



**COVER SHEET
STANDARD OPERATING PROCEDURE**

Operation Title: Ground Water Resource and Drinking Water Protection
At Petroleum Remediation Sites

Originator: Kelly Perkins
Quality Assurance Coordinator
Division of Technical Services
Bureau of Remediation and Waste Management

APPROVALS:

Division of Technical Services Director:

Molly King Molly King Aug 26, 2021
Molly King (Aug 26, 2021 12:09 EDT)
Print name Signature Date

Bureau of Remediation and Waste Management Director:

Susanne Miller [Signature] Sep 1, 2021
Print name Signature Date

QMSC Chair:

Bill Longfellow Bill Longfellow Sep 1, 2021
Bill Longfellow (Sep 1, 2021 14:08 EDT)
Print name Signature Date

Department Commissioner:

Melanie Loyzim Melanie Loyzim Oct 14, 2021
Print name Signature Date

DISTRIBUTION:

() Division of Technical Services.....By: _____ Date: _____



1. APPLICABILITY

This Standard Operating Procedure (SOP) applies to all BRWM staff working on petroleum remediation sites within the Petroleum Program. It is also applicable to all parties that investigate, mitigate, or remediate 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.

This SOP directs the remediation decisions for the site and surrounding area. If a discharge location meets any ONE of the following criteria, the remediation goal will include the protection and remediation of drinking water and ground water in accordance with the Conceptual Site Model (CSM, SOP RWM-PP-006).

- 1) A private or public drinking water supply well that is actively used for human consumption of the water is contaminated.
- 2) A discharge is located in a source water protection area of a public drinking water supply as mapped by the Maine Drinking Water Program in the Department of Health and Human Services (http://www.maine.gov/dep/gis/datamaps/DWP_Wells/index.html) (either a mapped travel zone or a 1000 ft radius). Professional judgment, as documented in the CSM, determines that there is a risk of impact to the water supply.
- 3) A discharge of petroleum products is located within 300 ft of an active private or transient public drinking water supply well used for human consumption (ITRC, 2018, Rand, 1994, Shih et al, 2004, Wiedemeier et al 1999, Zemo et al, 2017)
- 4) A discharge is located on a significant sand and gravel aquifer as mapped by the Maine Geological Survey in the Maine Department of Conservation. (<http://www.maine.gov/dacf/mgs/pubs/online/aquifers/aquifers.htm>); OR
- 5) Where there is a high probability of future residential development and use of the ground water for private drinking water wells. This is limited to entire parcels, and portions thereof, within 300 feet of a petroleum products discharge; that are currently zoned by the municipality or the Maine Land Use Planning Commission (plantations and unorganized townships) to expressly allow residential development as a permitted use; public drinking water service is not available within 1000 ft. of the discharge location; AND ground water at the property boundary of the parcel with the discharge is contaminated by oil above the Remedial Action Guidelines for Residential Exposure (RAGs, Table 5), or the Maine CDC Drinking Water Guidelines (State of Maine Maximum Exposure Guidelines, USEPA Maximum Contaminant Level, or USEPA Health Advisory Levels (<https://www.maine.gov/dhhs/mecdc/environmental-health/eohp/wells/index.htm>)).

The following exceptions apply to the above criteria:



- 1) Exception for Urban Ground Water Non-Attainment Areas. This SOP does not apply to a site where only Criteria 4 or 5 above applies, and the discharge location meets the definition of an urban ground water non-attainment area (see Section 3).
- 2) Exception for workplace safety. These guidelines are not intended or appropriate for use to protect construction, excavation or remediation workers against exposure to oil contaminated ground water encountered during construction or remediation activities.¹
- 3) In accordance with Section A2 of the RAG Addendum for Petroleum Remediation, The risk-based decision for remediation must evaluate the environmental footprint when existing contamination has been in place for sufficient time (relative to the fate and transport of petroleum contamination along the migration pathway) to reach the receptor and the receptor is not impacted above an applicable guideline in accordance with the CSM.

2. PURPOSE

The purpose of this document is to provide the MEDEP/BRWM with a list of considerations for protecting ground water resources and surface drinking water supplies, including when to undertake or fund the monitoring, treatment, and/or remediation of drinking water supplies at sites with a petroleum release.

