COVER SHEET
STANDARD OPERATING PROCEDURE

Operation Title: **VAPOR SOURCE MATERIAL (VSM) INVESTIGATION AND REMEDIATION AT PETROLEUM REMEDIATION SITES**

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1.0 APPLICABILITY

1.1 Introduction: This Standard Operating Procedure (SOP) applies to all programs in the Maine Department of Environmental Protection's (MEDEP) Bureau of Remediation and Waste Management (BRWM) divisions that respond to, investigate and/or or remediate air and vapor contamination related to petroleum releases that impact and pose risk to occupied building.

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.

Indoor air contamination related to heating oil spills constitutes the bulk of DEP's work related to petroleum vapor and this SOP is weighted toward heating oil spills. The SOP has 3 components, including:

1. Residential Heating Oil Tank Spill (RHOS) – Vapor Source Material Investigation and Remediation
2. Indoor Air Multi Contaminant Risk Calculator for RHOS
3. Vapor Intrusion Screening at Sites with Historical Gasoline Contamination

Components 1 and 2 above apply to heating oil sites. The following sections provide a general discussion of all three components and the appendices provide specific procedures for each component.

Appendix A - Residential Heating Oil Tank Spill (RHOTS) - Vapor Source Material (VSM) Investigation and Remediation

Appendix B – Indoor Air Multi Contaminant Risk Calculator for Residential Heating Oil Tank Spill (RHOTS)

Appendix C – Vapor Intrusion (VI) Screening at Sites with Historical Gasoline Contamination

1.2 Residential Heating Oil Tank Spill – Vapor Source Material Investigation and Remediation: Maine has hundreds of thousands of properties with heating oil tanks within or immediately adjacent to the building. Heating oil tanks are vulnerable to damage and aging and Maine DEP receives thousands of reports of leaking heating oil tanks annually. The release of heating oil from the oil storage tanks within or at homes and businesses constitute the majority of the Department's petroleum resources.

Heating oil releases within or immediately adjacent to an occupied structure (home or business) often result in a completed human health risk pathway to occupants through inhalation of petroleum vapors exceeding indoor air guidance values (chronic, sub-chronic, and frequently acute exposure values). DEP staff typically manages RHOTS sites because of the high risk level to human health and the need for immediate and aggressive actions to successfully mitigate the exposure. This is in contrast to a release of heating oil at a bulk oil facility or a transportation incident where there is typically not an immediate human exposure and the responsible party has at least in part, the lead.

Appendix A provides guidance pertaining to responding, investigating and remediating heating oil tank spills at or within buildings. Other heating oil spill locations and situations that are not adjacent to or not within a building and do not immediately impact or pose a risk to indoor air (such as transportation and bulk plant facilities) are not covered in this guidance.

1.3 Indoor Air Multi Contaminant Risk Calculator for Residential Heating Oil Tank Spills This SOP pertains to evaluating indoor air concentrations relative to the RAGs using a subchronic exposure for the multiple petroleum contaminants present in the indoor air at an occupied residence or commercial building. The use of the indoor air risk calculator assessment tool at residential and commercial heating oil spills is only appropriate when the spill is promptly reported, thoroughly investigated and the identified vapor source material is aggressively remediated and or comprehensively managed within 90 days of the release. The risk calculator provides a risk summation when multiple contaminants are present (typical with petroleum mixtures) and uses the sub-chronic (7 year) risk scenario. This exposure criteria is supported by the Maine CDC and is consistent with the RAGs. criteria for . This document is a companion to Maine DEP's Excel Program "Home Heating Oil Indoor Air Input Sheet and Summary of Total Incremental Lifetime Cancer Risks and Endpoint-Specific Hazard Indices" dated February 2019. Appendix B provides detail on applying the calculator.

1.5 VI Screening at Sites with Historical Gasoline Contamination:
This guidance is not applicable in situations where there is a catastrophic or recent release of gasoline, or there are reports of gasoline odors. Gasoline releases and indoor gasoline odors are to be immediately reported to emergency responders and occupants smelling gasoline should be advised to vacate the premises.

This SOP pertains to assessing petroleum vapor intrusion (PVI) potential associated with residual, gasoline contamination from historic releases. This SOP replaces the 2010 VI Guidance. Appendix C provides details on VI screening at gasoline sites to determine human health risks.

A site assessment in response to the release must consider the vapor potential, migration and exposure in accordance with "Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air" from EPA's Office of Solid Waste and Emergency Response, dated June 2015. Therefore, environmental professionals must have experience with this document and follow the document when investigation PVI from an historic gasoline release.

2.0 PURPOSE

The purpose of this SOP is to identify the presence of petroleum contaminated media that impacts or has the potential to impact indoor air quality above an acceptable risk-based concentration (herein referred to as Vapor Source Material or VSM). Additionally, this SOP outlines steps to evaluate the VSM and remediate the VSM when the indoor air quality exceeds the RAG or mitigate the pathway when indoor air quality is below the RAG.

At RHOS sites, Vapor Source Material (VSM) is defined as petroleum contaminated media that meet **all** the following conditions:

1. sufficient concentration to propagate vapor transmission,
2. located in close proximity to the building and
3. there is a direct vapor migration pathway connected to
4. an occupied building with measurable impacts to the indoor air quality.

National[1] and State[2] guidance is available on investigating vapor intrusion risk, and this guidance is primarily for situations where the inhalation pathway is complete, as is often the case with residential heating oil tank spills. By identifying the location and relative strength of VSM contributing to the complete pathway, mitigative and remedial actions can be effectively scoped and targeted.

In identifying VSM and monitoring the progress of a clean-up and/or mitigation, MEDEP relies on a formatted methodology of collecting, recording and tabulating spatial, temporal and experiential information. The information is reviewed and weighted based upon staff judgement and consideration of factors including conformance with the CSM, correlation with coincidental information, representativeness, frequency, and validity. Validity can be a qualitative measure of developing and adhering to a routine with respect to collecting and documenting information including routine, personnel, equipment, location, timing and influences. Information considered strong, reliable and defensible can be used to make decisions with respect to delineating the extent of impact, identifying VSM, determining effectiveness of corrective actions and completing involvement with a spill. This approach, of collecting, observing and documenting direct and indirect information to develop a comprehensive understanding, is referred to as a "multiple lines of evidence" (MLE) approach. It is particularly useful and important with regard to identifying and resolving vapor impacts as air/vapor is in a greater flux than other forms of contamination (water, soil) which presents difficulty in establishing a stable concentration to compare to clean up and performance guidelines.

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 BUILDING ENVELOPE : The below grade interface and connections between the building elements and the surrounding environment (foundation, backfill, piping, sump, utilities, penetrations, groundwater, soil) where an exchange or transmission of vapors is possible. The zone of the building envelope can change with seasons and groundwater table elevation.

4.2 Complete inhalation Pathway A pathway is considered complete when the indoor air concentration exceeds the RAG for the appropriate risk scenario and the exceedance is directly attributed to the vapor migration pathway between the VSM to the occupied building.

4.3 LINES of EVIDENCE also referred to as MULTIPLE LINES of EVIDENCE: Lines of Evidence is an approach of collecting, observing, documenting direct and indirect information to develop a dimensional understanding of a situation that can be evolving, as in the impacts or remedial progress at a residential heating oil tank spill. Typically, there is not a solitary piece of information (evidence) that adequately defines the situation, so it is necessary to collect multiple pieces of information to confidently comprehend the situation or status.

