DR receives many documents electronically. However, the BRWM File Room is the official file repository for MEDEP/DR files, and is for paper files only. All documents received electronically by the MEDEP/DR, whether by email or mailed disc or other type of data file, must be printed out and placed in the project file.

6.2.1 Draft vs. Final Documents

With the exceptions below, only final copies of documents are to be filed, as a draft document is a working document and may have errors or inaccuracies in it. Filing a draft document for the purpose of filing comments made to the report that are written within the margins of the text by the reviewer is not acceptable; Comments to draft documents that are significant enough to require documentation and filing as a public record must be written out in a memorandum, letter, or email (see Section 6.2.3.1) to the document originator or file.

A draft document may be filed if no or minimal changes have been made to the final document. In this instance, the project manager must mark on the cover the change from draft to final, and provide the appropriate date the Report was final and initial and date the change. If changes were made to the document itself, the project manager must insert the new final pages into the report, or make the change by hand, and initial and date each change.

A draft document may also be place in the project file if it may be a significant amount of time (6 months or greater) before the document is finalized. If this is the case the project manager must indicate on the cover that the document is draft, is awaiting finalization, indicate the date the final document is expected to be received, and sign and date. The project manager will be responsible for replacing the draft document with the final document once received, and removing the draft version from the file. If the document is never going to be finalized, this should be noted on the cover as well.

Draft documents must be retained by the Project Manager for at least 30 days after being replaced by a newer version, in case there is a Freedom of Information Act requesting the draft document. After 90 days, the draft should be discarded, unless a FOIA request has been filed on the project

6.2.2 Faxes

All faxes to the MEDEP should be followed up with the original document. Unless it will be a significant (greater than six months) amount of time before receiving the original, the fax copy of a document should not be filed; only the original. The fax copy must always be removed from the file once the original document is received.

A fax can be filed if the fax copy of a document will be the only copy of the document available to the MEDEP. In this case, the project manager should indicate the fax copy is the only copy available.

6.2.3 Records Sent Electronically to the Department

As stated earlier, records sent electronically to the Department must be printed out and placed in the file to be made available for public review. As indicated in Section 6.2.1, only final versions of documents will be filled.

6.2.3.1 Emails

All emails must be kept electronically as stated in State of Maine E-Mail Usage and Management Policy (a weblink to this Policy can be found on the MEDEP's QMP webpage). Additionally, since the BRWM project file is considered the official project record, all Emails that are of significance to a project must be filed in the project file. A "Significant" email is an email that provides information from which a decision is made, or documents a decision. An example of an "insignificant" email would be schedule coordination for a meeting or field event (please refer to the E-Mail Usage and Management Policy above for a more detailed description of email retention). The project manager will determine whether or not an email is significant and will require filing. To save space and paper, only one copy of an email is necessary in the file, even if the email was sent to multiple people. Additionally, emails should be printed out and filed after the "string" has ended, rather than printing out each email separately.

Electronic versions of draft documents are not to be kept; however, emails that record comments to and the finalizing of draft documents must be printed and kept in the file and electronically, as state in the above mentioned State E-Mail policy.

6.2.4 Post it Notes

Post it notes, or other similar adhesive paper pads or other pre-printed note pads, such as phone message notes, are not to be placed in the project file. If something is important enough to be added to the public record, it is to be done so in the standard appropriate letter or memorandum format.

6.2.5 Analytical Results

File category "01" is designated for laboratory analytical data sheets. However, only analytical results that are not included in a report should be filed on the "01" file. Examples of this would include, but not be limited to:

- Routine long term monitoring, in which a spreadsheet tabulating results attached to a summary memo at the end of a long term monitoring will be the only report generated.
- Routine long term water supply well monitoring, in which letters are sent to well owners transmitting the analytical results, and the laboratory analytical data package is kept in the "01" file as a complete document.

6.2.6 Records Relating to More than one Project

There may be instances in which the MEDEP/DR receives documents that relate to more than one project. Either a copy of the document must be included in each of the project's file for which it pertains, or a paper note in the file must cross-reference the appropriate file to obtain the report.

In the instance of large documents or closely related projects, the project manager should refer to reports that exist in another project file, rather than make copies. For example, one Phase II Site Assessment may incorporate several different parcels of property, each of which may be considered a separate project. The project manager may then elect to copy the cover page of the final report, and indicate on the cover page which project file contains the report in its entirety.