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. DEFINITIONS

4.1 LNAPL - Light non-aqueous phase liquid. A liquid having a specific gravity less than one and is composed of one or more organic compounds that are immiscible or sparingly soluble in water and is observable to be separate from water. The term encompasses all potential occurrences of LNAPL including free, residual, mobile, entrapped, and visible petroleum sheen.

4.2 MAINE CENTER FOR DISEASE CONTROL (CDC) DRINKING WATER GUIDELINES – (<https://www.maine.gov/dhhs/mecdc/environmental-health/eohp/wells/index.htm>) Maine CDC transitioned to using the Environmental Protection Agency's (EPA) drinking water standards and health advisory levels for contaminants found in well water in Maine and no longer maintains separate Maximum Exposure Guidelines (except for radon). The Maine CDC established an MCL for MTBE of 35 ug/L (<https://www.maine.gov/dhhs/mecdc/environmental-health/eohp/wells/documents/mtbe.PDF>).



- 4.3 PRIVATE DRINKING WATER WELL - This is defined in statute (38 MRSA, §1392) as a well that is used to supply water for human consumption and is not a public water supply well. Individual household wells are the most prevalent example. A well used exclusively for livestock, animals or plants does not meet this definition.
- 4.4 PROFESSIONAL JUDGMENT - The application of the accumulated knowledge and experience gained through relevant training that results in making informed decisions based on the conceptual site model. These decisions will guide the courses of action that are appropriate in specific circumstances. For this SOP, decisions are routinely made by a Maine licensed geologist, a Maine licensed professional engineer, or geologist or engineer otherwise in compliance with Maine’s professional regulation statutes.
- 4.5 PUBLIC DRINKING WATER SUPPLY WELL – For the purposes of this SOP, this refers to a well or water supply for the following types of water systems, as defined by the State of Maine Department of Health and Human Services Drinking Water Program:
- 4.4.1. “Community Public Water System” – A public water system which serves at least fifteen service connections used by year-round residents or regularly serves at least 25 year-round residents. (Year-round is defined as permanent residence greater than six months.) Examples include water utilities, mobile home parks, apartment buildings, and nursing homes.
- 4.4.2. “Non-Transient, Non-Community Public Water Supply Well” – A non-community public water system that serves at least 25 of the same persons for six months or more per year. Examples include schools, office buildings, factories.
- 4.6 TRANSIENT PUBLIC WATER SUPPLY WELL – A well or water supply that supplies a non-community public water system that serves at least 25 persons, but not necessarily the same persons, for at least 60 days per year. Examples include restaurants, camps and campgrounds, motels and hotels, and golf courses.
- 4.6 URBAN GROUND WATER NON-ATTAINMENT AREAS - These are aquifers or portions of an aquifer that because of current and historical land use and pollution have little potential for use as a public or private drinking supply source. For the purpose of these guidelines only, these are densely developed industrial, commercial or residential areas, supplied by public water, including portions of mapped sand and gravel aquifers or other ground water aquifers where any one of the following conditions are documented or found to exist:
- a) The aquifer or ground water beyond the property on which the discharge occurred was polluted with one or more man-made contaminants in concentrations exceeding the Remedial Action Guidelines for Groundwater or the Maine CDC Drinking Water Guidelines., AND the aquifer’s ground water has not been and is not now the subject



of a Department supervised or approved remediation effort with the eventual goal of restoring or protecting ground water to ensure its potability; OR,

- b) Dense commercial or residential development where most lots are ½ acre or less with subsurface waste water disposal, with public drinking water service , and no active, potable water supply wells within 1000 ft.; OR
- c) Where institutional controls or a municipal ordinance prohibits the withdrawal of ground water for human use within 1000 ft. of the discharge location; OR
- d) Other documentation demonstrating to the Department's satisfaction that the aquifer is unsuitable or unavailable as a future public or private drinking water resource.

4.7 SURFACE WATER

The State of Maine classifies three types of surface water: Fresh Surface Water, Lakes and Ponds, and Estuarine and Marine Waters. Fresh Surface Water has four classifications: AA, A, B and C. Lakes and Ponds has one GPA. Estuarine and Marine Waters has three classifications SA, SB, and SC.