4.4 ONE-WAY FLOOR DRAIN. A one-way valve for floor drains allows water to pass through while sealing out soil gases including odor. A typical brand name for one-way valves is Dranjer™. Dranjer™ floor drains can retrofit existing non-valved floor drains or be installed during the construction of a new floor depending on the type of Dranjer™ floor drain used.

4.5 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.

4.6 SMOKE PEN. Smoke pen is a small “pen shaped” device that emits an inert smoke. It can be used to test pressure gradients and air movement. Disposable puffers using titanium tetrachloride and moisture to make smoke are not recommended for use since a byproduct of making smoke with titanium tetrachloride is hydrochloric acid.

4.7 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.

4.8 VAPOR INTRUSION - Vapor Intrusion is the migration of hazardous vapors from a subsurface contaminant source, such as contaminated soil or groundwater or contaminated conduit(s), into an overlying building or unoccupied structure via any opening or conduit.

4.9 VAPOR BARRIER. A vapor barrier is plastic sheeting used to prevent the migration of soil vapors and water vapor from the soil into the building. A recommended product is 15-mil yellow plastic sheeting ("Stego® Wrap") from Stego® Industries, LLC with 0.0086 perms. Stego® Wrap is a vapor barrier that is very durable and puncture resistant and has an extremely low perm rating. In comparison, readily available 6-mil polyethylene has a perm rating of 0.06. It is important to note that the installed, effective permeance is largely dependent on the installation technique.

5.0 GUIDELINE PROCEDURES

5.1 Introduction

The procedural guidelines and planning aspects are developed in the following Appendices:

Appendix A - Heating Oil Investigation and -up
Appendix B - Petroleum Vapor Risk Calculator
Appendix C - VI Screening at Gasoline Sites

5.2 PID Use

A PID does not respond linearly to increasing fuel oil contamination concentrations in soil because many of the components that comprise the greatest mass of fuel oil are outside the ionization potential of the instrument. PID use to determine the presence or absence of fuel oil contamination in soil is permitted in the SOP under the following conditions:

- The PID lamp has been cleaned in accordance with the manufacturer's instructions
- The lamp cleaning is documented
- PID is calibrated before use at the site and bump tested after one hour of use
- The PID readings are used in conjunction with other lines of evidence and is not used exclusively as the only evidence

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

[1] OSWER Publication 9200.2-154 OSWER TECHNICAL GUIDE FOR ASSESSING AND MITIGATING THE VAPOR INTRUSION PATHWAY FROM SUBSURFACE VAPOR SOURCES TO INDOOR AIR U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response June 2015 https://www.epa.gov/sites/production/files/2015-09/documents/oswer-vapor-intrusion-technical-guide-final.pdf

[2] Supplemental Guidance for Vapor Intrusion of Chlorinated Solvents and other Persistent Chemicals Effective Date: February 5, 2016 https://www.maine.gov/dep/spills/publications/guidance/rags/VI-Persistent-Chems-Guidance-final-020516.pdf

Appendix A - Residential Heating Oil Tank Spill (RHOTS) - Vapor Source Material (VSM) Investigation and Remediation

Appendix A - Residential Heating Oil Tank Spill (RHOTS) Vapor Source Material (VSM) Investigation and Remediation

INTRODUCTION

Maine has hundreds of thousands of heating oil tanks within or immediately adjacent to occupied buildings. A Residential Heating Oil Tank Spill (RHOTS) can be very disruptive to the function and occupation of a residence by immediately contaminating indoor air. In addition to the building and indoor air, a RHOTS can quickly contaminate drinking water wells, ground water, soil, surface water, and septic systems.

The inhalation pathway between the release and the occupants of the building is often complete and urgency is required to rapidly mitigate the exposure and evaluate the impacts. The complete pathway is often obvious and identified and reported by the occupant due to the acrid, distinct odors associated with vapors from heating oil. Occupants usually notify their service provider and subsequent DEP notification is usually quick, which facilitates a rapid DEP response. This appendix summarizes proven methods to investigate and mitigate/remediate Vapor Source Material (VSM) at RHOTS.

Although it is the vapor phase of fuel oil that is completing the inhalation pathway, fuel oil contaminated building components, household items, soil, and groundwater are typical vapor source material and need to be evaluated in a timely manner to successfully mitigate/remediate a RHOTS . This appendix is based upon decades of environmental professional experience and is applicable to heating oil spills at residential commercial, and industrial buildings.

GUIDANCE PREMISE

Sections 6 and 8 of the OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air covers methods for identifying vapor source material and mitigation/remediation. This same approach, in general, is adopted to heating oil spills that impact indoor air. RHOTS are somewhat unique in comparison to other vapor forming chemicals (mercury, radon, dry cleaner solvents, etc.) because the release is usually inside or very close to an occupied residential building, the odor threshold is very low, and the effects of the release is often observed immediately by the homeowner (no heat, visible product, oil taste, smell, etc.) Similarly, the completed pathway is also observed immediately without the need for laboratory samples to be collected.. Key components of reducing the magnitude and duration of the exposure, protecting resources, and restoring property value are:

- an immediate report of a discharge,
- timely response by DEP and service provider,

- early identification of situations where teaming with Response Services, Tech Services staff, and Project Managers is warranted and early formation of the DEP project team,
- Communication between DEP team and property owner, building occupants, and any outside parties (oil companies, service technicians, fire departments, local government officials, etc.)
- thorough assessment and documentation of impacts and source areas, and
- aggressive removal and thorough control of source areas.

This appendix presents proven practices of DEP staff with decades of experience successfully investigating and remediating more than 15,000 RHOTS.

Diligent and thorough identification of VSM is a critical preface/component of a successful clean-up. Taking the time to assess and thoroughly remove the VSM is the preferred approach as it eliminates the exposure by the most effective means – at its source. A removal (a form of remediation) can be limited by costs, structural concerns, owner cooperation, weather, seasons, resources, and a variety of other factors. When removal is limited, supplemental actions may be necessary to mitigate the vapor inhalation risk..

Typical mitigation measures include concrete cleaning, concrete surface sealing, groundwater control, and installation of a sub slab depressurization system - SSDS. Several rounds of investigation, monitoring, and remediation may be necessary to facilitate vapor and air equilibration after remedial actions are taken so that weak and remote locations of VSM can be identified and remediated to achieve a successful site closure.. When the spill circumstances are known and the impact and amount of VSM is low, a single, cursory, confirmatory investigation may be adequate to complete actions and successfully close a site.

DEP staff time involved in assessing, remediating, and documenting heating oil spills is critical to::

- Completing time-sensitive steps to stop the leak and provide immediate steps to reduce human health risks
- Establish a well-developed conceptual site model
- Execute a timely and focused investigation.
- Develop an appropriate vapor control plan
- Implement effective mitigation and remedial actions that eliminate vapor inhalation risks permanently s
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- Provides immediate protection of public health, and
- Establishes long term liability protection with respect to 3rd Party Damage Claims.

