COVER SHEET
STANDARD OPERATING PROCEDURE

Operation Title: **Drinking Water Supply Well Treatment and Indoor Air Treatment at Petroleum Contaminated Sites in Maine**

Originator: **Kelly Perkins**
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1.0 APPLICABILITY

This Standard Operating Procedure (SOP) applies to all programs in the Maine Department of Environmental Protection's (MEDEP) Bureau of Remediation & Waste Management (BRWM). 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.

2.0 PURPOSE

The purpose of this document is to describe the MEDEP/TS procedure for placing, monitoring, and ending Department involvement with water or air treatment systems at petroleum impacted buildings.

3.0 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 Big Blue 20-inch Pentek Filter - A 20inch POE water cartridge filter made by Pentek (Pentair) using a carbon block filter to remove nuisance petroleum odors when concentrations are present below the RAG values in a water supply.

4.2 Extractable Petroleum Hydrocarbons (EPH)- Massachusetts Department of Environmental Protection's Method for Extractable Petroleum Hydrocarbons. https://www.mass.gov/files/documents/2017/12/21/MassDEP%20EPH%20Method%20-%20May%202004%20v1.1.pdf

4.3 Granular Activated Carbon (GAC)- A filter media used to remove organic and inorganic contaminants dissolved in water and control odors. GAC is a form of processed carbon designed to have small, micropores to increase surface areas available for adsorption or chemical reactions. GAC is made from raw organic carbonaceous materials such as coconut shells, nut shells, peat, wood, or coal.

4.4 GAC Indoor Air Scrubber- A portable indoor air filter using granular activated carbon to remove volatile organic contamination from the air.

4.5 Maine Licensed Geologist (LG) - A professional geologist licensed by the State of Maine under to Title 32, Chapter 73.

4.6 Maine Professional Engineer (PE) - A professional engineer licensed by the State of Maine under Title 32, Chapter 19

4.7 Petroleum Related Contaminants- Contaminants related to or associated with a petroleum release such as arsenic and lead in accordance with the Conceptual Site Model and confirmed with site sampling (RWM-PP-006 and RWM-PP-007).

4.8 Photo Ionization Detector (PID) - A PID measures volatile organic compounds (VOCs) and other gases in concentrations from parts per billion (ppb) to 10,000 parts per million (ppm). The PID is an efficient and inexpensive detector for many gas and vapor analytes. PIDs are hand-held portable instruments that produce instantaneous readings and operate continuously. Their primary use is for monitoring possible exposure to VOCs from petroleum fuels, solvents, and degreasers. Other applications include assessing performance of a SSDS by measuring the VOC concentration of the soil gas inside the exhaust pipe and assessment of vapor source strength and location, by measuring the concentration of the soil gas in test holes and cracks in the floor.

4.9 Point-of-Entry System (POE) – A point of entry treatment system is a whole-house (building) water treatment solution at or before the point the water enters the building.

4.10 Point-of-Use System (POU) - A point of use treatment system is not a whole-house (building) water treatment solution. A POU provides treatment at individual point of use location that serves one faucet.

4.11 Potability Test- Includes the following parameters: pH, Chloride, e.Coli bacteria, Fluoride, Total Hardness, Nitrate Nitrogen, Coliform Total, Nitrite Nitrogen, Arsenic, Calcium, Copper, Iron, Magnesium, Manganese, Uranium, and Radon

4.12 Professional Judgement- – 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.

4.13 Sub-Slab Depressurization System (SSDS)- A SSDS is withdrawing air from the soil immediately below a foundation slab in order to manipulate the pressure to prevent the soil gas from entering the building. It is widely used in radon mitigation. In order to be effective, the foundation slab needs to be of relatively low permeability in comparison to the sub slab soil in order to maximize influence below the slab. In addition to the low permeability slab, an SSDS consists of an extraction pipe, an in-line fan, and exhaust pipe. The intercepted soil gas is discharged to and dispersed to the atmosphere, away from receptors.

4.14 Volatile Petroleum Hydrocarbons (VPH)- Massachusetts Department of Environmental Protection's Method for the Determination of Volatile Petroleum Hydrocarbons.
https://www.mass.gov/files/documents/2018/02/23/VPH%20GC%20PIDFID_Revision%202_1_February%202018.pdf

4.15 Volatile Organic Compounds (VOCs) - Volatile organic compound are organic chemicals that have a high vapor pressure at room temperature. High vapor pressure correlates with a low boiling point, which relates to the number of the sample's molecules in the surrounding air, a trait known as volatility.

