MassDEP

Proposed Revisions to the Off-Gas Treatment Policy

Public Comment Draft

May 29, 2025

OFF-GAS TREATMENT

OF POINT-SOURCE REMEDIAL AIR EMISSIONS

Former Policy #WSC-94-150

This Policy concerns air emissions that occur as a result of air stripping of contaminated groundwater, vacuum extraction of soil gases, or any other remedial activity conducted pursuant to MGL Chapter 21E that creates a point-source discharge of contaminants to air. The intent of this Policy is to articulate when off-gas treatment of point-source remedial air emissions may not be necessary to protect human health, safety, public welfare, and the environment.

Comments Due By: **June 30, 2025**

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NOTE: Trichloroethylene is no longer a contaminant that may be evaluated in a generic manner by this guidance document. Also, naphthalene 1,2-dichloroethylene, and chlorobenzene are now included as "Group 1" contaminants in the emission-distance graphs, The gasoline graph has been eliminated, and such impacts may be addressed by Aliphatic and Aromatic Hydrocarbon data obtain using the Volatile Petroleum Hydrocarbon (VPH) and/or Air-phase Petroleum Hydrocarbon (APH) methods.

EMISSION-DISTANCE GRAPHS

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1,1-Dichloroethane	1	9
1,2-Dichloroethane	1	9
1,2-Dichloroethylene (cis and trans)	1	9
Ethylbenzene	4	12
Methylene Chloride	2	10
Methyl Ethyl Ketone	3	11
Methyl-Tertiary Butyl Ether	4	12
Naphthalene	1	9
Phenol	2	10
Tetrachloroethylene	1	9
1,1,1-Trichloroethane	4	12
Trichloroethylene – NOT SUBJECT TO THIS GUIDANCE		
Toluene	2	10
Vinyl Chloride	1	9
Xylenes (total)	2	10

1.0 Background and Purpose

The Massachusetts Department of Environmental Protection (MassDEP) Bureau of Waste Site Cleanup (BWSC) regulates activities at sites contaminated by a release of oil or hazardous materials in accordance with the requirements and specifications contained in 310 CMR 40.0000, the Massachusetts Contingency Plan (MCP)

Remedial actions at such sites may involve the collection and treatment of groundwater and/or soil gases and discharge of contaminated vapors to the ambient air. Emissions of this nature generally result from the operation of contaminated groundwater "air strippers" or soil vapor extraction (SVE) systems, designed to volatilize or "off-gas" contaminants from soil and/or groundwater to the atmosphere.

The purpose of this policy is to (1) describe the regulatory jurisdictions and procedures that govern emissions of this nature, (2) delineate and explain the required performance standards applicable to remedial emissions, (3) articulate details of the Response Action Performance Standard (RAPS) and (4) provide a simplified and conservative methodology for determining when off-gas controls may not be needed/may no longer be needed.

The information contained in this document is intended solely for guidance. This document does not create any substantive or procedural rights, and is not enforceable by any party in any administrative proceeding with the Commonwealth. The regulations related to remedial air emissions contain both specific and general requirements. In addition to summarizing specific requirements, this document also provides guidance on what measures MassDEP considers acceptable for meeting the general requirements set forth in the regulations. Parties using this guidance should be aware that there may be acceptable alternatives to this guidance for achieving compliance with such general regulatory requirements.

2.0 Applicability

This policy applies to remedial actions being conducted at disposal sites subject to the performance and submittal requirements of 310 CMR 40.0049 of the MCP

The guidance contained in this policy applies to any point-source remedial air emissions, such as, air discharges from packed-tower or diffused aeration air strippers, bioreactors, and SVE systems, except as described below.

This policy is neither designed nor intended to apply to the following:

(1) Well-head treatment systems at public water supply wells that are operated in conformance with applicable regulations and/or in conformance with requirements specified by the MassDEP's Drinking Water Program.

(2) Sub-Slab Depressurization Systems installed at residential dwellings, schools, or commercial buildings to prevent the migration of subsurface vapors into living/working spaces, provided the total air emission rate of all volatile contaminants is less than 100 pounds/year.

(3) Point-source remedial air emissions temporarily authorized by MassDEP to prevent or abate an imminent hazard to health, safety, public welfare, or the environment. In such cases, treatment devices, when necessary, must be installed as soon as possible.