Emergency measures for building occupants may include voluntary and temporary relocation. DEP does not have the authority to require evacuation, but the option can be discussed with the property owner, local, and state public health officials as deemed appropriate by DEP staff on-site.

A PID may be used in accordance with Section 5.2 of this SOP.

Procedure

This appendix focuses on petroleum vapors/odors caused by heating oil spills and provides BRWM staff with:

1. Objectives for investigating and remediating the spill
2. Communications and Responsibilities between the property owner/occupant and DEP
3. Methodology
4. Best Management Construction Practices/
5. Related references and SOPs

1. Objectives for investigating and remediating the spill

    a. Develop and validate a Conceptual Site Model – CSM. Indoor air impacts are most times obvious. Understanding, locating and controlling primary vapor source material can take time and effort but it is a critical objective upon arrival. Success of decisions ranging from "wait and see" to an aggressive pursuit of VSM are contingent upon constructing and validating the conceptual site model in order to effectively design and plan the investigation(s), monitoring and remediation.
    b. Develop and implement a remedy and verify that it is performing adequately (demonstrate reliable influence on the residual VSM in order to declare that the environmental exposure condition is under control).
    c. Closure: Continue periodic performance monitoring checks, look for trends over time and seasons, compare to closure criteria, and document that DEP is satisfied with the clean-up by closing out the project.

2. Communications, Interactions and Expectations between Owner/Occupant and DEP.

   In order to establish an informed and cooperative relationship between the parties involved in the investigation, clean up and administration, there are many items that are to be discussed at the onset and continued throughout the investigation and clean-up. Items include program scope, program administration, expectations, health (including the range of sensitivities and tolerances), work scope, access, disruptions, scheduling, and finances. Details to cover with the owner/occupants include:

   a. Identifying parties with knowledge of the spill and or influences on the spill impact.

   b. Provide DEP Objective: Inform occupants/owner that DEP's mission is to identify and control vapor source material (VSM) to reduce exposures and protect the environment. Emergency, temporary ventilation and filters are available while the assessment is ongoing and the clean up actions will be presented prior to implementation. Multiple rounds of monitoring, observation and communications will be necessary to complete the understanding of the impacts, complete the evaluation of the remedy, convey status, and make decisions. Occupant assistance in reducing exposure and understanding progress will be requested by avoiding source areas and reporting experience/impression following remedial/mitigation actions.

   c. Health Affects / Risk Guidance: As a matter of course at heating oil spills, DEP does not conduct health risk assessments or have the authority and qualifications to determine if oil impacted indoor air is "safe" to habitate. Inform occupants that it is their decision on whether they can stay in the building. Inform owners/occupants that fuel oil vapors are not an imminent threat with regard to ignition or explosion. Recommend that they avoid/limit exposure to fuel oil product, contaminated media and vapor. Inform them that if they or their family have respiratory illness, vulnerable due to age (pre-teens and elderly), or are experiencing symptoms that they are uncomfortable with, they should consider alternative accommodations. Inform them that DEP's workplace PID action level (SOP RWM-PS-002 Last Revised 11/26/19) is 10 parts per million (PPM) and with adjustments

for a 24 hour/7 day per week residential exposure, DEP recommends against occupying areas, rooms and buildings where PID measurements are sustained above 3 PPM.

d. Health Affects / Risk Referrals The State of Maine's Center for Disease Control has an Environmental Health Unit (EHU) that can be contacted to discuss health effects and reactions with fuel oil vapors. If it is a situation with multiple families or individuals (commercial/office, multi housing) and/or sensitive population (small children/elderly, respiratory conditions) or both (school, hospital, assisted living/elder care), advise owner/manager/administrator that immediate involvement of CDC provides valuable assistance in communicating and decision making with respect to health and safety. When EHU is involved, DEP can serve as field staff with regard to information and sample collection, risk calculation, and comparison to "typical background" levels detected in Maine homes. Site/exposure/population specific interpretations are the domain of the EHU unit.

e. Alternative Temporary Housing: Accounting for finances, site safety, availability of alternate housing through family and friends, sensitivity of population, perceived timeline and degree of difficulty in achieving "under control" status, Response Staff, at their discretion, are authorized to offer assistance in finding and funding alternative accommodations. Refer to 2017? memo regarding Red Cross and relocation policy.

f. Timeframe: The timeline of marked improvement can range from a few hours to a few weeks. The time frame can be affected by many factors including the volume of oil lost, the lag time between the spill and the reporting, proximity of groundwater, building drainage, building construction, building HVAC, and the season. Typically, the VSM is considered "under control" within a month. Operation and maintenance of engineering controls for the residual VSM typically are necessary for 2 to 5 years.

g. Inform them of the Clean-up Lead Options available to them and document their decision.

h. Inform them of the Ground and Surface Water Response Clean-up Fund (G&SWRCF) available through the State Fire Marshall's Office and administered by DEP.

i. Beyond the basic emergency measures of stopping the leak, collecting readily available free phase oil, and minimizing the exposure (such as temporary ventilation), provide the property owner and occupants with recommended measures, in writing, at each step, and acquire consent as you proceed through the investigative and remedial steps.

j. Where the amount of the discharge is significant yet the recovery is limited so a significant amount of oil is lost to the environment, conduct "due diligence" to ensure lost product is not shallow or within the building envelope where it poses risk of future impact to building, well or nearby surface water when influenced by groundwater and/or heating season. Depending upon the situation, due diligence may involve monitoring for a period to evaluate seasonal influences.

3. Methodology

A. Establish Multiple Lines of Evidence. Multiple Lines of Evidence are used to assess the impacts and evaluate the effectiveness of a remedy. In selecting points to monitor along a particular line, it is important to pick points that are representative (of the impact and or progress) and in locations that provide a baseline reference and are repeatable in that it is expected to endure the corrective actions. For instance, a point on a section of concrete floor may be a useful point to mark the extent and/or level of impact but if a portion of the impacted floor is removed and the monitoring point is removed with it, the "baseline" reference is lost. If that point is cleaned and sealed rather than removed, it would continue to serve as a progress marker, however its value may be temporarily impaired due to the PID interference associated with the drying/curing time with cleaning solvents and sealing products.

As the site progresses, some lines may become irrelevant and others may increase in value. In order to have flexibility in lines to carry forward and to establish a strong understanding of baseline conditions to illustrate progress over time, it is important to establish multiple types and locations of monitoring points, and to monitor all the points frequently early in the process, especially before and after corrective actions, to gain a relative sense of the location of VSM and to understand progress in the control of VSM.

B. Gather Multiple Lines of Evidence. Record influences on those results such as weather, groundwater level, stage of investigation/clean-up, investigative/remedial activity, the presence and operational status of remedial equipment (both temporary

and long term), occupant presence/activity, and building operations (HVAC). Lines of evidence may include:

a. Collected and chronicled information from parties involved with the spill, living with the spill impacts, frequent visitors, and staff/contractors managing and cleaning up the spill.
b. Concentration/impact results from observations, field screening equipment, lab samples

C. Example of Establishing and Gathering Multiple Lines of Evidence: In terms of a RHOTS, a developed and consistent methodology can be PID screening, observing and soliciting occupant impressions at each monitoring location from clean to dirty, starting in the outside fresh air, entering the upper floor (assuming the VSM is in the basement), the headspace at the top of the basement stairway, the stairway landing in the basement, basement location(s) that are representative of the indoor air impacts in the breathing zone and expected to be available despite the range of investigative and remedial activities that may take place. For instance the top of the hot water tank and/or the 7th step of the basement stairway are locations that are likely to endure. Once the ambient air impact has been assessed, move on to source area assessments, again proceeding from clean to dirty to identify VSM and to monitor progress and performance of prior remedial activities.