Additionally, the State of Maine designates Surface Water of Special Considerations including waters that are classified as sustenance fishing including sections of the Penobscot River Basin, St. Croix River Basin, and St. John River Basin and some lakes and ponds including, Conroy Lake in Monticello; Grand Lake Metagaming in Trout Brook Township and T6R8 W.E.L.S; Mattamiscontis Lake in T3R9N.W.P. and T2R9 N.W.P; Grand Falls Flowage, Berry Brook Flowage, George Brook Flowage, Huntley Brook Flowage, Lewey Lake, The Basin, The Narrows, Long Lake and Big Lake, adjacent to Indian Township; and Sysladobsis Lake in T5N.D.

5. GUIDELINES AND PROCEDURES

5.1 PLANNING

A well-developed Conceptual Site Model (CSM) is imperative for effective use of this technique (see SOP RWM-PP-006 – Conceptual Site Model for Petroleum Contamination). It will determine the necessity and frequency of ground water sampling. Prior to conducting any sampling event, a Sampling and Analysis Plan (SAP) should be developed (see SOP RWM-PP-007 - Development of a Sampling and Analysis Plan).

5.2 PROCEDURE

5.2.1 OVERVIEW

At sites where there has been an oil discharge, and the location meets the criteria detailed in Section 1 of this SOP, MEDEP BRWM staff should:



- Include protection of the drinking water and ground water resource in the CSM for the site.
- Protect drinking water and ground water from both direct contamination and contamination leaching from soil to ground water in accordance with the CSM.
- Notify the Department of Health and Human Services Drinking Water Program (DWP) if there is a public drinking water supply or transient public water supply involved.
- Work with DWP staff as per DWP/MEDEP Memorandum of Agreement (MOA) to determine the risk to the water supply.

5.2.2 CONSIDERATIONS

MEDEP BRWM staff should use the CSM to document their professional judgement for determining when a well or surface water supply is at risk and when to develop a Sampling and Analysis Plan. Professional judgement should include all the following factors as applicable:

- a) Well Construction – well type, casing length, depth to water table, well inspection results, integrity of casing and seal, wellhead location and access
- b) Well or Surface Water Use – private or public water supply; seasonal or year-round; residential, commercial, or industrial use; typical demand on well or number of occupants
- c) Geologic Setting – topography, slope, soil type, soil characteristics, bedrock type, bedrock strike and dip, overburden thickness, estimated hydraulic conductivity and gradient, seepage velocity, modeled well travel times, surficial geology and depositional setting
- d) Spill Information – volume, product type(s), elapsed time from date of spill to reporting date, distance from drinking water sources, duration of spill (catastrophic vs long slow leak), surface spill vs subsurface/basement spill, confidence that initial spill cleanup removed the majority of the contamination, site history

When the location of the petroleum release is not obvious, or the volume of the discharge is unaccounted, further investigation (e.g. test borings or test pits) may be warranted.

Further site investigation and remediation may also be needed to protect drinking water and ground water to meet the Maine Remedial Action Guidelines (RAGs) for Sites Contaminated with Hazardous Substances.



At sites where there is LNAPL on the ground water table, efforts should focus on removing recoverable product. Some methods of product recovery include pulling the product out of a recovery well with a liquid vactor truck, pumping it out with the MEDEP/TS Fast Oil Recovery Trailer, or installing a Treatment Trailer for longer term product recovery and contaminant plume control (SOP RWM-PP-013). Other remediation options are provided in the BRWM Technical Services Remediation Tool Kit Working Document.

6. QUALITY ASSURANCE/QUALITY CONTROL

Data quality objectives (DQO) 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 multi-incremental samples to allow determination of an upper contaminant limit for the decision unit, 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. REFERENCES

<https://www.maine.gov/dhhs/mecdc/environmental-health/dwp/pws/whataPWS.shtml>

DWP/MEDEP MOA

BRWM Remediation Tool Kit Working Document

ITRC (Interstate Technology & Regulatory Council). 2018. TPH Risk Evaluation at Petroleum-Contaminated Sites. TPHRisk-1. Washington, D.C.: Interstate Technology & Regulatory Council, TPH Risk Evaluation Team. <https://tphrisk-1.itrcweb.org>.

