

MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTE SITE CLEANUP

PUBLIC COMMENT DRAFT

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**MCP REQUIREMENTS AND RECOMMENDATIONS
FOR ACTIVE EXPOSURE PATHWAY MITIGATION
MEASURES**

Policy #WSC-26-xxx

GENERAL STATEMENT

There are few scenarios of greater concern at contaminated disposal sites than vapor intrusion pathways, where exposures are real, continuing, unavoidable, and generally undetectable to building occupants, including sensitive populations, who can experience adverse health effects at even low levels of exposure over a short period of time if the exposure is not abated. It is for this reason that operating regimens for Active Exposure Pathway Mitigation Measures (“AEPMMs”) are a critical and indispensable element in ensuring the long-term safety of building occupants, especially when considering that most AEPMMs will need to operate for decades, and that the eventual decline or failure of electro-mechanical systems is inevitable. The most common AEPMM used in Massachusetts is a sub-slab depressurization system (“SSDS”), which is the focus of this guidance document.

Terms used in this document have the meaning given to them in Chapter 21E of the General Laws of Massachusetts (“Chapter 21E”) and the Massachusetts Contingency Plan at 310 CMR 40.0000 (“MCP”).

OPERATING REGIMEN

The operating regimen for AEPMMs at a site with a Permanent or Temporary Solution or Remedy Operation Status must be documented in the relevant Permanent Solution Statement, Temporary Solution Statement, or Remedy Operation Status submittal (collectively, “Submittals”), as specified in 310 CMR 40.0893(2)(g), 40.1025(3), 40.1026(3), 40.1056(2)(l), and 40.1057(2)(i). These Submittals must specify “the methods and frequency for monitoring” that will ensure, at a minimum, that “a level of No Significant Risk is maintained for the Receptor(s) of concern”. See, e.g., 310 CMR 40.1025(2), 310 CMR 40.1025(3), 310 CMR 40.1026(2) and 310 CMR 40.1026(3). Key items to consider in this regard are noted below:

- The written articulation of the operating regimen and supporting elements (referred to in this guidance as “Operating Regimen Document”) must be part of, or attached to, a Permanent Solution Statement, a Temporary Solution Statement, or, in the case of Remedy Operation Status, a Phase IV Operation, Maintenance and Monitoring Plan submitted for a disposal site. Such documents must be submitted by a Licensed Site Professional (“LSP”), who must opine that all elements of the submittal, including the Operating Regimen Document, comply with all requirements of the MCP.
- Consistent with the provisions of 310 CMR 40.0893(2)(g), 40.1025(3)(b), and 40.1026(3)(b), the Operating Regimen Document must contain a clear statement that the system has been designed and will be monitored and maintained in a manner that will ensure a level of No Significant Risk for the receptor(s) of concern under normal operating conditions, at the present time and for the foreseeable future.
- In accordance with 310 CMR 40.0893(2)(g), 40.1025(3)(c), and 40.1026(3)(c), actions required to meet MCP requirements must be clearly stated in the Operating Regimen Document, with respect to methods and frequency of specific inspectional, maintenance, monitoring, and data recording activities. Required elements of the operating regimen are to be notated as “shall” or “must”, not “should”.

KEY COMPONENTS OF AN SSDS AEPMM OPERATING REGIMEN

The two most important components of an operating regimen of an SSDS AEPMM are: (i) use of a remote monitoring (telemetry) system, and (ii) on-site monitoring of system components (e.g. vacuum). The totality of information and data obtained from all monitoring efforts (including indoor air quality) must be sufficient to ensure continuous and long-term system operations and maintenance of a condition of No Significant Risk.

The MCP allows the use of an array of telemetry systems, providing information and data with varying degrees of operational certainty. The selection and use of a telemetry system with a high degree of certainty will lessen the need for complementary on-site monitoring efforts. Conversely, telemetry systems with a lower degree of certainty will require a more rigorous and frequent on-site monitoring program.

TELEMETRY SYSTEMS

The three most used SSDS AEPMM telemetry systems, and the degree of operational certainty they bring to an operating regimen, are detailed below.