D.Review lines of Evidence and Make Determinations: Tabulate observations, experiences, results collected over time and space and look for patterns and trends and identify strong lines based upon that review. Strong lines are considered representative and are corroborated with other lines (for instance PID readings are consistently an order of magnitude higher on stained versus unstained portions of a concrete floor – stains correspond with the PID readings so stains and PID can be considered strong lines of evidence). Continue building upon the strong lines by returning to those locations/features each monitoring event and document the findings. Use the data to develop understandings in the CSM, identify areas/locations of residual VSM, and to make decisions regarding the need for further corrective actions, continued monitoring and closure. An example of tabulated monitoring results is in the attached Table 1. Representative results from Table 1 can be applied to Table 2 which provides criteria and thresholds to consider in making decisions regarding:

a. Identifying VSM within the building and building envelope
b. Determining the status (controlled or uncontrolled) of the VSM
c. Qualify the relative extent and level of VSM contamination to assist in determining removal versus mitigation/control

d. Identify when the residual VSM is reduced in extent and strength so that the risk of unacceptable exposures has been satisfactorily addressed. At this point, remediation, mitigation, and monitoring activities can be concluded and the closed status can be conferred upon the oil spill.

Incorporate site specific factors in determinations including: sensitivity of occupants, use of the building (seasonal/primary/rental residence), building style/age/construction/systems, extent and severity of the spill impacts, degree of difficulty in mitigating, time to mitigate, weather, season, water table, clean-up contractor availability, K-1 vs #2 fuel oil. All the gathered evidence and site specific factors influence the timeframe, urgency, and options available to control VSM. The lines of evidence methodology and decision criteria are provided as reference or default guide. It is not intended to void individual/regional methodologies and criteria. However it is recommended to arrive with a conceptual methodology and criteria that can be explained and defended.

Photoionization Detectors (PIDs) provide valuable information in identifying the presence and relative strength of vapor source material, understanding the progress of corrective actions and communicating the status to interested parties. However it is important to note that DEP's Standard Operating Procedure #TS004, "Compendium of Field Testing of Soil Samples for Gasoline and Fuel" does not address the vapor pathway and does not accept use of the PID bag headspace method for field screening of fuel oil contaminated soil. PIDs have a nonlinear response to heating oil so that independent field screening thresholds representative of risk cannot be developed with PIDs and fuel oil. Furthermore, weather, equipment manufacturing, equipment age/use, user methodology, and background levels of non-spill related volatile organic compounds (VOCs) all influence the response of PIDs. Recognizing this conflict, between the availability, use and experience with PIDs and the nonlinear response to fuel oil, DEP recommends developing site specific context for the PID readings and compensating for variability across days, users and instruments by conducting multiple visits with the same equipment, same methodology, at valued locations, over a range of conditions and operations/activities, and noting the conditions and operations. Of note is the weather, groundwater elevation, fan(s) on/off, HVAC status, windows and doorways open/closed, remedial and household activities), and personal observations such as visual staining, odor level, homeowner experience and odors in clothing upon departure. **It is the pattern or trend observed and understood over time that builds confidence that the vapor source is properly identified and remediated, not the day's PID reading. The use of a PID must adhere to Section 5.2 of this SOP.**

4. Best Management Construction Practices This section of the guidance provides an "awareness" summary of construction practices, methods and standards adopted from other trades and developed through DEP and contractor experience. The practices are promoted to provide immediate and long term protection for workers and occupants. A list of related SOPs is also provided.
    a. Expand the site safety plan to address the potential for spreading oil through a building by "Foot Tracking" (workers, occupants and inspectors walking through oil impacted areas and spreading oil by walking with dirty shoes into previously un-impacted areas.) Foot Tracking can be limited by immediately limiting personnel, limiting routes and identifying/marking accepted routes, placing and maintaining pads along accepted routes.

    b. Photos for assessment: Photos can sometimes capture and document impacts better than the naked eye. Wicking up a sheetrock wall is an example of impacts identified by photos but not first hand visual. Photos can be used to document remedial progress about the impact to a sump water quality over time or stain lightening after each cleaning event.

    c. Inventory/tag/segregate between impacted and unimpacted goods. Items can be shuffled during emergency clean-up and documenting the initial location of goods with respect to oil impacts helps draw the line between suspected and unsuspected oiled items. Documentation and marking reduces the chances of oiled goods being returned to areas that have been screened and cleaned. Documentation and marking can assist the homeowner in identifying items for disposal and salvage and in future insurance claims. Photos and color coding with tape are helpful inventory tools.

    d. Temporary ventilation: Locate temporary ventilation fans outside: If a leak develops in the pressurized discharge side of the fan, the contamination is discharged outside rather than inside the building. Ramfans and radons fans are suitable for outdoor use. Where practical, provide security and weather protection for exterior fans.

    e. Vapor/dust barriers (zippered systems are now available) are recommended for concrete work and interior excavation. Negative

pressure within the enclosure is necessary to contain dust and vapor and reduce the exposure.

f. "Permanent" Barriers can include insulation, sealants, poly sheeting, and false partition walls and false floor. Where vapor source material removal is not feasible, a barrier must be applied to protect indoor air from the petroleum vapors. In areas where a spill has occurred outside a fieldstone foundation, the foundation should be sealed on the inside with a closed-cell spray foam insulation to create a barrier to vapors entering the basement.

   When interior oil impacts cannot be removed such as in a wall, ceiling or floor, "false" walls, ceilings and floors can be installed to enclose the source and where warranted, negative pressure can be applied to the cavity between the contaminated material and the "false" barrier.

   Poly Sheeting Barriers are generally used in areas with a dirt floor, or under a mobile home. Poly should be White Cap type crawlspace vapor barrier, 12 mil, sealed to the walls with slats or double-sided tape. It should also be sealed to any support posts located in the area of concern. In dirt basements, it should be protected by covering with sand and pea stone. Poly sheeting is also used between backfill and the new slab to impede residual sub slab contamination.

g. Indoor Air Treatment: Granular activated carbon air scrubbers are most often used in occupied areas of a building to decrease petroleum vapor concentrations in the initial days or weeks following a spill, while source removal is taking place. Scrubbers can be used to remove lingering petroleum odors after source removal efforts are complete. They can also be used to provide peace of mind for sensitive homeowners. The DEP has two types of air scrubbers – the "R2D2" units and the "big blue" units. The R2D2 units have more carbon and circulate air at a slower flow rate. The big blue unit has only a thin carbon filter and circulates air at a much higher flow rate.

h. Permanent ventilation: See Sub Slab Depressurization System (SSDS) SOP RWM=PP-019 for application and guidance. Note that pre-emptive SSDS, can be a relatively low cost investigative tool. Guidance for alternative permanent ventilation such as Air Exchangers is under development.

i. Wet saws are recommended for concrete cutting to reduce dust and vapor generation.

j. Observe Building Science principles, particularly in measuring air flow direction with respect to vapor source material and when altering pressure fields in a building which can affect the draft on combustion appliances.