6.2.7 Non standard sized items

Non standard sized items should be "standardized" to the 8 ½ X 11 standard letter size for filing. If the item cannot be standardized, MEDEP/DR staff must discuss appropriate means of filing the object with MEDEP/BRWM file room staff, and then implement that plan.

6.2.7.1 Photographs

Photographs taken should be incorporated into the trip report developed for the field activity during which the photograph was taken (see MEDEP/DR SOP DR# - 013 – Documentation of Field Activities and Development of a Trip report), or the activities final report. However, photographs can also be filed as a stand alone record.

Photographs taken using film should be developed, and in the case of print photography, on the back of each photograph, the site name, site town, date of photograph, person taking the photograph, and brief statement of actions in photograph. Photographs should then be placed in a standard letter sized (8 ½ x 11) photograph holder with their associated negatives, and placed in the file (category "00"), along with a cover memo attached outlining the actions in the photographs.

For slide pictures, slides should have the name of site, town, date, and name of person taking the picture on the frame of the slide. The slides should then be placed in a standard letter sized slide holder, and placed in the file (category "00"), along with a cover memo attached outlining the actions in the photographs.

As with film photography, digital photographs should be printed out and placed in the trip report developed for the field activity during which the photograph was taken (or final report), although digital photographs can also be stand alone records following the procedure with film print photographs discussed above. Staff should also follow the protocols for digital photography as outlined in MEDEP SOP OC-PE-012 – Digital Photography.

6.2.7.2 Records on non Paper Media

A copy of all reports stored for a project on digital storage devices that are alterable or unable to be reviewed in the file room must be printed out and placed in the paper file for file reviewers. If the record cannot be printed out (or if project manager wishes the data file to be kept in addition to the paper file), the file room will store the data storage device and make it available for public review. All electronic data files for a project that the file room will act as a custodian for will be listed in the "02" file. These data files may be in the form of floppy disks, CD data disks, data thumb drives, etc. The entry must clearly state if the data file IS OR IS NOT available in paper form in the project file.

6.2.7.3 Maps/Engineering Drawings

All maps and engineering drawings not standard letter size will be folded and placed in a standard letter sized holder, with the Site name, town, date, and associated report indicated. If the map/drawing is a stand alone document, the project manager will attach a brief memorandum to the file outlining the information presented on the map/drawing.

6.2.7.4 Public Displays for Public meetings

Large size displays developed for public meetings are not to be kept in the BRWM File; only the summary handouts, and any official notes taken at the meeting. If a record of these displays are necessary, take a picture or electronically transfer the display onto paper that will fit into the file.

6.3 Annual File Maintenance

If the project is a multiyear project, it is also recommended that on a yearly basis the project manager review the file to assure it is complete, organized, and does not contain draft record, multiple copies of records, or other irrelevant items.

6.4 Project File Closure

At the end of the project, it is the responsibility of the project manager to review the entire project file, and ensure the project file is complete, organized, and has no draft or multiple copies of records, and meets the standards outlined above.

6.5 Project File Security

All project files are to be located in areas where public access is restricted by locking doors. The security of files in the custody of the BRWM file room in Augusta is the responsibility of the file room. The security of files not in the custody of the file room is the responsibility of the project manager. The responsible entity must ensure that files are not altered, damaged, destroyed or stolen. Once a project is closed, then the project manager must transfer the file to the BRWM file room in Augusta. If a project file is to be maintained in a regional office, the BRWM file room in Augusta must be alerted to this fact, so that people contacting the Augusta file room for the file will know that they need to arrange to review the file in the regional office.

ATTACHMENT D

QUALITY ASSURANCE PLAN
Maine Department of Environmental Protection
Division of Site Remediation

MEDEP Basic Data Review Checklist

Attachment A
(from EPA New England Guidance and National Functional Guidelines-NFG
and modified for MEDEP EGAD flagging conventions)

Organic – Blank Contamination Data Review Guidance

All blank sample results should be evaluated manually for contamination in accordance with the most recent NFG blank criteria. **Note:** This represents a change from previous EPA NE data validation guidance which included the application of a "5x or 10x" rule in accepting, qualifying or rejecting sample results based on blank contamination.