Rand, J.B., 1994. Mother Nature's Cure. Lessons Learned in the Remediation of Petroleum Contaminated Sites in Maine, 1994 Conference. Consulting Engineers of Maine, Department of Environmental Protection. Augusta, Maine April 28, 1994 Proceedings, 109-121.

Shih, T., Y. Rong, T. Harmon, and M. Suffet, 2004. Evaluation of the impact of fuel hydrocarbons and oxygenates on groundwater resources. Environmental Science & Technology. Vol. 38, No. 1: 42-48.

Wiedemeier, T. H., H. S. Rifai, C. J. Newell, and J. T. Wilson. 1999. Natural Attenuation of Fuels and Chlorinated Solvents in the Subsurface: John Wiley & Sons



Zemo, D. A., K. T. O'Reilly, R. E. Mohler, R. I. Magaw, C. E. Devine, K. S. Ahn, and A. K. Tiwaryk. 2017. "Life Cycle of Petroleum Biodegradation Metabolite Plumes, and Implications for Risk Management at Fuel Release Sites. Integrated Environmental Assessment and Management. doi: 10.1002/ieam.1848." Integrated Environmental Assessment and Management no. 13 (4):714-727

8. FOOTNOTES

¹ Applicable work place safety regulations such as OSHA regulations 40 CFR 1910.120 and 1925.55 should be consulted.

RWM-PP-010-GroundwaterResourceandDrinkingWaterProtection

Final Audit Report

2021-10-14

Created:	2021-08-25
By:	Lindsay Caron (LINDSAY.ER.CARON@MAINE.GOV)
Status:	Signed
Transaction ID:	CBJCHBCAABAAK244KJvw7qFdpUsTix559OsYtMrNr7JS

"RWM-PP-010-GroundwaterResourceandDrinkingWaterProtection" History

 Document created by Lindsay Caron (LINDSAY.ER.CARON@MAINE.GOV)

2021-08-25 - 2:11:08 AM GMT- IP address: 198.182.163.115

 Document emailed to Molly King (molly.king@maine.gov) for signature

2021-08-25 - 2:12:56 AM GMT

 Email viewed by Molly King (molly.king@maine.gov)

2021-08-26 - 4:09:11 PM GMT- IP address: 104.47.65.254

 Document e-signed by Molly King (molly.king@maine.gov)

Signature Date: 2021-08-26 - 4:09:59 PM GMT - Time Source: server- IP address: 198.182.163.115

 Document emailed to Susanne Miller (susanne.miller@maine.gov) for signature

2021-08-26 - 4:10:01 PM GMT

 Email viewed by Susanne Miller (susanne.miller@maine.gov)

2021-08-26 - 4:30:26 PM GMT- IP address: 104.47.64.254

 Document e-signed by Susanne Miller (susanne.miller@maine.gov)

Signature Date: 2021-09-01 - 5:48:20 PM GMT - Time Source: server- IP address: 184.153.146.117

 Document emailed to Bill Longfellow (william.longfellow@maine.gov) for signature

2021-09-01 - 5:48:22 PM GMT

 Email viewed by Bill Longfellow (william.longfellow@maine.gov)

2021-09-01 - 6:07:41 PM GMT- IP address: 104.47.65.254

 Document e-signed by Bill Longfellow (william.longfellow@maine.gov)

Signature Date: 2021-09-01 - 6:08:04 PM GMT - Time Source: server- IP address: 24.198.167.74

 Document emailed to Melanie Loyzim (melanie.loyzim@maine.gov) for signature

2021-09-01 - 6:08:06 PM GMT

 Email viewed by Melanie Loyzim (melanie.loyzim@maine.gov)

2021-10-14 - 5:42:13 PM GMT- IP address: 104.47.64.254

 Document e-signed by Melanie Loyzim (melanie.loyzim@maine.gov)

Signature Date: 2021-10-14 - 5:42:27 PM GMT - Time Source: server- IP address: 24.198.212.100

 Agreement completed.

2021-10-14 - 5:42:27 PM GMT