   Use of smoke pens at the doorway to the cellar or at basement window or bulkhead will help assess air flow under natural conditions. Natural air flow can provide the desired flushing (when air from the first floor is being drawn in to the basement and exhausted through a cellar bulkhead or window opening) however often-times the open cellar bulkhead or window acts as an intake. Although outside fresh air is entering, it may be drawn across VSM on its way to an upper occupied floor. Ideally, the area of VSM is under negative pressure with respect to other areas and floors of the home and this may be accomplished by measuring the natural air flow direction and designing and constructing ventilation to induce a negative pressure in the VSM area.

   When a spill occurs at a site with a larger HVAC system, such as at a school or at a commercial property, the operation of the HVAC system can often be altered. The goal is to isolate the area of the building where the spill occurred so that petroleum vapors are not circulated throughout the entire building.

   Prior to air flow manipulation and installation of vapor barriers, identify combustion appliances in the building. Do not include combustion appliances within an area designed to maintain a negative pressure (such as a poly sheeting enclosure). Where significant changes in air flow and pressures are involved (such as a ram fan in the heating season), have a qualified individual monitor the draft of the combustion to determine the effect of ventilation on performance of the appliance. Significant ventilation operations and effects should be continually monitored and shut down when they cannot be monitored.

k. Identify structural elements of a building within the impacted area and establish "limits/bounds" of slab and soil removal earthwork to maximize removal of VSM without jeopardizing the structure. This is the realm of structural engineers and beyond the scope of this SOP. For conventional

sized and constructed residences with standard 8" concrete walls and 6" footings, general guidelines and rules of thumb are under development with respect to a percentages, length, and width of floor that can be removed, the amount of concrete floor to leave in place around the perimeter and posts, excavation depth and slope with respect to footings, allowable amount of exposed footing, and backfill operations and specifications. Use of qualified contractors is recommended for work within and around structures. Identification and location of utilities (sewer, water, gas, fuel, electrical, radiant floor heating) is necessary before probing and removal. Control measures are an acceptable alternative to removal work around and within older and sub-standard foundations.

l. Design and construction of backfill and concrete floors. Ventilation and drainage (both subslab and slab surface) need to be considered when backfilling a basement excavation and placing a concrete floor. If a sump is a component of the vapor control system, it needs to accommodate subslab and slab surface drainage and it needs to be vapor tight and accessible for monitoring and product recovery. Details on incorporating a sump into vapor control systems are provided in the attached FIGURE 1. In order to pick up surface drainage when the sump is sealed, waterless trap seals are available for the sump cover as well as at a designed low point in the new floor. A one-way valve creates a seal to reduce petroleum vapors from coming up through a floor drain but still allows surface water to flow into the drain.

m. Worker safety: electrical, excavation/heavy equipment, noise, petroleum vapor, radon gas, silica dust, mold, sewer, vapor, infectious disease from vermin, vermin waste, sewer, buried utilities, protective pets.
n. Protect from liability claims for construction damages or unauthorized disposal of oil impacted goods. Take photos to document foundation, yard, drainage, household items conditions before investigating and remediating. Engage in frequent , thorough, documented discussions about saving or tossing impacted items. Segregate and cover clean and dirty items outside the home to verify the status and allow the homeowner time to go through the piles and confirm final disposition

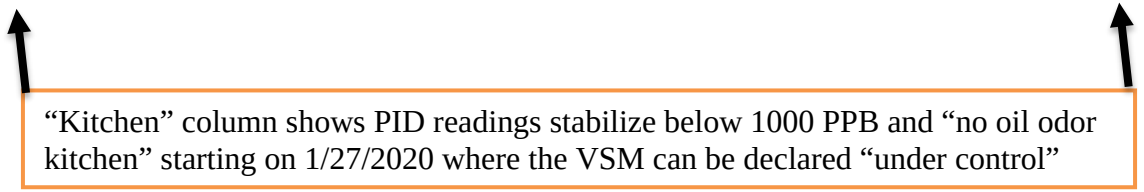
5 Related documents and references include:

i. SSDS SOP RWM-PP-019Floor Cleaning and Sealing Whitepaper
ii. Treatment Trailer SOP RWM-PP-013

iii. Clean-up Options “Tool – kit”

State of Maine – Department of Environmental Protection – Bureau of Remediation and Waste Management
Petroleum Remediation Guidelines SOP 009
Vapor Source Material (VSM) Investigation and Remediation
Appendix A - Table 1 Residential Heating Oil Tank Spill (RHOTS)
TABULATING DATA TO DEVELOP and INTERPRET LINES OF EVIDENCE

Date	Staff	Time	Instrument	Bump	Outside Ambient	Kitchen	Carbon Air Filter Exhaust	2nd Floor Head Stairway	Basement Top Hot Water Tank	SSDS Exhaust	Complete pathway	Product	Living Space Vapor	Surface Water Impact	GW Plume	
1/21/2020	PME and SGB	13:00	PPB RAE 4937	9880	Not Recorded	38000			48000		Yes	Yes	Yes	Yes	Yes	Tank blew in am. Product inside basement and outside in drain ditch. NRC cleaned floor.Installed carbon air filter.
1/22/2020	PME and SGB	13:15	PPB RAE 4937	9916	70	7000	<2300		12380							Drilled holes in slab and PID screened. Notably less oil smell.
1/24/2020	PME	9:00	PPB RAE 4937	9731	0	2003	<1000		4900							Dave and Mark from Air and Water Quality Treatment install SSDS.
1/27/2020	PME w MW	13:00	PPB RAE 4937	9575	32	765	<450		4271	4420						NRC cleaned basement floor earlier in day: contribute to PID? No oil smell but Simple Green odor. SSDS bleed valve full open. Jenny asked about moving carbon air filter to upstairs where oil smell is strongest.
2/3/2020	PME meet SGB	9:00	PPB RAE 4937	10050	30	590	<700	1080	2200	2540	Contained /Under Control	Contained/ Under Control	No	Negligible	No	**No oil odor kitchen**. NRC Camera and jet drain lines - no oil generated
2/4/2020	PME	15:05	PPB RAE 3035	9742	15	856	<350	1463	2905	3010	Contained /Under Control	Contained/ Under Control	No	Negligible	No	SSDS Bleed valve closed when screen. Pre Binz PID survey of floor and wall
2/5/2020	PME	8:45	PPB RAE 3035	10740	150	475			2030	1245	Contained /Under Control	Contained/ Under Control	No	Negligible	No	**No oil odor kitchen**. NRC applying BINZ to floor and wall
2/10/2020		13:30	PPB RAE 3035	10250	6	438	<500	610	478	441	Contained /Under Control	Contained/ Under Control	No	Negligible	No	**No oil odor kitchen**. Post BINZ PID survey. Nate England reported that he went away this weekend and oil odor improved upon return. Noi oil discharging in ditch.



