



1. APPLICABILITY

This Standard Operating Procedure (SOP) applies to all BRWM staff working on petroleum remediation sites within the Petroleum Program. It is applicable to all petroleum remediation sites after a referral has been made from Response Services. It is applicable to all parties that investigate, mitigate, remediate, or monitor petroleum releases.

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. PURPOSE

The purpose of a Sampling and Analysis Plan is to provide a method for proper planning prior to completing a sampling event. A SAP outlines the goals of the activity and methodology that will be used to achieve the goal. A well-developed SAP 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. A SAP will be developed in accordance with the site specific conceptual site model (RWM-PP-006) and reviewed by all Project Team members in accordance with RWM-PP-006 and RWM-PP-017.

The purpose of this document is to describe the MEDEP BRWM requirements for the development of a Sampling and Analysis Plan (SAP).

3. RESPONSIBILITIES

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

4.0 DEFINITIONS

4.1 CONCEPTUAL SITE MODEL (CSM) - See RWM-PP-006. A written or pictorial representation of an environmental system, the extent of the contaminant source, and the biological, physical and chemical processes that determine the transport of contaminants from sources through environmental media to environmental receptors within the system. (ASTM E1689 - 95 (2014), Standard Guide for Developing Conceptual Site Models for Contaminated Sites).

4.2 CONTAMINANT OF CONCERN (COC) - A contaminant that has been released at a site and risk evaluation indicates that mitigation or remediation is necessary to prevent exposure to the contaminant.

4.3 DATA QUALITY OBJECTIVE (DQO) - Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality and quantity of data needed to support technical



4.4 PROJECT LEAD – As defined in the RAGs, the “project lead” is the agency, group, or organization that is the primary leader and funder for remedial activities at the site and generally hires the contractor that undertakes the remediation. The project lead may be the site owner/operator or other Potential Responsible Party, a state or federal agency, a developer, or other person.

4.5 PROJECT TEAM - The project team includes DEP staff within BRWM that are simultaneously assigned and actively involved in a petroleum release case that requires remediation of soil, water, or air. The project team may include members of the Division of Response Services, Division of Technical Services, Division of Petroleum Management, and the Division of Remediation. Additionally, the team may include environmental consulting technical staff hired by the MEDEP or a responsible party.

4.6 PROJECT TEAM LEADER - The project leader is the BRWM staff member who is directing actions to be taken at the site, maintains communications with affected property owners, occupants of the property, and other project team members, documents site activities, and approves payment of invoices for the project. During the initial response action, the OHMR is the project team leader until a referral has been made. After the referral is completed, the project team will decide who the project leader shall be based on the site specific needs. If a referral is made to the Petroleum Project Management Unit then the assigned project manager becomes the project team leader.

4.7 SAMPLE POINT NAME – The specified sample point name for the monitoring well (e.g. MW-1), water supply well (e.g. Smith), pore water location (e.g. PW-1), The sample point name is consistent with the designated sample location on the Chain of Custody, recorded in EGAD, GIS, and the sample location map.

5. GUIDELINES AND PROCEDURES

5.1 INTRODUCTION

A SAP includes a narrative document accompanied by sample location map(s) and tables with the designated sample point name as they appear on the chain of custody. Sampling events that require a SAP include both single-event investigation sampling and multiple-event monitoring sampling, also known as routine monitoring.

Attachment 1 of this SOP presents a template for single-event investigation sampling. The SAP can be updated for each phase of investigation where previous data exists and is reviewed for data gaps. Typical sampling activities covered under the Attachment 1 includes testpits, soil borings, groundwater sampling from temporary monitoring wells, neighborhood water supply sampling events, borehole evaluations, surface water, and porewater sampling.

Attachment 2 of this SOP presents a template for multiple-event sampling at the same locations associated with routine monitoring. One SAP can be developed and used for the entire monitoring period of a petroleum remediation site where the same sample points are sampled more than once. Typical sampling activities covered under the Attachment 2 includes two templates that can be used for routine monitoring of water supplies, monitoring wells,



groundwater treatment system sampling, vapor monitoring, indoor air screening, and air sampling.