Apply the NFG criteria and actions based on the highest blank contamination associated with the samples. PES (Performance Evaluation Sample) contamination is not used to qualify data.
− In determining the highest blank contamination, evaluate all blanks including method, clean-up, instrument, storage, bottle, trip and equipment rinsate blanks.

− If the blank action for an analyte is determined using the concentration from an equipment, trip or bottle blank, then the positive values in the equipment, trip or bottle blank should be reported unqualified on the Data Summary Tables. However, if the blank action is determined from a laboratory blank (e.g., method, clean-up, storage, or instrument blank), then the positive values in the equipment, trip or bottle blanks should be qualified.

− For aqueous equipment, trip and bottle blanks, if an analyte is present in the non-aqueous sample and is also present in the associated aqueous equipment blank, trip blank or bottle blank, then flag that sample result (in the EGAD sample comments field) as B, to indicate to the end user that an indeterminate amount of sampling error has potentially impacted the sample results.

NFG criteria:

Table 1. Blank Actions for Low/Medium Volatiles Analyses

Blank Type	Blank Result	Sample Result	Action for Samples
Method, Storage, Field, Trip, Instrument **	Detects	Not detected	No qualification
	< RL*	< RL*	Report RL value with a U
		≥ RL*	Use professional judgment- Flag affected sample data with "B"
		< RL*	Report RL value with a U

Attachment A
(from EPA New England Guidance and National Functional Guidelines-NFG and modified for MEDEP EGAD flagging conventions)

	> RL*	> RL* and < blank	Report the blank concentration for the sample with a U or qualify the data as unusable R
		≥ RL* and ≥ blank concentration	Use professional judgment- Flag affected sample data with "B" qualifier
	= RL*	< RL*	Report RL value with a U
		≥ RL*	Use professional judgment- Flag affected sample data with "B"
	Gross	Detects	Qualify results as unusable R

* 2x the RL for methylene chloride, 2-butanone, and acetone.

** Qualifications based on instrument blank results affect only the sample analyzed immediately after the sample that has target compounds that exceed the calibration range or non-target compounds that exceed 100 µg/L.

Table 2. Blank Actions for Semivolatiles Analyses

Blank Type	Blank Result	Sample Result	Action for Samples
Method, Field	Detects	Not detected	No qualification
	< RL*	< RL*	Report RL value with a U
		≥ RL*	Use professional judgment- Flag affected sample data with "B" qualifier
	> RL*	< RL*	Report RL value with a U
		≥ RL* and <blank concentration	Report the blank concentration for the sample with a U or qualify the data as unusable R
		≥ RL* and ≥ blank	Use professional judgment- Flag affected sample data with

	= RL*	< RL*	Report RL with a U
		≥ RL*	Use professional judgment- Flag affected sample data with "B" qualifier
	Gross contamination	Detects	Qualify results as unusable R
	TIC > 10 µg/L (for aqueous blanks) TIC > 330 µg/kg (for non-aqueous blanks)	Detects	Use professional judgment- Flag affected sample data with "B" qualifier

* 5x the RL for bis(2-ethylhexyl)phthalate for low-level non-aqueous and aqueous samples.

Table 3. Blank Actions for Pesticide Analyses

Blank Type	Blank Result	Sample Result	Action for Samples
Method, Sulfur Cleanup, Instrument, Field	Detects	Not detected	No qualification
	< RL	< RL	Report RL value with a U
		≥ RL	Use professional judgment- Flag affected sample data with "B" qualifier
	> RL	< RL	Report RL value with a U
		≥ RL and < blank concentration	Report the blank concentration for the sample with a U, or qualify the data as unusable R
		≥ RL and ≥ blank concentration	Use professional judgment- Flag affected sample data with "B" qualifier

	= RL	< RL	Report RL values with a U
		≥ RL	Use professional judgment- Flag affected sample data with "B" qualifier
	Gross	Detects	Qualify results as unusable R

Table 4. Blank Actions for Aroclor Analyses

Blank Type	Blank Result	Sample Result	Action for Samples
Method, Sulfur Cleanup, Instrument, Field	Detects	Not detected	No qualification
	< RL	< RL	Report RL value with a U
		≥ RL	Use professional judgment- Flag affected sample data with "B" qualifier
	> RL	< RL	Report RL value with a U
		≥ RL and < blank concentration	Report the blank concentration for the sample with a U, or qualify the data as unusable R
		≥ RL and ≥ blank concentration	Use professional judgment- Flag affected sample data with "B" qualifier
		< RL	Report RL values with a U

	= RL	≥ RL	Use professional judgment- Flag affected sample data with "B" qualifier
	Gross	Detects	Qualify results as unusable R

Inorganic – Blank Contamination Data Review Guidance

All blank sample results should be evaluated manually for contamination in accordance with the most recent NFG blank criteria. **Note:** This represents a change from previous EPA NE data validation guidance which recommended the application of a 5x rule in accepting, qualifying or rejecting sample results based on blank contamination.