Petroleum Remediation Guidelines SOP 009
Vapor Source Material (VSM) Investigation and Remediation
Appendix A - Table 2 Residential Heating Oil Tank Spill (RHOTS)
SCREENING CRITERIA in ASSESSING EXTENT, IMPACT, CONTROL and CLOSURE of VSM

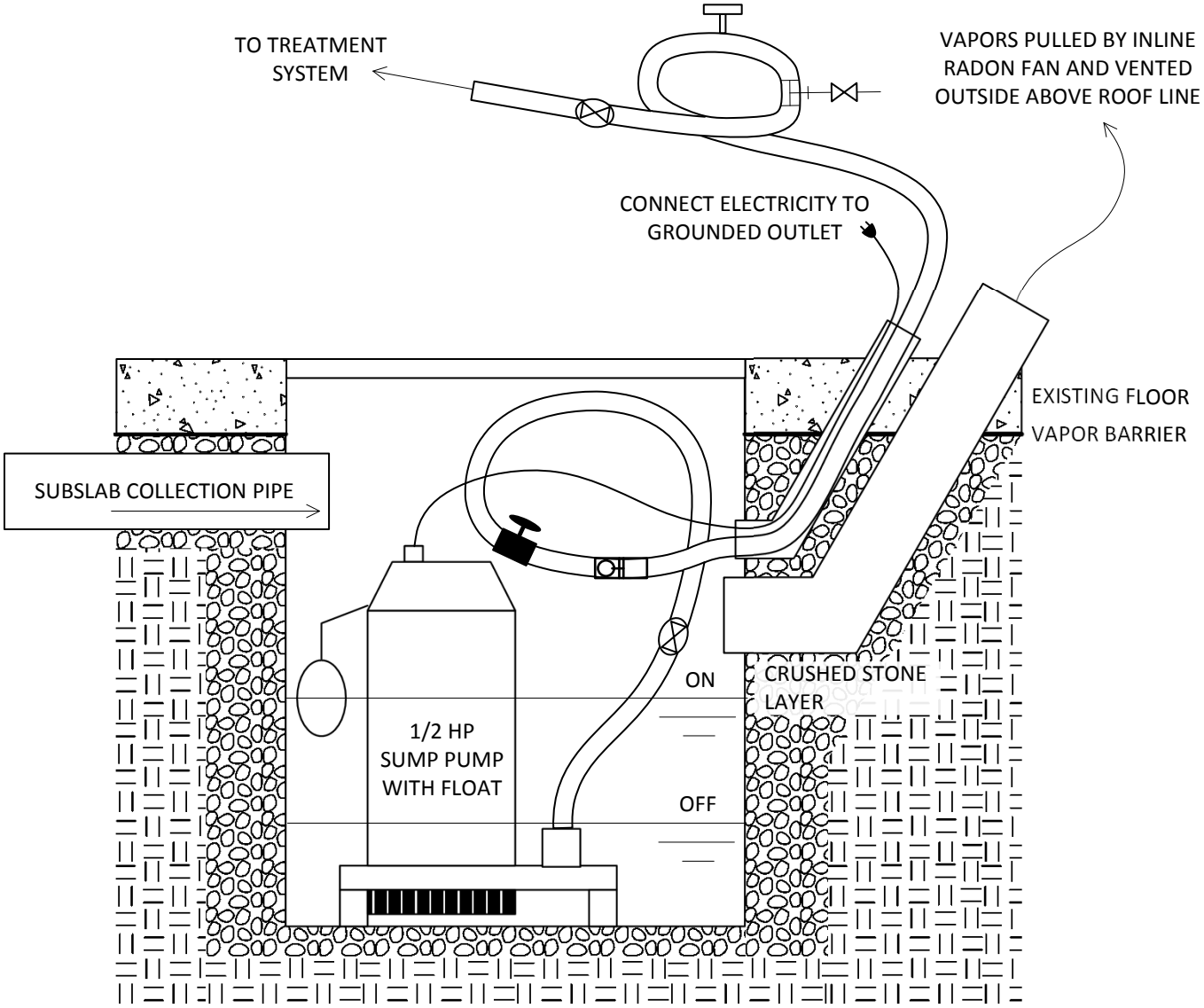
UNMANAGED VAPOR SOURCE MATERIAL (VSM) IMPACTING INDOOR AIR **Corrective Action indicated when supported by the weight of following lines of evidence**
^Sustained moderate fuel oil odors in occupied area
^Sensitive population and complaints of health effects
^Heating season and low confidence in immediate, thorough, reliable control of vapor source material
^Significant amount of LNAPL or oil stained goods and/or building materials within building
^Sustained PID greater than 3[a] parts per million in an occupied area
MANAGED VAPOR SOURCE MATERIAL (VSM) IMPACTING INDOOR AIR **Montoring Indicated when supported by the weight of following lines of evidence and conditions**
^Slight/Tolerable/Infrequent fuel oil odors and odors not detected in clothing upon departure
^Documented understanding of spill impacts, extent, migration, pathways
^Removal of primary VSM and reliable control of residual VSM
^Stable PID less than 1[b] parts per million in occupied areas
REMOVAL of UNATTACHED / NON -STRUCTURAL FINISHES and STORED GOODS
^When material has absorbed or been in direct contact with liquid LNAPL
REMOVAL of BUILDING COMPONENTS, SLAB and SUB SLAB SOIL **Removal indicated when supported by weight of following lines of evidence and conditions & practical to apply**
^Slab/Building Component: Oil was in contact long enough to saturate/permeate/severely stain
^Slab/Building Component: After thorough cleaning, PID attributed to oil and registers > 5[b] PPM over > 20 sq ft
^Subslab Soil: Oil saturated soil per Oleophylic Dye, or Shake Test. Or PID Bag Headspace > 100 PPM over > 50 sq ft
^Prior to persuing soil, verify subslab source extent and level of impact with soil bag headspace samples
^Clean, seal and SSDS when slab/element/subslab is not saturated/absorbed and impacts are weak/limited in extent
CLOSURE - EVIDENCE that RESIDUAL VSM CONTAMINATION is STABLE, LIMITED and LOW
^Upon multiple checks and under a range of conditions including conceptual worst case
^0.3 PPM < Source Area Indoor Air < 0.7 PPM, without controls, and PID response not primarily attributed to spill
^Subslab source area < 5[b] PPM PID in drill hole headspace without controls operating
^Acceptable risk calculation with results of subslab source area vapor samples without controls operating
^Groundwater within 3 feet of building envelope < 10[b] times Maine Groundwater Remedial Action Guidelines
^SSDS Stack exhaust < 1.0[b] PPM
^Correlating lines of evidence, including support of closure from occupant and CDC (if involved)
^Acceptable risk calculation with results of indoor air sample(s) w/o controls operating.

a DEP's workplace PID action level (SOP RWM-PS-002 Last Revised 11/26/19) is 10 parts per million (PPM) and with adjustments for a 24 hour/7 day per week residential exposure results in a residential action level of 3 PPM. Actions include avoiding areas, rooms and buildings where PID measurements are sustained above 3 PPM.

b Based upon DEP experience with successful clean-ups

Petroleum Remediation Guidelines SOP 009
Vapor Source Material (VSM) Investigation and Remediation
Appendix A Residential Heating Oil Tank Spill (RHOTS)
FIGURE 1 - ACCESSIBLE, VAPOR TIGHT SUMP