However MassDEP reserves the right to require off-gas controls on the above or any discharge should such emissions create odorous or adverse health, safety, or environmental conditions downwind of the discharges.

3.0 Regulatory Jurisdictions

While point-source remedial air emissions are regulated primarily by Mass DEP/BWSC under MGL c.21E and 310 CMR 40.0000, remedial air emissions **that will exceed 1 ton/year** (with or without off-gas treatment/controls) may also be subject to the regulatory provisions specified by Mass DEP Bureau of Air and Waste (BAW) under MGL c.111, section 142 A-K and 310 CMR 7.00, the "Massachusetts Air Pollution Control Regulations." Under these provisions, two options exist to satisfy BAW requirements:

(1) the proponent of the remediation may file an appropriate permit/plan application, as specified in 310 CMR 7.02; or

(2) the proponent of the remediation may, under the "permit by rule" provisions of 310 CMR 7.03, elect to apply off-gas control treatment (if not already required by BWSC requirements under 310 CMR 40.0049) for groundwater or soil venting systems that ensures 95% removal of volatile emissions, and implement specified monitoring and documentation procedures.

At most disposal sites remediated under MGL c 21E, remedial air emissions are less than 1 ton/year (even without treatment), and in most cases, will not require an air discharge permit or permit by rule from BAW. Regardless of emission levels, however, BAW has the authority to require a plan application or permit if such emissions create or contribute to a condition of air pollution.

4.0 Performance Standards for Determining When to Apply Off-Gas Controls

4.1 Background

Under the provisions of 310 CMR 40.0000, MassDEP/BWSC has established requirements and procedures for conducting remedial actions at contaminated sites. The Remedial Air Emission provisions of 310 CMR 40.0049 stipulate that point-source air emissions from remedial systems must be treated by control devices prior to their discharge to ambient air, unless the person undertaking the response action submits a Licensed Site Professional (LSP) Opinion to MassDEP prior to commencement of the remedial action stating that such emissions, if not treated, would be at or below a level of No Significant Risk to health, safety, public welfare, and the environment.

Once installed, off-gas controls must be maintained until the remedial air discharge is terminated or until an LSP Opinion is submitted stating that such off-gas controls are no longer needed.

4.2 No Significant Risk

In order to achieve compliance with 310 CMR 40.0049, untreated remedial air emissions must be at or below a level of No Significant Risk to health, safety, public welfare, and the environment. In this context, "No Significant Risk" exists when all of the following conditions are met:

Human Health

A condition of No Significant Risk to human health would exist if the risk of harm to persons exposed to remedial air emissions meet the risk management criteria specified in 310 CMR 40.0900:

- using a cumulative risk approach, the risk associated with the remedial air emissions must be equal to or less than the Cumulative Cancer Risk Limit (an Excess Lifetime Cancer Risk of one-in-one hundred thousand), and the Cumulative Noncancer Risk Limit (a Hazard Index of 1.0); or
- using a chemical-specific approach, and consistent with the approach used to develop MCP Method 1 standards for soil and groundwater, the receptor concentration resulting from each oil or hazardous material emitted must be equal to or lower than the concentrations of that chemical which are associated with an Excess Lifetime Cancer Risk of one-in-one million and a Hazard Quotient of 0.2.

In accordance with the provisions of 310 CMR 40.0902(3), concentrations of oil and hazardous materials in ambient air at background concentrations need not be included in risk assessment and may be assumed to constitute a condition of No Significant Risk to human health.

Safety

In accordance with the provisions of 310 CMR 40.0960, a condition of No Significant Risk to human safety would exist if:

- remedial air emissions do not result in the generation and/or accumulation of explosive vapors; and
- access to remedial treatment systems is restricted as needed to prevent physical harm or bodily injury.

Public Welfare

In accordance with the provisions of 310 CMR 40.0900 and 40.0994, a condition of No Significant Risk to public welfare would exist if:

- remedial air emissions do not result in nuisance odor conditions at downwind human receptors, and do not result in nuisance noise conditions. For the purpose of predicting the occurrence of such odor conditions, the 50th percentile odor recognition concentration should be utilized.

Environment

In accordance with the provisions of 310 CMR 40.0995, a condition of No Significant Risk to the environment would exist if:

- remedial air emissions and/or fallout from remedial air emissions do not result in a deleterious impact to critical habitat, endangered species, or other ecological receptors.