- The most robust telemetry system is one that continuously monitors and transmits extraction and/or sub-slab vacuum level data to a website that meets MassDEP specifications (see 310 CMR 40.1027(2)(c)), and immediately and automatically provides notification to specified parties (including MassDEP) if vacuum levels are outside specified ranges or if transmissions are no longer being received. Such “continuous vacuum transmission” systems are the most technologically advanced monitoring option and the only option that provides real-time confirmation of system operations through the transmission of data.
- A less robust system is one that is designed to provide a notification when extraction vacuum levels are below or outside of a specified value or range (see 310 CMR 40.1027(2)(b)). Such an “episodic transmission” system is not as reliable as a continuous transmission system. While a lack of notification *could* mean the AEPMM is working appropriately, it could also mean that neither the AEPMM nor telemetry system are working at all.
- The least robust system allowed by the MCP for installations predating March 1, 2024, is the transmission of the shutdown and restart of the system, potentially triggered by a power outage (see 310 CMR 40.1025(3)(d)(6)). Even if such a transmission occurs, an AEPMM system that has undergone a shutdown and restart will not necessarily retain power, be working properly, or be maintaining necessary sub-slab vacuum levels.

Regardless of the type of transmission, all telemetry systems must be able to immediately send an alert to the owner/operator of the AEPMM system and MassDEP simultaneously upon the occurrence of the required regulatory trigger. Delayed or “cascade” notification systems, where the first notified party would or could halt further notifications, are not allowed (see 310 CMR 40.1025(3)(d)(3) and 310 CMR 40.1026(d)(3)).

ON-SITE MONITORING

On-site monitoring of AEPMM operations and building conditions must be a part of all operating regimens and be of a scope and level of frequency commensurate with site and contaminant

conditions and the operational certainty afforded by the selected telemetry system.

A key component of on-site SSDS AEPMM monitoring is vacuum measurement devices, particularly at and on extraction pipes. The need for this fundamental system component was first emphasized by MassDEP in its 1995 publication, *Guidelines for the Design, Installation, and Operation of Sub-Slab Depressurization System*.¹ Given the lack or inaccessibility of sub-slab soil vapor probes in many SSDS AEPMM installations after several years of operation, these devices are generally the only means to assess whether the design level of vacuum extraction is being maintained by system operations.

The preferred and recommended vacuum measurement device for extraction pipes in SSDS AEPMM installations is a u-tube manometer, due to its simplicity, accuracy, and low cost.

RESPONSE ACTION PERFORMANCE STANDARD (RAPS) AND AEPMMs

While the MCP notates a few specific requirements for AEPMMs and operating regimens, it does not provide the details inherent to such operations. As with all other elements of the MassDEP semi-privatized waste site cleanup program, such details are subject to the Response Action Performance Standard (RAPS) described in 310 CMR 40.0191. RAPS is defined to include “...the level of diligence reasonably necessary....to design and implement specific remedial actions at a disposal site to achieve a level of No Significant Risk for any foreseeable period of time”. The MCP provides that “RAPS shall be employed during the performance of all response actions conducted pursuant to [the MCP]” (see 310 CMR 40.0191(2)). “Response Actions” includes the operation, maintenance and monitoring of SSDS systems installed to achieve and maintain a Permanent Solution or other appropriate MCP endpoint.

The RAPS provision is complemented and supported by the statement at 310 CMR 40.0100(1) that MassDEP has “*the final administrative authority and discretion to determine...the appropriate extent and nature of a response action consistent with M.G.L. c. 21E and 310 CMR 40.0000...*”.

To ensure consistent and protective operations, MassDEP has prepared this guidance document in order to describe the level of diligence and monitoring generally needed in an operating regimen to comply with the requirements of 310 CMR 40.0191 (RAPS) and 310 CMR 40.0100(1) with respect to SSDS AEPMM operations. Proposed modification of one or more of these expectations is permissible on a site-specific basis, but only if consistent with the MCP and only if detailed and compelling justification is provided by an LSP in the Operating Regimen Document, including a clear statement that such measures are not reasonably necessary to ensure the continued maintenance of a condition of No Significant Risk for the foreseeable future.

CONTENT OF AN SSDS AEPMM OPERATING REGIMEN DOCUMENT

Consistent with the requirements of 310 CMR 40.1025, and 310 CMR 40.1026, the Operating Regimen Document for an SSDS AEPMM is expected to include, at a minimum:

1. **A brief description of the site, contaminants of concern, and pre-AEPMM indoor air data summations.** With the exception of sites where emergency conditions warranted

¹ Massachusetts Department of Environmental Protection, *Guidelines for the Design, Installation, and Operation of Sub-Slab Depressurization System* (1995).

immediate mitigative measures, or newly constructed buildings with appropriate vapor barriers, there is an expectation that at least one round of indoor air data will be obtained prior to the installation and operation of vapor mitigation measures, including SSD systems. Such information is essential for the development of the operating regimen, long-term monitoring programs, and eventual system termination evaluations. In the absence of such data, conservative assumptions will need to be used when estimating sub-slab vapor/indoor air attenuation factors.