5.0 GUIDELINES AND PROCEDURES

5.1 INTRODUCTION

Indoor Air Treatment- When an oil spill occurs inside or nearby a building foundation the indoor air is screened for VOCs with a PID. When the results show a potential health impact to the indoor air an indoor air treatment system is installed.

If an indoor area cannot be ventilated, then a portable GAC air scrubber can be installed. Possible scenarios for not ventilating an indoor area are due to cold outdoor temperatures, no available windows or doors to the outside, or preventing airflow from highly contaminated areas to low contaminated areas.

Drinking Water Supply Well Treatment- When an oil spill is investigated nearby drinking water wells are sampled for petroleum. When sampling shows petroleum or petroleum related chemicals above the Remedial Action Guidelines (RAGs), the well owner signs a Short-Term Point-Of-Entry Treatment Agreement, and a POE or POU filter system is placed in the building. Professional judgement can be exercised with petroleum nuisance odors and concentrations above reporting limits but below Petroleum Remediation Guidelines. A "Big-Blue" treatment system can be used in place of a GAC treatment to control nuisance odors when petroleum is present below the RAG values.

When the Department provides short-term treatment for nuisance odors Department personnel must explain to the well owner that long-term filtration for nuisance odor will not be provided through the Claims Unit. During the time that the water filter system is needed the water is monitored to show that the system is working. When the filter is no longer necessary for protection of human health the system will be removed or if the building owner wishes they may accept ownership, financial and other liabilities for the system by signing a Point of Entry Transfer of Responsibility Agreement. DEP may consider leaving a Big Blue for nuisance odors to avoid possible radon daughter product accumulation issues.

5.2 PLANNING

A well-developed Conceptual Site Model (CSM) including Vapor Source Assessment (see SOP RWM-PP-006, CSM) is imperative for effective use of these techniques. Prior to conducting any sampling event, a Sampling and Analysis Plan (SAP) should be developed (SOP RWM-PP-007 and RWM-DR-014 - Development of a Sampling and Analysis Plan).

5.3 PROCEDURE

5.3.1 OVERVIEW

Indoor Air Treatment –
When vapor source material is present within the building envelope and there is evidence that it is or is likely to impact indoor quality (see SOP RWM-PP-009) an SSDS installation will be offered to the building owner. The system will be installed to US EPA's Radon Mitigation Standards and following the SSDS SOP RWM-PP-019.

Ancillary systems, such installation and operation of a groundwater sump and sump pump, and/or a vapor barrier, may be needed for an SSDS to be effective at controlling vapor source material (see SOP RWM-009 and RWM-PP-019).The SSDS and ancillary systems are to be installed, operated, and maintained in accordance with SOP RWM-PP-018 and RWM-PP-019.

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If a petroleum contaminated indoor area cannot be ventilated, then a portable GAC air scrubber can be installed. Prior to installation the effluent of the air scrubber will be tested with a PID to see if the GAC needs to be changed. During operation, a use log will be maintained, including PID readings of influent and effluent, spill number, date, and initial GAC re-bedding dates.
The influent and effluent air for the scrubber is monitored with a PID before installation and during the remediation of the petroleum spill. If the effluent is higher than the influent, the air scrubber should no longer be used until the filter cartridge is re-bedded with new GAC.

Drinking Water Supply Well Treatment-
Petroleum- When petroleum compounds are detected above Remedial Action Guidelines (RAGs) by VPH or EPH a POE GAC water filtration system will be offered to the building owner. The system will generally consist of two 10-inch diameter by 54-inch high spun fiberglass tanks connected in series. Ideally, the system is installed inside the building adjacent to the pressure tank. If there is no way to install the system inside the home, a heated shed is set up outside and then plumbed into the home's water system with heat tracing on the water lines leading to and from the shed. The system will have three sample ports, one placed before any treatment, another between the two GAC filter tanks, and one placed after both GAC filter tanks.