DRAWN BY: LD MEDEP
REVISED 6.2020 BY PME



KEY

GATE VALVE

CHECK VALVE

CAM LOCK DISCONNECT

VACUUM RELIEF VALVE

SAMPLE PORT

NOTES

Appendix B – Indoor Air Multi Contaminant Risk Calculator for Residential Heating Oil Tank Spill (RHOTS)

Petroleum Remediation Guidelines SOP 009

Vapor Source Material (VSM) Investigation and Remediation Appendix B

Indoor Air Multi-Contaminant Risk Calculator for Residential Heating Oil Tank Spills

Indoor Air Multi-Contaminant Risk Calculator for Residential Heating Oil Tank Spills (RHOTS)

1) APPLICABILITY

This guidance document pertains to the use of indoor air multi-contaminant risk calculator assessment tool at home heating oil spills where the spill is promptly reported, thoroughly investigated and the vapor source material is aggressively remediated. This concept allows use of the sub-chronic (7 year) risk scenario to develop targets. This document is a companion to Maine DEP's Excel Program "Home Heating Oil Indoor Air Input Sheet and Summary of Total Incremental Lifetime Cancer Risks and Endpoint-Specific Hazard Indices" dated February 2019.

2) LIMITATION

This guidance is not intended for use with gasoline vapor intrusion or when a significant home heating oil plume remains below a building. Nor is it intended for persistent compounds such us chlorinated solvents. A petroleum spill or a RHOTS with a significant plume still below a building may not be mitigated within a seven year period this guidance is not applicable for the sources and pathways that are complete for more than 7 years. Also, the guidance does not address non-human health endpoints, such as ecological impacts

3) BACKGROUND

The multi-contaminant risk calculator is used to determine the cumulative sub-chronic risk for the total Incremental Lifetime Cancer Risk (ILCR) and the endpoint specific Hazard Index (HI). Action Levels are for volatile chemicals found in #2 fuel oil and kerosene.

The Risk Calculator uses the screening levels (SLs) developed using risk assessment guidance from the EPA Superfund program. The SLs are risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. The Risk Calculator determines the individual risk for each chemical analyzed and the risks are summed to determine if the overall ICLR risk exceeds 1×10^{-5} for residential exposure or non-residential exposure. The Risk Calculator also determines the HI risk for each chemical. The individual HI risks are summed to determine if the overall HI risk exceeds 1.

The EPA Screening Levels are determined for residential exposure and indoor worker exposure. The Risk Calculator uses the indoor worker scenario for non-residential exposures where the occupants are only present for part of the day such as schools, businesses, office buildings, and day cares. The residential exposure scenario is used for households nursing homes and hospitals where the occupants are living at the site.

REFERENCES

EPA Regional Screening Levels Calculator, May 2019
"https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search"

The EPA updates the RLS's on a semiannual basis. When the updates are published, the calculator will be updated as well.

4) GUIDELINES AND PROCEDURES

Laboratory canisters should be located in a place to conservatively represent the exposure. A Laboratory Certified in Maine for TO-15, TO-15 SIM and APH analysis should be used. The concentration results are entered into the respective boxes in the Excel Program for each chemical. The individual ICLR and HI results are shown in the cancer and noncancer risk summary. If an individual compound is above the action level, the risk will present as in bold, red font. The Risk Calculator sums the individual risks to determine the cumulative results. Incremental Lifetime Cancer Risk Action Level is a cumulative risk above 1 E-05. 1 E-05 is an increased cancer risk of 1 in 100,000. Hazard Index Action level is any cumulative risk above 1.

The Individual risk summary section reports the results with 3 significant digits. The cumulative results sections report the results with only 1 significant digit. One significant digit is used to determine if the results are above the action levels. Therefore, an ICLR results of 1.49 E-05 and a HI results of 1.49 are both below their respective action levels when rounded and will only be displayed as red and bold when they are above 1.49 E-05 and 1.49 respectively.

In addition to Maine DEP, Maine's Division of Toxicology, within the Environmental Health Unit of CDC, is to be immediately informed when a spill has occurred at a sensitive receptor such as schools, daycares, and/or elderly care facilities as site specific protocols and communications may be necessary.

REFERENCES

EPA Regional Screening Levels Calculator, May 2019
"https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search"

State of Maine – DEP - BRWM
Petroleum Remediation Guidelines SOP 009
Investigating and Remediating Vapor Source Material at
Residential Heating Oil Tank Spills
Appendix B Indoor Air Input Sheet and
Summary of Total ILCR and Hazard Indices

Site:		Sample Date:	
Town		Sample ID	
Spill No.		Lab:	
Risk Calculator for Residential Heating Oil Tank Spills Only		Sample Location:	

CAS Number	Chemical	Indoor Air Concentration (ug/m^3)	Maine Typical Residential Indoor Air (ug/m^3)
106-99-0	1,3-Butadiene		0.38
1634-04-4	Methyl tert-butyl ether		NA
71-43-2	Benzene		2.9
DEP2038	C5-C8 Aliphatics		240
108-88-3	Toluene		34
100-41-4	Ethylbenzene		3.5
1330-20-7	Xylene		19
DEP2039	C9-C12 Aliphatics		230
DEP2040	C9-C10 Aromatics		43
91-20-3	Naphthalene		1.6

RISK SUMMARY

Resident Sub-chronic (7 year)	
non-cancer	cancer

Non-Resident Sub-chronic (7 year)	
non-cancer	cancer

Resident	
	Subchronic
Cumulative ILCR	
Cumulative HI	

Non-Resident	
	Subchronic
Cumulative ILCR	
Cumulative HI	

Notes:

ILCR and HIs above the Action Levels are written in red.
Incremental Lifetime Cancer Risk (ICLR) Action Level is anything greater than 1E-05.
1E-05 is an increased risk of cancer of 1 in 100,000.

Hazard Index (HI) Action Levels are any HI levels greater than 1

Sub-Chronic Action levels are based on 7 years of exposure at the same concentration.

The Risk Summary Chart shows the ICLR and HQ for each specific compound by itself.

The Cumulative ILCR shows the combined effect of all the compounds on the ILCR Result.

This version of the risk calculator is not to be used for gasoline sites.

Maine DEP report titled " Typical Concentrations of Petroleum Compounds in Maine Residential Indoor Air, January 2014."
Link to report: https://www.maine.gov/dep/spills/petroleum/documents/typical_compounds4-2012rev2014.pdf

Version: November 18, 2019 Updated from EPA's RSL **May 18, 2020** (no changes made)

Appendix C – Vapor Intrusion (VI) Screening at Sites with Historical Gasoline Contamination

RWM-PP-009 Appendix C

Vapor Intrusion Screening at Historic Gasoline Sites

1) APPLICABILITY

This appendix is applicable to assessing petroleum vapor intrusion potential associated with residual, historic gasoline contamination encountered and/or suspected. It is applicable to property redevelopment, ownership transfer, in any of BRWM programs, including the petroleum program and the VRAP. This appendix is a companion to Maine DEP's "PVI Flow Chart" dated June 2019. This appendix replaces the petroleum vapor intrusion screening process in DEP's 2010 VI Guidance.

2) LIMITATION

This guidance is not intended for use where gasoline vapor intrusion is obvious and or related to a recent discharge. If vapor intrusion is obvious, inform occupants to immediately evacuate and notify emergency fire and response personnel. This guidance is not applicable to home heating oil spills impacting indoor air.