2. **Documentation on the demonstration of effectiveness of the SSD system.** Such documentation includes a tabulation of indoor air data representative of exposures for the Receptors (populations) of concern during operation of the Active Exposure Pathway Mitigation Measure under normal operating conditions and over a period of time sufficient to account for temporal variability.
3. **For AEPMMs operating in connection with a Permanent Solution, a demonstration that failure of the system for more than 60 consecutive days will not pose an Imminent Hazard to building occupants.** For systems mitigating indoor air levels of trichloroethylene (TCE), given the possibility of impacts in as little as several weeks should the SSD system not be operating properly, Imminent Hazard concentrations of TCE calculated using the most current version of MassDEP Shortforms shall not be adjusted (i.e., calculated concentrations shall not be multiplied by a factor of 30). Absent unusual site conditions, the possible presence of sensitive receptors shall be an assumed foreseeable exposure in such calculations.
4. **Building map/plan showing the “as-built” SSDS installation.** A building map/plan showing the “as built” installation is expected to include: (i) the location and identification of all extraction points/lines, discharge points, fans/blowers, and other system components, and (ii) operationally relevant building installations, including sumps, floor drains, elevator shafts/stairwells, and sub-slab soil vapor probe installations. This information is needed to evaluate and monitor system operations.
5. **Details on SSDS/AEPMM piping (size and materials), fans/blowers (brands, model numbers, performance specifications), filters, etc.** Required maintenance schedules for the equipment and estimates of equipment life spans should also be included.
6. **A concise summary of expected operating conditions, including pressure/flowrate information.** This information is needed to verify proper system operations during future inspections.
7. **Details on the telemetry system.** Details on the system shall include model, specific alarm condition(s), time interval of noncompliance to activate alarm condition, method(s) of communication, and procedures for annual testing. Such details are necessary to evaluate and monitor telemetry operations.
8. **Details on vacuum measuring devices.** Such details shall include a statement that a vacuum measuring device (e.g., u-tube manometer) has been affixed to each extraction pipe, along with: (i) markings notating the acceptable vacuum range, and (ii) a label indicating the name and phone number/email address of who to contact if a reading is

outside of this range. Such actions are needed to verify proper operation of the system and enable building occupants a means to detect and communicate potential system problems.

9. **Accessibility and integrity of fans, blowers, valving, gauges, and other key system components.** A statement must be provided that key system components are accessible for inspection, including by MassDEP staff, and that mechanical/control components are protected from accidental or unauthorized modifications.
10. **Acceptable vacuum/pressure ranges.** A concise tabulation of acceptable vacuum/pressure ranges shall be provided for all monitoring points (e.g., extraction pipe manometer, sub-slab soil vapor probes). Such values shall be selected to: (i) ensure the maintenance of a condition of No Significant Risk, and/or (ii) identify potential operational problems.
11. **Minimum vacuum levels.** Details and justification must be provided on how the acceptable level(s) of vacuum at the extraction point(s) or in sub-slab probes will correlate to sub-slab vacuum fields sufficient to eliminate or mitigate vapor intrusion in a manner that maintains a condition of No Significant Risk to building occupants. Note that the MassDEP recommended minimum sub-slab vacuum levels of -0.012 inches of water column in the winter and -0.020 inches water column in the summer are for the design of SSDS's and cannot be the sole basis of the establishment of this metric, which must be based also on post-installation confirmatory indoor air data obtained over a period of time sufficient to account for temporal variability. Absent definitive studies and data in this regard, the low alert level should not be more than 20% less than the designated operating vacuum level.
12. **Maximum vacuum levels.** Details and justification must be provided on how the acceptable high level(s) of vacuum at the extraction point(s) will correlate with system blockage/groundwater entrainment or other system malfunctions that may impact operational efficiency or efficacy or indicate system malfunctions.
13. **HVAC considerations.** Notation must be made on the degree to which HVAC operations within the building(s) of interest are likely to affect indoor air quality and the system's ability to maintain a condition of No Significant Risk. Where necessary, steps that will be taken to ensure proper operations for the foreseeable future must also be provided.
14. **Detailed description of specific inspectional, maintenance, monitoring, and data recording activities** (see "Scope and Frequency of On-Site Monitoring for all SSDS AEPMMs," below).
15. **Tabulated phone numbers/email addresses** for the named points of contact.