Radon, associated with naturally occurring radionuclides, is present in Maine groundwater and can accumulate in GAC filter systems used as point of entry treatment to remove dissolved petroleum contamination from groundwater. The accumulation of naturally occurring radionuclides on the carbon within the GAC filters can result in high carbon disposal costs and increased human health risks from exposure to the radionuclides within the home or business. Whenever a GAC water treatment system is installed, a water sample must be tested for Radon to determine if it may cause problematic accumulation of radionuclides in the GAC system. The accumulated radionuclides can be managed by replacing the GAC at an interval sufficient to restrict radionuclide accumulation (see SOP RWM-PP-014-ADDEMDUM B, Radon). Alternative treatment options are available, depending on the general water quality, to treat water that contain high levels of radon, including air-stripping POE systems. Alternative water supply options can also be evaluated including public water and overburden replacement well options (https://www.usgs.gov/centers/new-england-water/science/study-test-a-novel-shallow-well-design-may-provide-contaminant?qt-science_center_objects=0#qt-science_center_objects). Raw water quality should be determined, and options evaluated to determine the most appropriate treatment and replacement options available. SOP RWM-PP-016 provides procedures for water supply replacements.

The system will be sampled for petroleum compounds upon installation to ensure proper function and again quarterly for the first year of operation. During the time of quarterly sampling, before-filter samples will be evaluated to see if petroleum concentrations remain above RAG. If at any time petroleum is detected in the between-filter sample the water treatment system will be serviced to restore the effectiveness of the primary GAC vessel. For PFAS detections between GAC filters, refer to RWM-PP-015, Attachment A. GAC units should be serviced annually to prevent bacterial growth from fouling the carbon and producing odors in the treated water. The actual maintenance schedule will depend on the specific water conditions at the receptor.

Sometimes the water chemistry at a site causes taste and odor issues noticeable by the well owner. GAC tanks can also be changed in response to taste and odor complaints not related to petroleum that may be caused by coliform bacteria build up in the GAC.

When sampling shows that petroleum concentrations are consistently below RAG for 4 quarters (or a site-specific interval and duration approved by LG or PE) the filter system will be removed. If the building owner wishes to keep the system or replace the GAC units with the big blue in-line filters with carbon cartridges, procedures in SOP RWM-PP-018 should be followed for proper transfer of ownership of any remaining water treatment equipment to the property owner.

5.3.2 PROJECT SPECIFIC CONSIDERATIONS

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

Sub-slab depressurization system (SSDS) – An SSDS should be installed to meet USEPA's Radon Mitigation Standards. The fan should not be located inside or below a living space. The exhaust should be 10' away or 2' above any windows or openings into a living space. The SSDS should not cause a back draft on any combustible appliances in the building. found in RWM-PP-019 SSDS SOP.

Indoor Air Scrubber – The indoor air scrubber should be tested in fresh air with a PID to ensure the GAC filter is not spent. If the exhaust air has a higher concentration of VOC's than the influent air, then the GAC filter needs to be changed before the filter is used inside a home. If the air scrubber can no longer be used, the filter cartridge should be removed and labeled "Spent".

Drinking Water Supply Well Treatment and Monitoring-

Arsenic- When a large petroleum spill occurs, biodegradation of petroleum in groundwater may create geochemical conditions leading to reductive dissolution and desorption of ferric hydroxide minerals that may contain arsenic. BRWM staff should analyze for arsenic at sites where there is a large volume of petroleum released, and petroleum has reached the bedrock and/or

groundwater or is likely to reach the bedrock and/or groundwater. Arsenic is generally treated by placing a POU system at the faucet used for drinking and cooking water. In some cases, where young children may incidentally ingest bath water a POE system may be necessary (SOP RMW-PP-014-Addendum C).

Lead and Lead Scavengers- Lead can be present in water samples at some petroleum spill sites, older sites where leaded motor fuel was stored and spilled and aviation gas (AvGas) spill sites. Follow SOP RWM-PP-014 for guidance on when and how to analyze water for the presence of lead, 1,2-DCA, and EDB. Lead is generally treated by placing a POU system at the faucet used for drinking and cooking water. In some cases, where young children may incidentally ingest bath water a POE system is necessary in consultation with Maine CDC toxicologists.

Monitoring frequency- The standard POE system sampling interval is quarterly for one year. In some cases, such as a seasonal residence a site-specific interval and duration can be selected by LG or PE based on the CSM and subject to approval by the Department.