4.3 Demonstrating No Significant Risk

Prior to the commencement of remedial actions where off-gas controls WILL NOT be applied to systems emitting contaminated vapors, an LSP Opinion must be submitted to MassDEP stating that such emissions will not exceed a level of No Significant Risk at Potentially Impacted Receptors. This Opinion shall be based upon an analysis of the following:

(1) threshold (non-carcinogenic) and non-threshold (carcinogenic) health risks resulting from each oil and hazardous material emitted to the atmosphere, to evaluate risks to human health;

(2) potential odor and noise conditions resulting from such emissions, to evaluate risks to public welfare; and

(3) direct impacts of emissions on ecological receptors to evaluate risks to the environment.

Potential risks to human safety should also be considered when undertaking any remedial action at a disposal site.

To facilitate a demonstration of No Significant Risk, mathematical models may be used to predict increased ambient air concentrations at Potentially Impacted Receptors. Mathematical models typically calculate (increased) maximum hourly concentration values at a specified down-wind receptor.

This computed maximum hourly concentration should be:

(1) multiplied by 0.40, to obtain an estimate of the average (increased) daily receptor concentration value, in order to evaluate threshold health risks;

(2) multiplied by 0.08, to obtain an estimate of the average (increased) yearly receptor concentration, in order to evaluate non-threshold health risks; and

(3) remain unadjusted (maximum hourly concentrations), to evaluate potential receptor odor concerns.

The use of the above multiplying factors is consistent with standard statistical averaging practices, as used and recommended by MassDEP and the U.S. Environmental Protection Agency (EPA).[1]

To evaluate non-threshold and threshold health risks. available MassDEP risk assessment guidance and/or the agency's "Short Form" publications may be consulted. The use of a 50th percentile odor recognition concentration should be used to evaluate the potential for odor impacts at Potentially Impacted Receptors.

For chemicals with background concentrations in ambient air exceeding a condition of No Significant Risk or an odor threshold, the required evaluation of potential health and odor concerns should be made on the basis of increased ambient concentration values resulting from the proposed remedial emission. For the purpose this policy, background concentrations of individual or collective VOCs should be determined by site-specific air sampling and analysis, or by citation of appropriate values from scientific literature.

4.4 Definition of and Distance to "Potentially Impacted Receptors"

In order to characterize the risk posed by oil and/or hazardous materials, human and environmental receptors must be identified in accordance with 310 CMR 40.0920. For the purposes of this policy, human receptors or "Potentially Impacted Receptors" are defined to include:

(1) residential properties, schools, daycare centers, or elder-care facilities;

(2) parks, playgrounds, and recreation areas;

(3) off-property commercial areas where continuing exposure to a human receptor is likely; and/or

(4) on-property areas where continuing non-occupational, exposure to a human receptor is likely (e.g., a former gasoline service station now being utilized as a restaurant).

In applying the Response Action Performance Standard (RAPS) and the "Simplified Remedial Emission Evaluation Methodology" (Section 7), distances should be measured from the base of emission stack(s) to the nearest "Potentially Impacted Receptor" as described below:

(1) the property boundary of the nearest residential dwelling;

(2) the property boundary of the nearest school, daycare center, elder-care facilities, park, playground, and recreation area; and/or

(3) any on or off-property point where continuing exposure to a potentially impacted receptor is likely.

[1] *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised*, (EPA-454/R-92-019), October 1992(provides a more detailed discussion of multiplying factors.)

5.0 Performance Standards for the Operation and Monitoring of Off-Gas Control Systems

Except where an LSP Opinion is submitted as specified by 310 CMR 40.0049 stating that achievement of a 95% level of emission reduction is not feasible or necessary, or where treatment standards are specified in writing by MassDEP based upon its review of proposed or ongoing response actions, off-gas control systems (e.g., activated carbon, incineration, catalytic or thermal oxidation, or biotreatment units) must be designed, constructed, and operated in a manner that:

(1) as specified in 310 CMR 40.0049, ensures the continuous reduction of at least 95% of the emitted oil and hazardous material, on a weight basis, or reduction to a background level (generally $\leq$ 1 ppmV as isobutylene on a photoionization detector (PID) meter), whichever concentration is higher;

(2) does not expose down-wind receptors to concentrations exceeding a level of No Significant Risk; and

(3) does not expose down-wind receptors to nuisance odor or noise conditions.