SCOPE AND FREQUENCY OF ON-SITE MONITORING FOR ALL SSDS AEPMMs

The nature and scheduling of inspection, maintenance, monitoring and data recording requirements specified in the Operating Regimen Document must consider, at a minimum:

- the type and concentrations of subsurface and sub-slab contaminants of concern,
- presence of sensitive receptors,
- building and sub-slab conditions (e.g., new construction/SSDS with vapor barrier vs old(er) building with complex sub-slab conditions),

- number of extraction points/presence of manifolds/valving
- pre-AEPMM vapor intrusion impacts/indoor air concentrations,
- operational uncertainties related to fluctuating water tables, difficulties in maintaining negative sub-slab pressures, etc.,
- whether vacuum testing is and will be conducted on a regular basis on far-field sub-slab vapor probes, and
- the type of telemetry system.

Of particular concern are buildings with measured or likely pre-AEPMM indoor air concentrations of trichloroethylene (TCE) in excess of an Imminent Hazard level, given evidence that suggests even short-term/low-level exposure to sensitive receptors or populations can result in serious health effects, including heart malformations in developing fetuses.

In order to demonstrate the achievement and maintenance of a condition of No Significant Risk, as required by 310 CMR 40.0893(2)(g), 40.1025(3)(b), and 40.1026(3)(b), MassDEP's minimum expectations regarding the types and frequencies of on-site monitoring activities in all SSDS AEPMM operating regimens are as follows:

- *Frequency of Inspection* – A full inspection of all system components on at least an annual basis. Prompt targeted inspections of specific system elements are expected if and when there are reports or observations of operational deficiencies or failures, including when vacuum readings are outside of an established range, or when there are frequent unscheduled shutdowns.
- *Scope of Inspection* - A full inspection to include, but not necessarily be limited to, the following:
 - *Fans/blowers* – note loud/abnormal operations; inspect/clean any filters; inspect any alarm and/or telemetry connections.
 - *Pressure levels* – record all pressure/vacuum levels at all extraction points, prior to and/or after fan/blowers, available sub-slab soil vapor probes, and anywhere else in the system where such measurements are made. Compare pressure/vacuum levels to allowable range values in the Operating Regimen Document; note and follow-up on inconsistencies. Ensure that the acceptable pressure/vacuum range is clearly denoted at each measurement point, and update, if necessary, the name and phone number of the person to contact if outside of the designated range. Where appropriate/accessible, measure basement/sub-slab pressure differential with a micro-manometer and compare to acceptable values in the Operating Regimen Document.
 - *Piping* – inspect all exposed piping for signs of damage.
 - *Building* – inspect all visible/accessible areas of the building foundation/slab for cracks and/or signs of excavation or damage that could lessen sub-slab depressurization. Inspect all floor drains, sumps, and other installations or piping; ensure that any necessary mitigation measures remain in place (e.g., air-tight covers for sumps; inserts for floor drains). Make routine inquiries/observations of any

changes to building ventilation or HVAC systems that could lessen system effectiveness.

- *Indoor Air Testing* Indoor air testing can be used as a line of evidence to demonstrate the SSDS is continuing to maintain a level of No Significant Risk for the receptor(s). At sites where an adequate sub-slab negative pressure field is established and maintained, significant vapor intrusion impacts to indoor air are unlikely, though there is some degree of uncertainty. This uncertainty can increase over time, due to a number of factors, including the development of cracks in the foundation system, penetrations of the slab/vapor barrier (e.g., for utility repair), and changes in air exchange rates within the structure; the latter being most problematic in residential apartment complexes in older buildings with complicated and changing HVAC systems.

If during the inspection of the system, changes in the building/HVAC systems are observed or system components have been replaced, indoor air testing is recommended. Given indoor air testing is the only way to definitively determine indoor air contaminant concentrations and confirm a condition of No Significant Risk, indoor air testing is recommended on a periodic frequency (minimum of every 5 years) as a best practice to show the AEPMM is continuing to maintain a condition of No Significant Risk.

Beyond these recommendations, there is an expectation that indoor air will be conducted in the following cases:

- If the SSDS is shut down for a period of greater than 30 consecutive days or more at a site where pre-AEPMM indoor air concentrations of TCE constituted an Imminent Hazard condition, excluding systems in newly constructed buildings with a robust and proven vapor barrier; and/or
- at sites where sub-slab vacuum levels are observed to be significantly lower than values established in the operating regimen for protective SSDS operations, and where such a condition was likely present for at least 6 months.