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

Water Sampling at Petroleum Release Sites

ADDENDUM – B – ADDITIONAL REQUIREMENTS FOR THE SAMPLING OF RADON FOR THE PURPOSE OF MANAGING GROUNDWATER TREATMENT
SOP-RWM-PP-006 Conceptual Site Model for Petroleum Contamination
SOP-RWM-PP-007 Development of a Sampling and Analysis Plan
SOP RWM-PP-014 Water Sampling at Petroleum Sites
SOP RWM-PP-014 Water Sampling at Petroleum Sites ADDENDUM B Radon
SOP RWM-PP-014 Water Sampling at Petroleum Sites ADDENDUM C Arsenic

SOP RWM-PP-018 Agreements

Lead Scavengers Survey Report Final, LUST Task Force, Association of State and Territorial Solid Waste Management Officials (ASTSWMO); August 2014

COVER SHEET
STANDARD OPERATING PROCEDURE-ADDENDUM

OPERATION TITLE: **Drinking Water Supply Well Treatment at Petroleum Contaminated Sites in Maine**

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

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DRAFT: April 8, 2020 (TAM)

REVISED: May 12, 2020 (TAM)

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Department Commissioner:

Melanie Loyzim  Sep 8, 2021

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1.0 APPLICABILITY

This Standard Operating Procedure (SOP) ADDENDUM applies to all programs in the Maine Department of Environmental Protection's (MEDEP) Division of Technical Services (TS). It is also applicable to all parties that investigate, mitigate, or remediate petroleum releases. This SOP does not apply to non-petroleum spill related releases.

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/TS procedure for placing, monitoring, and ending Department involvement with water treatment systems at petroleum impacted buildings where compounds related to Per- and Polyfluoroalkyl Substances (PFASs), including Perfluorooctanoic acid (PFOA) and Perfluorooctane sulfonate (PFOS) have been identified as COCs through the CSM.

3.0 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 Per- and polyfluoroalkyl substances (PFAS Compounds) – Per- and polyfluoroalkyl substances are synthetic (man-made) organofluorine chemical compounds that have multiple fluorine atoms attached to an alkyl chain that includes PFOA, PFOS, GenX, and many other chemicals. PFAS have been manufactured and used in a variety of industries since the 1940s, notably fire-fighting foams. There is evidence that exposure to PFAS can lead to adverse human health effects.

4.2 Professional Judgement – 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.

5.0 GUIDELINES AND PROCEDURES

5.1 INTRODUCTION

Drinking Water Supply Well Treatment- When an oil spill is investigated, nearby drinking water wells are sampled for petroleum. When the CSM identifies PFAS compounds as a COC, then sampling for PFAS compounds will also occur. When sampling shows PFAS compounds above Petroleum Remediation Guidelines (PRG), the well owner signs a Short-Term Point-Of-Entry Treatment Agreement, and a POE or POU filter system is placed in the building. During the time that the water filter system is needed the water is monitored to show that the system is working. When the filter is no longer necessary for protection of human health the system will be removed or if the building owner wishes they may accept ownership, financial and other liabilities for the system by signing a Transfer of Ownership Agreement. A Long Term POET Filter Agreement may also be necessary in situations where the only practicable/feasible alternative is long-term treatment of the water supply. Refer to Agreements SOP-RWM-PP-018.

5.2 PLANNING

Refer to SOP-RWM-PP-015, Drinking Water supply Well Treatment and Indoor Air Treatment at Petroleum Contaminated Sites in Maine.

5.2.1 Sampling Methodology

Refer to Remediation SOP-RWM-DR-014-ADDENDUM – Additional Requirements For Sampling PFASs.

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

Refer to Remediation SOP-RWM-DR-014-ADDENDUM – Additional Requirements For Sampling PFASs.

5.2.3 Media Sampled/Analytical Parameters

Refer to Remediation SOP-RWM-DR-014-ADDENDUM – Additional Requirements For Sampling PFASs.

5.3 PROCEDURE

5.3.1 OVERVIEW

PFAS Compounds - When PFAS compounds are detected above the Cleanup Guidelines identified in the Petroleum RAGs, a POE or POU GAC water filtration system will be offered to the building owner. (Professional judgement may be used to install a GAC water filtration system at concentrations less than the PRG). The POE Granular Activated Carbon (GAC) system typically consists of one 5-micron cartridge filter, two 10-13 inch diameter by 54-inch high spun fiberglass tanks filled with a known volume of granular activated carbon, connected in series and one water meter. Typically, the treatment tanks are sized to accommodate a specific Empty Bed Contact time for treatment, which includes an assessment of the anticipated water usage. The system will have three sample ports, one placed before any treatment, another between the two GAC filter tanks, and one placed after both GAC filter tanks.