Apply the NFG criteria and actions based on the highest blank contamination associated with each sample. PES (Performance Evaluation Sample) contamination is not used to qualify data.

− In determining the highest blank contamination, evaluate all blanks including preparation/method, calibration/instrument, bottle, and equipment rinsate blanks.

− Initial and continuing calibration blank contamination within an analytical sequence applies to all samples analyzed in that sequence. Use professional judgment- Flag affected sample data with "B" qualifier to apply contamination only to a specific subset of samples.

− If the blank action for an analyte is determined using the concentration from an equipment or bottle blank, then the positive values in the equipment or bottle blank should be reported unqualified on the Data Summary Tables. However, if the blank action is determined from a laboratory blank (e.g., preparation or calibration blank), then the positive values in the equipment and bottle blanks should be qualified.

− For aqueous equipment and bottle blanks, if an analyte is present in the non-aqueous sample and is also present in the associated aqueous equipment blank or bottle blank, then flag that sample result as EB or BB, respectively, to indicate to the end user that an indeterminate amount of sampling error has potentially impacted the sample results.

NFG criteria:

Attachment A
(from EPA New England Guidance and National Functional Guidelines-NFG and modified for MEDEP EGAD flagging conventions)

Table 5. Blank Actions for ICP-AES Analysis

Blank Type	Blank Result	Sample Result	Action for Samples
ICB/CCB	≥ MDL but ≤ RL	Non-detect	No action
		≥ MDL but ≤ RL	Report RL value with a "U"
		> RL	Use professional judgment- Flag affected sample data with "B" qualifier
ICB/CCB	> RL	≥ MDL but ≤ RL	Report RL value with a "U"
		> RL but < Blank Result	Report at level of Blank Result with a "U" or qualify data as unusable (R)
		> Blank Result	Use professional judgment- Flag affected sample data with "B" qualifier
ICB/CCB	≤ (-MDL) but ≥ (-RL)	≥ MDL, or non-detect	Use professional judgment- Flag affected sample data with "B" qualifier
ICB/CCB	< (-RL)	< 10x the RL	Qualify results that are ≥ RL as estimated low (J) Qualify non-detects as estimated (UJ)
Preparation Blank	> RL	≥ MDL but ≤ RL	Report RL value with a "U"
		> RL but < 10x the Blank Result	Use professional judgment- Flag affected sample data with "B" qualifier to qualify results as unusable (R) or estimated high (J)
		≥ 10x the Blank Result	No action
Preparation Blank	≥ MDL but □□ RL	Non-detect	No action
		≥ MDL but □□RL	Report RL value with a "U"
		> RL	Use professional judgment- Flag affected sample data with "B" qualifier
Preparation Blank	< (-RL)	< 10x the RL	Qualify results that are ≥ RL as estimated low (J) Qualify non-detects as estimated (UJ)

Attachment A
(from EPA New England Guidance and National Functional Guidelines-NFG and modified for MEDEP EGAD flagging conventions)