Except when conducted to evaluate system deficiencies, indoor air testing is also expected to be conducted during winter conditions in a location(s) with the highest pre-AEPMM indoor air contaminant concentrations. Indoor air testing data indicating that a condition of No Significant Risk is not being maintained (due to the presence of a vapor intrusion pathway) must be promptly reported to MassDEP.

- *Follow-up Actions* – An expectation exists that the Operating Regimen Document will include a process and timeframe to address deficiencies and concerns related to AEPMM operations, including details on who will perform these actions.
- *Records* – All details of system inspection, including observations, pressure data, maintenance or repair activities, and dates of air sampling are expected to be documented in a logbook and/or electronic file and made available to MassDEP upon request.

ADDITIONAL ON-SITE MONITORING EXPECTATIONS FOR SSDS AEPMMs WITH EPISODIC TELEMTRY SYSTEMS

Meeting the standard of care identified in 40.0191 requires additional on-site inspection and monitoring for AEPMMs with episodic telemetry transmissions, compared to sites with continuous transmission telemetry. The following are the expected actions and schedules.

Episodic Telemetry Transmission of Power Out (only) Data

- At least quarterly on-site inspection of fan/blower(s) and telemetry system.
- At least quarterly on-site measurement of vacuum at extraction point(s).

Episodic Telemetry Transmission of Vacuum Data

- At least semi-annual on-site inspection of fan/blower(s) and telemetry system.
- At least semi-annual on-site measurement of vacuum at extraction point(s).

Episodic Telemetry Transmission at Sites with Past Imminent Hazard conditions for TCE

- At least quarterly on-site inspection of fan/blower(s) and telemetry system.
- At least quarterly on-site measurement of vacuum at extraction point(s).

SPECIFICATIONS FOR AEPMMs WITH CONTINUOUS TRANSMISSION VACUUM TELEMETRY SYSTEMS

No additional on-site monitoring requirements are expected for AEPMMs with continuous transmission vacuum telemetry systems, beyond the yearly inspection previously detailed for all AEPMMs. However certain steps are required to standardize transmission procedures and optimize the utility of such systems.

Data Collection and Transmission

- The sampling rate (vacuum) should be between 10 to 60 seconds, with an averaging period of 10 to 30 minutes, and transmission interval of 15 to 60 minutes.
- Communication **must be** via CSV (comma separated values) format, **with each value enclosed in quotes**, in the sequence articulated below:

Site RTN (x-yyyyyyy), Device Number (01, 02, etc.), Event Description (shutdown, restart), Event Date (YYYYMMDD), Event Time (HH:MM, 24-hour format)

An example of the above is:

“1-0012345”, “01”, “shutdown”, “20240620”, “19:25”

Website Details

In accordance with the provisions of 310 CMR 40.1027(2)(c), remote monitoring devices that continuously monitor and transmit key AEPMM operational data shall transmit such data to a website that meets MassDEP specifications. A website of this nature shall be deemed to meet MassDEP specifications if all the following statements are true:

- Each AEPMM is identified by RTN, address, city, and unique name or identification code (e.g., Device Number), as specified in the Operating Regimen Document.
- The low and high vacuum alert points are specified.
- A real-time graph is displayed or retrievable plotting vacuum level in inches of water

column over time, in user-selected intervals including the last 12 hours and last 30 days.

- An option is provided to download discrete data points for a user-selected time interval since the date of initiation of continuous monitoring.
- The website is capable of providing view-only access.

Access

The provisions of 310 CMR 40.1027(2)(c) further specifies that MassDEP shall be provided with the URL to obtain access to the specific web page(s) hosting the data transmissions from each registered system. The URL address, and any needed passwords or instructions, may be provided to MassDEP in the following manner:

- in the Operating Regimen Document,
- in a discrete communication from the AEPMM owner or consultant to MassDEP, or
- in a discrete communication from the website vendor to MassDEP.

If desired, such communications may include a request for confidentiality pursuant to 310 CMR 3.23.

EXISTING INSTALLATIONS AND PAST SUBMITTALS

As specified in 310 CMR 40.1101(3), in its audit of any past submittals concerning the design and operation of AEPMMs or SSD systems, conclusions by MassDEP on regulatory compliance shall be based upon the MCP and RAPS in effect at the time of submittal.

However, as stated in 40.1190(2), MassDEP reserves the right to require additional response actions (e.g. modifications of existing systems and monitoring programs), if such actions are necessary to protect health, safety, public welfare, or the environment.