The following are considered by MassDEP to be the minimum monitoring procedures for off- gas control systems necessary to ensure compliance with the 95% VOCs reduction performance standard. Proponents should continuously evaluate the need to expand on these minimum requirements during the operation of the treatment system.

a) In accordance with 310 CMR 40.0049(6), influent and effluent vapor samples must be obtained from the off-gas control system 1, 7, 14 and 28 days after system start-up, and monthly thereafter. Vapor samples should be analyzed using a gas chromatograph, or, as and where appropriate, they may be screened for total VOCs using a PID or flame ionization detector (FID).

b) All VOC vapor samples should be obtained from "in-line" sampling ports in the vapor treatment system piping.

If used, the state of calibration of the PID or FID meter must be confirmed every 20 analyses or daily, whichever is more frequent, by testing with a certified standard, with percent recoveries in the range of 80% to 120%. Such data should be included in relevant submittals to MassDEP.

6.0 Response Action Performance Standard

To meet the Response Action Performance Standard (RAPS) in 310 CMR 40.0191, remedial action alternatives must be designed and implemented in a manner which is protective of health, safety, public welfare, and the environment. In evaluating whether off-gas controls are necessary to meet a condition of No Significant Risk, there are certain conditions which cannot be adequately addressed via air dispersion modeling. Moreover, unless continuous emission/ambient air monitoring is conducted, all site-specific remedial emission monitoring programs are subject to significant spatial and temporal data limitations.

Because of these concerns, it is MassDEP's position that evaluations of this nature must take into account the following site and operational factors

(1) **Gasoline Releases**

Gasoline releases represent a unique contamination profile due to the large and highly variable number of volatile aliphatic and aromatic hydrocarbon compounds. Of particular concern are the potential public welfare problems that may result from the discharge of odorous compounds such as alkenes or biological degradation products. These factors must be considered prior to any decision to allow the untreated emissions of such contaminants.

(2) **Non-Aqueous Phase Liquids (NAPL)**

Release conditions where mobile non-aqueous phase liquids, such as free-phase gasoline, are present represent a unique set of concerns. System failures could result in free-phase liquids entering air emission stacks. Globule/colloidal non- aqueous phase liquid entrainment into aqueous flow systems or volatilization into SVE systems, could result in transient, but potentially significant fluctuations in emission levels. To address these concerns, at sites where the point of groundwater recovery or SVE is within 30 feet of a location where measurable (≥ 1/8 inch) NAPL exists, off-gas controls should be applied to protect against the impact of such potential system failures on ambient air quality. Such a recommendation would not apply to bioventing systems at sites where non-volatile NAPL is present.

(3) **Soil Vapor Extraction Systems**

The recovery rate/air emission rate from SVE systems are unlike those of groundwater air stripping systems. In a typical SVE application, initial operation will produce a high air emission rate, followed by sharply reduced levels tailing off to a asymptotic steady-state condition. In order to effectively capture this initial contaminant mass and guard against transient discharge anomalies that could occur as a result of changing and dynamic vadose-zone conditions, all SVE systems should be initially fitted with off-gas control devices for the first 1500 hours of operation. Following this initial period, off-gas control devices should only be removed if none of the other application conditions articulated in Section 4.0 exist.

(4) **Modeling Limitations**

Because of limitations inherent in most mathematical models, off-gas control devices should be applied on any remedial system where the discharge stack height (point of emission) is less than 15 feet (4.5 meters) above ground level, or where the distance to the nearest Potentially Impacted Receptor is less than 66 feet (20 meters) from any emission stack.

7.0 Simplified Remedial Emission Evaluation Methodology

A simplified methodology has been developed by MassDEP for determining when the application of off-gas controls can be reasonably and safely eliminated from new systems and/or removed from existing systems, based upon the air emission rate and distance to Potentially Impacted Receptors. Specifically, a series of emission-distance graphs have been developed to evaluate risks to human health and public welfare, based upon air dispersion modeling.[2]

7.1 Modeling Assumptions/Results

The EPA "Screen" Model (EPA-450/4-88-010) was used to help predict potential ambient air concentration levels of 21 volatile organic compounds at varying distances from a point-source air discharge. Modeling inputs were designed to represent reasonably conservative, although not worst-case, site conditions and remedial system operational parameters. Modeling outputs were compared to designated "acceptable" increased ambient receptor concentrations. For the universe of targeted compounds, "acceptable" increased ambient receptor concentrations were defined as the lowest of the following three values: (1) A Hazard Quotient of 0.2, (2) an Excess Lifetime Cancer Risk (ELCR) value of 1 x 10-6, and (3) the 50th percentile odor recognition threshold.