Table 6. Blank Actions for ICP-MS Analysis

Blank Type	Blank Result	Sample Result	Action for Samples
ICB/CCB	≥ MDL but ≤ RL	Non-detect	No action
		≥ MDL but ≤ RL	Report RL value with a "U"
		> RL	Use professional judgment- Flag affected sample data with "B" qualifier
ICB/CCB	> RL	≥ MDL but ≤ RL	Report RL value with a "U"
		> RL but < Blank Result	Report at level of Blank Result with a "U" or qualify data as unusable (R)
		> Blank Result	Use professional judgment- Flag affected sample data with "B" qualifier
ICB/CCB	≤ (-MDL),but ≥ (-RL)	≥ MDL, or non-detect	Use professional judgment- Flag affected sample data with "B" qualifier
ICB/CCB	< (-RL)	< 10x RL	Qualify results that are ≥ RL as estimated low (J-) Qualify non-detects as estimated (UJ)
Preparation Blank	> RL	≥ MDL but ≤ RL	Report RL value with a "U"
		> RL but < 10x the Blank Result	Qualify results as unusable (R) or estimated high (J)
		≥ 10x the Blank Result	No action
Preparation Blank	≥ MDL but ≤ RL	Non-detect	No action
		≥ MDL but ≤ RL	Report RL value with a "U"
		> RL	Use professional judgment- Flag affected sample data with "B" qualifier
Preparation Blank	< (-RL)	< 10x RL	Qualify results that are ≥ RL as estimated low (J) Qualify non-detects as estimated (UJ)

Attachment A
(from EPA New England Guidance and National Functional Guidelines-NFG and modified for MEDEP EGAD flagging conventions)

Table 7. Blank Actions for Mercury Analysis

Blank Type	Blank Result	Sample Result	Action for Samples
ICB/CCB	Absolute value is ≥ MDL but ≤ RL	Non-detect	No action
		≥ MDL but □□RL	Report RL value with a "U"
		> RL	Use professional judgment- Flag affected sample data with "B" qualifier
ICB/CCB	Absolute value is > RL	≥ MDL but □□RL	Report RL value with a "U"
		> RL but < Blank Result	Report at level of Blank Result with a "U" or qualify data as unusable (R)
		> Blank Result	Use professional judgment- Flag affected sample data with "B" qualifier
ICB/CCB	≤ (-MDL), but ≥ (-RL)	≥ MDL, or non-detect	Use professional judgment- Flag affected sample data with "B" qualifier
ICB/CCB	< (-RL)	< 10x the RL	Qualify results that are ≥ RL as estimated low (J) Qualify non-detects as estimated (UJ)
Preparation Blank	> RL	≥ MDL but ≤ RL	Report RL value with a "U"
		> RL but < 10x the Blank Result	Qualify results as unusable (R) or estimated high (J)
		≥ 10x the Blank Result	No action
Preparation Blank	≥ MDL but ≤ RL	Non-detect	No action
		≥ MDL but □□RL	Report RL with a "U"
		> RL	Use professional judgment- Flag affected sample data with "B" qualifier
Preparation Blank	< (-RL)	< 10x the RL	Qualify results that are ≥ RL as estimated low (J) Qualify non-detects as estimated (UJ)

Attachment A
(from EPA New England Guidance and National Functional Guidelines-NFG and modified for MEDEP EGAD flagging conventions)

Table 8. Blank Actions for Cyanide and Wet Chemistry Analyses

Blank Type	Blank Result	Sample Result	Action for Samples
ICB/CCB	Absolute value is ≥ MDL but ≤ RL	Non-detect	No action
		≥ MDL but ≤ RL	Report RL value with a ”U”
		> RL	Use professional judgment- Flag affected sample data with “B” qualifier
ICB/CCB	Absolute value is > RL	≥ MDL but ≤ RL	Report RL value with a “U”
		> RL but < Blank	Report at level of Blank Result with a “U” or qualify data as unusable (R)
		> Blank Result	Use professional judgment- Flag affected sample data with “B” qualifier
ICB/CCB	≤ (-MDL), but ≥ (-RL)	≥ MDL, or non-detects	Use professional judgment- Flag affected sample data with “B” qualifier
ICB/CCB	< (-RL)	< 10x the RL	Qualify results that are ≥ RL as estimated low (J) Qualify non-detects as estimated (UJ)
Preparation Blank	> RL	≥ MDL but ≤ RL	Report RL value with a “U”
		> RL but < 10x the Blank Result	Qualify results as unusable (R) or estimated high (J)
		≥ 10x the Blank Result	No action
Preparation Blank	≥ MDL but ≤ RL	Non-detect	No action
		≥ MDL but ≤ RL	Report RL value with a “U”
		> RL	Use professional judgment- Flag affected sample data with “B” qualifier
Preparation Blank	< (-RL)	< 10x the RL	Qualify results that are ≥ RL as estimated low (J) Qualify non-detects as estimated (UJ)

Attachment A
(from EPA New England Guidance and National Functional Guidelines-NFG and modified for MEDEP EGAD flagging conventions)