Attachment 1 and Attachment 2 can be supplemented with the CSM attachment (RWM-PP-006), maps, and tables for reference and clarity to avoid duplication and improve efficiency.

Attachments 1 or 2, together with a sample location map, and the Chain of Custody can be used to document sampling events as required in SOP RWM-PP-017.

Regardless of the type of sampling event (monitoring or site investigation) a SAP will contain the following elements.

5.2 ASSESSMENT OF EXISTING DATA

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

5.2.1 SITE RECONNAISSANCE

Prior to sampling 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, along with recommendations for overcoming these issues, should be discussed in the SAP. For routine monitoring, where staff have already conducted field investigations or remedial actions, a separate site reconnaissance is not necessary.

4.2.2 CONCEPTUAL SITE MODEL

The first step in developing any sampling plan is to develop a conceptual site model (CSM). 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.

Refer to MEDEP SOP RWM-PP-006 for the procedure on developing a Petroleum Program CSM. Considerations specific to a Petroleum Program site CSM include, but are not limited to, the following:

1. The product type, volume, duration, and date of the release
2. Site history
3. Remaining impacts to environmental media following emergency remediation
4. The location of the release relative to water supplies, ground water resources, and surface water resources
5. Impact or risk of impact to indoor air quality – consider heating, ventilation, and air conditioning (HVAC) system



6. The location of the release relative to structures on the site – inside or outside of the building
7. Impacts to preferential pathways such as sumps, floor drains, perimeter drains, etc.
8. Types and characteristics of at-risk water supplies – casing condition and depth, well depth, etc.
9. Impacted building components - construction of building and foundation type
10. Site topography
11. Groundwater geochemistry changes and non-petroleum vapor impacts caused by the petroleum release

5.3 TITLE SECTION

The title section of an SAP will contain the name and town of project, the MEDEP Spill #, other relevant project numbers (EGAD, Tank Registration, REMO), and the name and title of the person developing the SAP.

5.4 INTRODUCTION

The introduction will state the DQOs which include the goals of the sampling plan and the end use of the data relative to the criteria that the data will be compared to. The introduction will state the purpose of the sampling (i.e. monitor at-risk property, monitor effects of emergency actions, monitor effects of remedial actions, monitor on-going mitigation actions, monitor for site closure). The purpose will include a statement justifying the need for the sampling related to the spill, actions taken, action not taken due to site-specific conditions including the nature of the migration pathway and/or the nature of the receptor(s). At a minimum, petroleum sites require a Level 2 data deliverable and 95% data usability. If a higher level data deliverable or a different data usability percentage is required, it must be specified in the project SAP. Provide references to specific SOPs that will be followed during the sampling event(s).

5.5 BACKGROUND INFORMATION

At a typical Petroleum Program site, the background information is documented by the Division of Response Services in the spill report file. Reference to the spill number is sufficient for providing background information.

5.6 SITE SPECIFIC HEALTH AND SAFETY CONCERNS

This document should reference the site safety plan (RWM-PP-071).and note any special safety concerns that exist at the site that pose a safety risk to samplers.

If below grade sampling is part of the SAP, Dig-Safe and Ok To Dig and/or nonmember utilities 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.

5.7 SAMPLING METHODOLOGY/EQUIPMENT



A description of the sampling methodology will be included in the SAP. In instances where a MEDEP SOP is available, reference to SOPs by either name or document number is sufficient. Any site-specific modification to the methodology must be documented.

5.8 SAMPLES AND PARAMETERS

5.8.1 SAMPLE LOCATIONS

A map or labeled photograph showing planned sampling locations shall be included in the Petroleum Program project file. 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.

5.8.2 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);
- Porewater;
- Soil gas and/or sub-slab soil gas;
- Indoor air;
- Surface Water;
- Sediment;
- Neat waste material.

5.8.3 ANALYTICAL PARAMETERS

Parameters will be identified by either laboratory analysis methodology number and name of analysis, or by field test type

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.