Model output data for air plume "wake" areas were used to formulate a series of emission-rate vs. distance-to-receptor graphs. The 21 targeted contaminants were grouped into 4 categories, based upon commonality of "acceptable" receptor concentration values.

[2] MassDEP "*Point-Source Air Emissions from 21E Remedial Systems*" discussion document, dated June 26, 1992, provides a more detailed description of the air dispersion modeling.

Modeling results indicate the possibility of deleterious air plume "cavity effects" within 66 feet (20 meters) of the emission point. Accordingly, off-gas controls should always be applied for all emission stacks located less than 66 feet (20 meters) from a "potentially impacted receptor."

7.2 Calculating Air Emission Rate (Emission Flux)

For contaminated groundwater air stripping systems, the remedial air emission rate should be calculated as follows:

(1) Unless a pilot study has been undertaken to determine steady-state influent groundwater concentrations, the highest aqueous concentration value for each contaminant from within the projected recovery area should be the designated influent concentration level.

(2) The air emission rate (µg/s) is calculated for each influent contaminant assuming 100% mass-transfer from the aqueous phase, according to the relationship:

$$E = [C_W * Q_W] / 15.84$$

where:

E = air emission rate, µg/s
C_W = aqueous concentration, µg/l
Q_W = influent aqueous flow rate, gal/min

For Soil Vapor Extraction (SVE) Systems, after the recommended 1500 hours of off-gas controls, the remedial air emission rate should be calculated as follows:

(1) Stack concentrations should be measured directly from a sampling port in the stack by obtaining a vapor sample for analysis by EPA Method TO-15 and/or MassDEP APH.

(2) The air emission rate (µg/s) is determined for each contaminant, according to the following relationship:

$$E = [C_a * Q_a] / 2118$$

where:

E = air emission rate, µg/s
C_a = air (stack) concentration, µg/m^3
Q_a = air (stack) discharge rate, CFM

Air emission rates (µg/s) from other remedial systems should be determined by the most appropriate method(s).

7.3 Using Emission-Distance Graphs

Four emission-distance graphs are provided.

(1) The emission-distance graphs (Figures 1 through 4) should, in most cases, address potential impacts to human health and public welfare; project proponents must still satisfy the safety and environmental performance standards specified in Section 4.

(2) For each **individual** site contaminant, select the appropriate graph and plot the calculated air emission rate ("x" axis) against the distance to nearest "potentially impacted receptor" ("y" axis).

If **any** coordinate point for **any** individual contaminant is below the designated line (i.e., in shaded area, then, under this approach, off-gas controls may NOT be eliminated.

> *Due to the inherent degree of uncertainty in predicting downwind ambient air concentrations, MassDEP reserves the right to require off-gas treatment at locations where health concerns and/odors are present, regardless of the need for such treatment as determined using this simplified graphical approach.*

8.0 Licensed Site Professional Opinions

All LSP Opinions, as described in this policy and 310 CMR 40.0049, must be accompanied by the appropriate level of documentation to support the particular Opinion. Specifically:

(1) an LSP Opinion submitted to MassDEP prior to the commencement of the remedial action stating that untreated emissions will present No Significant Risk must be supported by information and reasoning which addresses all of the criteria outlined in 40.0049. As this provision requires the LSP to consider "all relevant policies issued by the Department", i.e., this Policy, the LSP Opinion should address why it is not necessary to apply off-gas controls to meet the conditions outlined in Section 4.0 of this Policy in order to achieve the No Significant Risk standard;

(2) an LSP Opinion submitted stating that off-gas controls are no longer necessary in order to achieve the No Significant Risk standard, based on the absence of all of the conditions outlined in Section 4.0 of this policy must be supported by an adequate description of why those conditions no longer apply; and

(3) an LSP Opinion submitted stating that 95% reduction in level of emissions is not feasible or necessary, as described in 310 CMR 40.00409, must be supported by the information and reasoning used to reach this conclusion.