Other treatment options for PFAS to be considered include: POU treatment carbon cartridges, ion exchange and reverse osmosis (membrane filtration). Note that reverse osmosis produces a permeate stream (treated water) and a reject stream (PFAS compound concentrated wastewater) which is typically disposed through a subsurface wastewater disposal system or POTW. This reject stream has the potential to create recontamination issues.

Consideration shall be given to the impacts of co-contaminants including petroleum compounds, radon and arsenic. Considerations include pretreatment options, impact on treatability, impact on GAC disposal, time of expected contaminant breakthrough etc.

Consideration to arsenic leaching from the sourced carbon shall be given. Manufacturers must provide appropriate assurance/compliance testing to ensure levels of arsenic leaching will not exceed current MCL limits. This may require acid washing or water washing the carbon prior to being put in service.

If potability of the water is in question, raw water will be sampled for potability to see if pretreatment for potability parameters would be cost effective.

The system will be sampled for PFAS compounds (See Section 5.2.3) upon installation to ensure proper function and again quarterly for the first year of operation. (Note: Professional judgement should be used in determining sampling frequency and includes an assessment of concentration of

compounds, size of units, backup capacity, sampling resources etc.) Quarterly sampling shall occur at the pre-filter, in-between filters and post filters locations. During the time of quarterly sampling, before-filter samples will be evaluated to see if PFAS concentrations remain above PRG. If PFAS compounds are detected in the "between-filter" sample, the water treatment system will be assessed to ensure there is no risk to human health and serviced, as appropriate to restore the effectiveness of the first GAC filter tank. PFAS compounds at levels less than 50% of the allowable PRG may be permissible to leave the GAC filter in service. This (GAC filter servicing) should be evaluated on a case by case basis using professional judgement for systems with carbon units in series.

When sampling shows that PFAS concentrations are consistently below PRG for 4 quarters (or a site-specific interval and duration approved by CG or PE) the filter system will be removed. If the building owner wishes to keep the system, they can agree to take ownership of the system and execute a Transfer of Ownership Agreement with the MEDEP (refer to Agreements SOP RWM-PP-018).

Given the persistent nature of PFAS compounds, certain sites may be candidates for long term arrangements for system maintenance. Refer to Agreements SOP RWM-PP-018.

5.3.2 PROJECT SPECIFIC CONSIDERATIONS

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

Drinking Water Supply Well Treatment and Monitoring-

PFAS – When PFAS is associated with a petroleum spill, BRWM should analyze for the appropriate suite of PFAS contaminants in addition to conducting a Total Oxidizable Precursors (TOP) assay analysis for PFAS compounds (See Section 5.2.3). Generally, PFAS compounds will be treated by placing a POE system on the water supply, particularly if there is a likelihood of incidental ingestion of bath water. However, a National Sanitation Foundation (NSF) certified POU system may be suitable at the faucet used for drinking and cooking water after a review of the homeowner's specific situation taking into account number and age of the residents, specific household water use, and expected future conditions.
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Monitoring frequency- The standard POE system sampling interval is quarterly for one year. The monitoring frequency can be revised after review of sampling results from one year's operation. Professional judgement should be used in determining sampling frequency and includes

an assessment of concentration of compounds, size of units, backup capacity, sampling resources, seasonal versus year-round residency, CSM, etc.)

Carbon Source – A recommended carbon source for PFAS treatment is not provided. The source of the carbon should be determined by the vendor using their professional judgement for the specific system installation. A carbon source must be chosen that ensures any levels of arsenic leaching from the carbon, when added to the source water arsenic levels, do not exceed current MCL limits.

POU Reverse Osmosis Treatment systems – RO systems are a viable alternative to removing PFAS contaminants to permit a viable drinking water source. However, a concentrated reject stream may exist. It is recommended that RO use for PFAS be limited to existing POU setups that are present prior to a petroleum spill. This limitation to POU setups only is based on a small volume reject stream relative to the entire household water usage. RO systems should not be considered unless it is proven that the reject stream disposal will not create additional contamination issues. Professional judgement is to be used in determining expanded uses of RO systems for PFAS.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

Data quality objectives should be stated in the System's Operation and Maintenance Plan's (OMP) sampling and analysis plan (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, including the re-collection of samples.

7.0 REFERENCES

RWM-PP-015 Drinking Water supply Well Treatment and Indoor Air Treatment at Petroleum Contaminated Sites in Maine.

RWM-PP-014, Addendum – B – Radon

RWM-PP-018 Agreements

RWM-PP-015_WaterSupplyFiltrationand Air Treatment

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