5.8.4 FIELD ANALYSES

Field instruments will be identified and the purpose of their use (direct lab sampling, evaluate data quality control, making field decisions related to remedial actions, or evaluating air and water quality) will be documented. Include appropriate references to specific field procedures (such as soil gas, vapor source material identification, identification of gasoline contaminated soil, etc.) using appropriate SOP references. Appropriate reference to field instrument calibration should be noted (RWM-PP-008).



5.9 FIELD QUALITY CONTROL SAMPLES

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

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

5.10 REPORT GENERATION

Every sampling event will be documented in the project file. Data obtained as part of the SAP will be assessed and documented in the project file.

6. 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 samples should be accompanied by a Chain of Custody and should be properly preserved from the time they are collected to the time they are analyzed.

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. At a minimum, petroleum sites require a Level 2 data deliverable and 95% data usability.

7. REFERENCES

ASTM E1689 - 95 (2014), Standard Guide for Developing Conceptual Site Models for Contaminated Sites.

SOP RWM-PP-006 Conceptual Site Model for Petroleum Contamination
SOP RWM-PP-017 Site Activity Tracking and Site Closure



ATTACHMENT 1
SAMPLING AND ANALYSIS PLAN TEMPLATE
FOR SINGLE EVENT SITE SAMPLING

MEDEP Petroleum Program
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.)

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/RAGs
- 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 and OK To Dig)

- 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: _____



ATTACHEMNT 2

SAMPLING AND ANALYSIS PLAN TEMPLATE

FOR MULTIPLE EVENT SITE SAMPLING AND ROUTINE MONITORING

Routine¹ Sampling and Analysis Plan (SAP) for _____
(Site Name) (Town) (Spill #)

SAP Developed By: _____ Date: _____

Refer to the project file for site map, CSM, and background information.

Data Quality Objectives:

- Meet the Petroleum Guidelines
- Other: _____

Groundwater – Water Supply Wells

Sample Point Name(s): _____			
Well Type: _____ Sample Location: _____ Collection Method: _____			
	Before Filters	Between Filters	After Filters
Sample Frequency	_____	_____	_____
Laboratory Analysis Method*			

Sample Point Name(s): _____			
Well Type: _____ Sample Location: _____ Collection Method: _____			
	Before Filters	Between Filters	After Filters
Sample Frequency	_____	_____	_____
Laboratory Analysis Method*			

Sample Point Name(s): _____			
Well Type: _____ Sample Location: _____ Collection Method: _____			
	Before Filters	Between Filters	After Filters
Sample Frequency	_____	_____	_____
Laboratory Analysis Method*			

Groundwater – Monitoring Wells

	Sample Point Name			
Sample Collection Method	_____	_____	_____	_____
Sample Frequency	_____	_____	_____	_____
Laboratory Analysis Method*				

Groundwater – Recovery Well

	Sample Point Name:					
	FORT event		Treatment Trailer			No treatment
	before pumping	after pumping	before filters	between filters	after filters	
Sample Collection Method	_____	_____	_____	_____	_____	_____
Sample Frequency	_____	_____	_____	_____	_____	_____
Laboratory Analysis Method*						

Vapor

	Sample Point Name				
Location	_____	_____	_____	_____	_____
Screening Method	_____	_____	_____	_____	_____
Screening Frequency	_____	_____	_____	_____	_____
Sample Method	_____	_____	_____	_____	_____
Sample Frequency	_____	_____	_____	_____	_____
Laboratory Analysis Method*					

*Commonly used sample analysis methods are listed below. For a method not included in the list, look up or ask the Chemistry Unit for the name and number of the method.

EPH- MADEP-EPH Rev 1.1

VOA- EPA 524.2

APH- MADEP-APH Rev 1.0

VPH- MADEP-VPH Rev 1.1

VOA- SW8260 C/D

TO-15

TEPH- MADEP-EPH Rev1.1

SVOA- SW8270 D/E

1. This SAP is designed for Routine sampling events at Petroleum Program sites. For all other sampling events, including soil, sediment, surface water, and neat material sampling, develop a site-specific SAP or use Attachment A of MEDEP SOP No. RWM-DR-014.












RWM-PP-007_SamplingandAnalysisPlan

Final Audit Report

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