3) BACKGROUND

Complete petroleum vapor intrusion pathways are primarily associated with recent catastrophic underground releases or surface spills that penetrate the surface which is not covered by this SOP. Petroleum Vapor Intrusion (PVI) is rarely detected through investigation of residual impacts from a historical release. Instances of PVI at historical releases involve gross impacts (residual free product on the water table and/or petroleum saturated soil), shallow groundwater (less than 15 feet), buildings located hydraulically downgradient from the gross contamination, and zones of densely developed mixed use buildings with buildings and utilities in close proximity to the residual contamination.

Historic petroleum investigations and clean ups were not designed to assess or address PVI so there is a possibility that vapor source material remains on a property even after the site has been closed by MEDEP. Vapor source material, or gross contamination, may have been identified during the historical clean-up but historic soil removal was limited by structures and or property boundaries. Additionally, new development may encroach upon gross levels of residual gasoline or connect migration pathways between the vapor source material and receptors who were not present at the time of the former investigations.

4) GUIDELINES AND PROCEDURES

This appendix and the accompanying Figure 1 provide a process that define levels of gasoline in soil and groundwater that are considered vapor source material and present vertical and lateral distances between vapor source material and receptors – "PVI inclusion distances". If vapor source material is detected or suspected within the inclusion distances, notify DEP to scope and schedule the follow up investigation. Vapor barriers and sub slab depressurization system infrastructure may be required by local codes and are recommended when developing within 100 feet of historical contamination.

In addition to Maine DEP, Maine's Division of Toxicology, within the Environmental Health Unit of CDC, is to be immediately informed when sensitive receptors such as schools, daycares, and/or elderly care facilities are within the inclusion distance as site specific protocols and communications may be necessary.

5) REFRENCES

USEPA 2015, Technical Guide for Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank Sites, EPA-510-R-15-001, June 2015

GEI, 2012, Summary Report, State of Maine, Vapor Intrusion Study for Petroleum Sites, Prepared for State of Maine DEP, prepared by GEI Consultants, Inc., January 2012

NH-DES, 2013. Revised Vapor Intrusion Screening Levels and TCE Update; Vapor Intrusion Guidance, Waste Management Division Update, State of New Hampshire Department of Environmental Services; February 3, 2013

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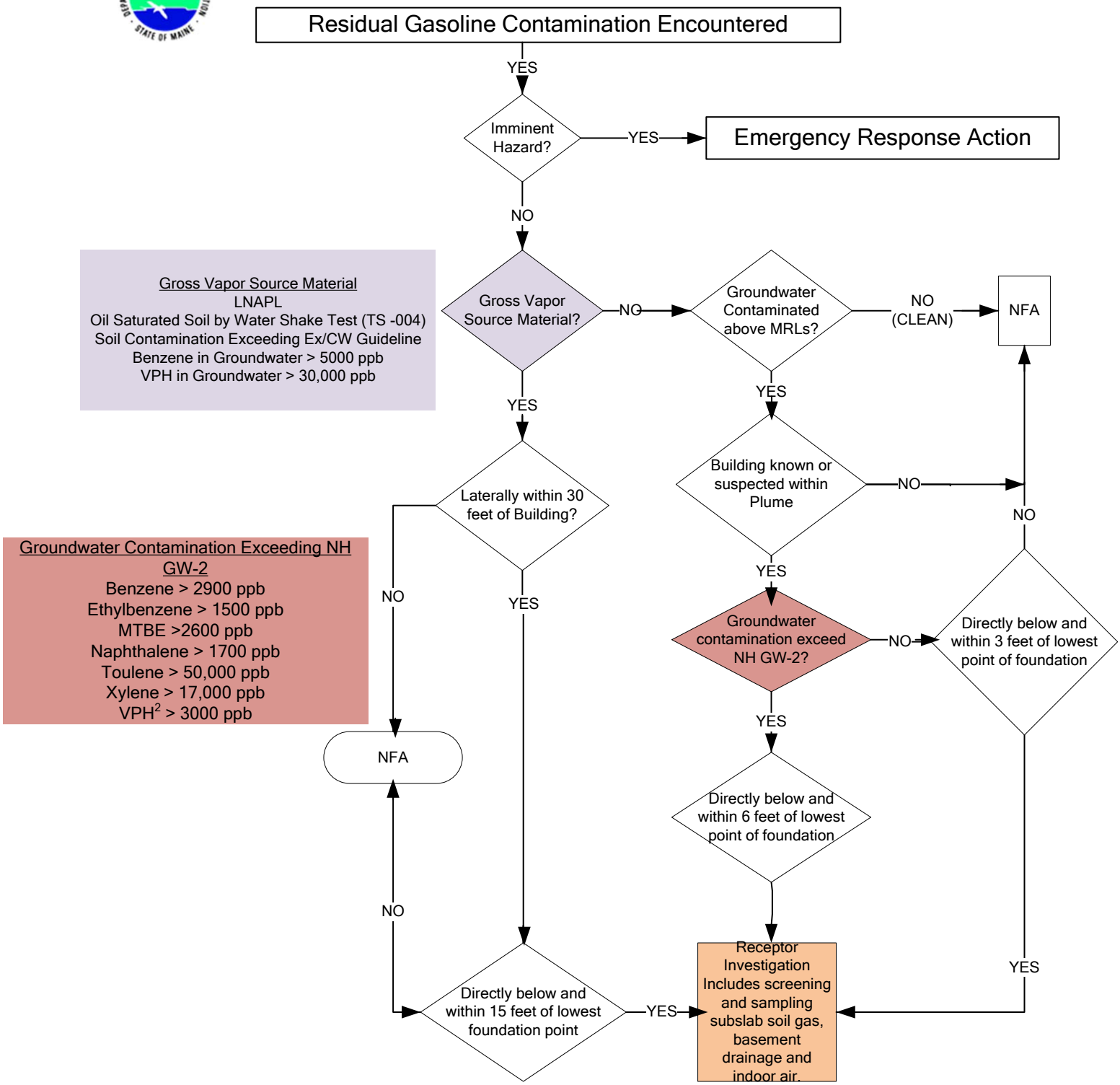
FIGURE 1 - VI Screening at Sites with Historical Gasoline Contamination

Revision No. 01
Interim dated May 30, 2019,



Receptor Subslab Screening/Sampling Criteria for Additional Action
ELEVATED PID > 10 PPM
and/or depressed oxygen < 15%
and/or depressed CO2 < 1%
Or Sub slab APH analysis > 50 times IASL

Receptor Basement Drainage Screening/Sampling Criteria for Additional Action
DRAINAGE HEADSPACE PID > 5 PPM
Or DRAINAGE PIDSOW[3] > 10 PPM
Or DRAINAGE with SHEEN or VPH Analysis > 3 PPM

Note 1: Adapted from NH DES "**Vapor Intrusion Guidance", July 2006**
Note 2: VPH GW-2 Standard from Massachussetts DEP
Note 3: PIDSOW = PID screening of oil in water by sampling with a 16 oz bottle, shaking, and PID screening headspace.

RWM-PP-009_VaporSourceInvestigationRemediation

Final Audit Report 2021-09-13

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