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Figure 1
Emission Rate vs. Distance: Group 1

[Concentrations at receptor above shaded area projected to be < 1 µg/m^3]

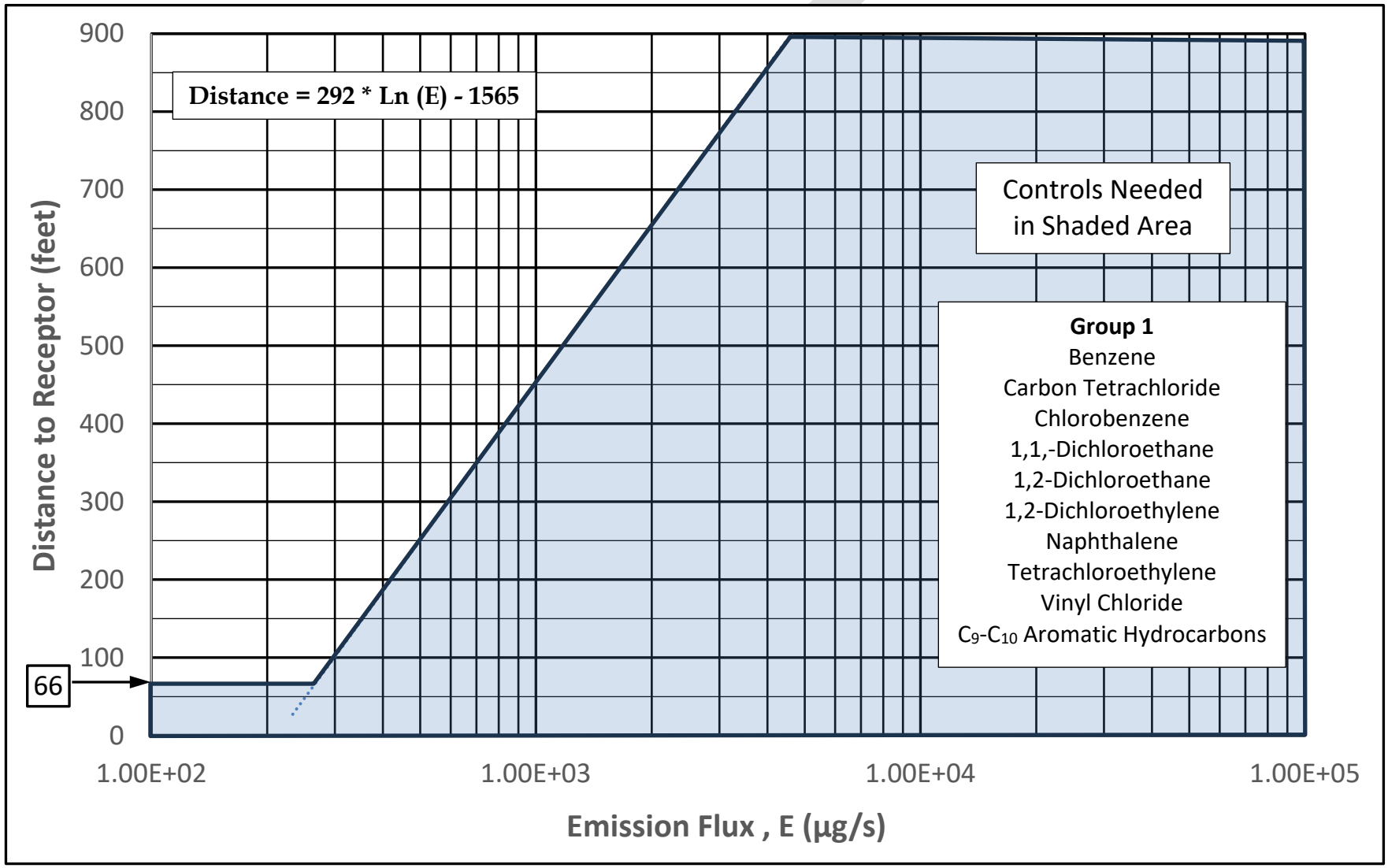

Figure 2
Emission Rate vs. Distance: Group 2

[Concentrations at receptor above shaded area projected to be < 13 µg/m^3]

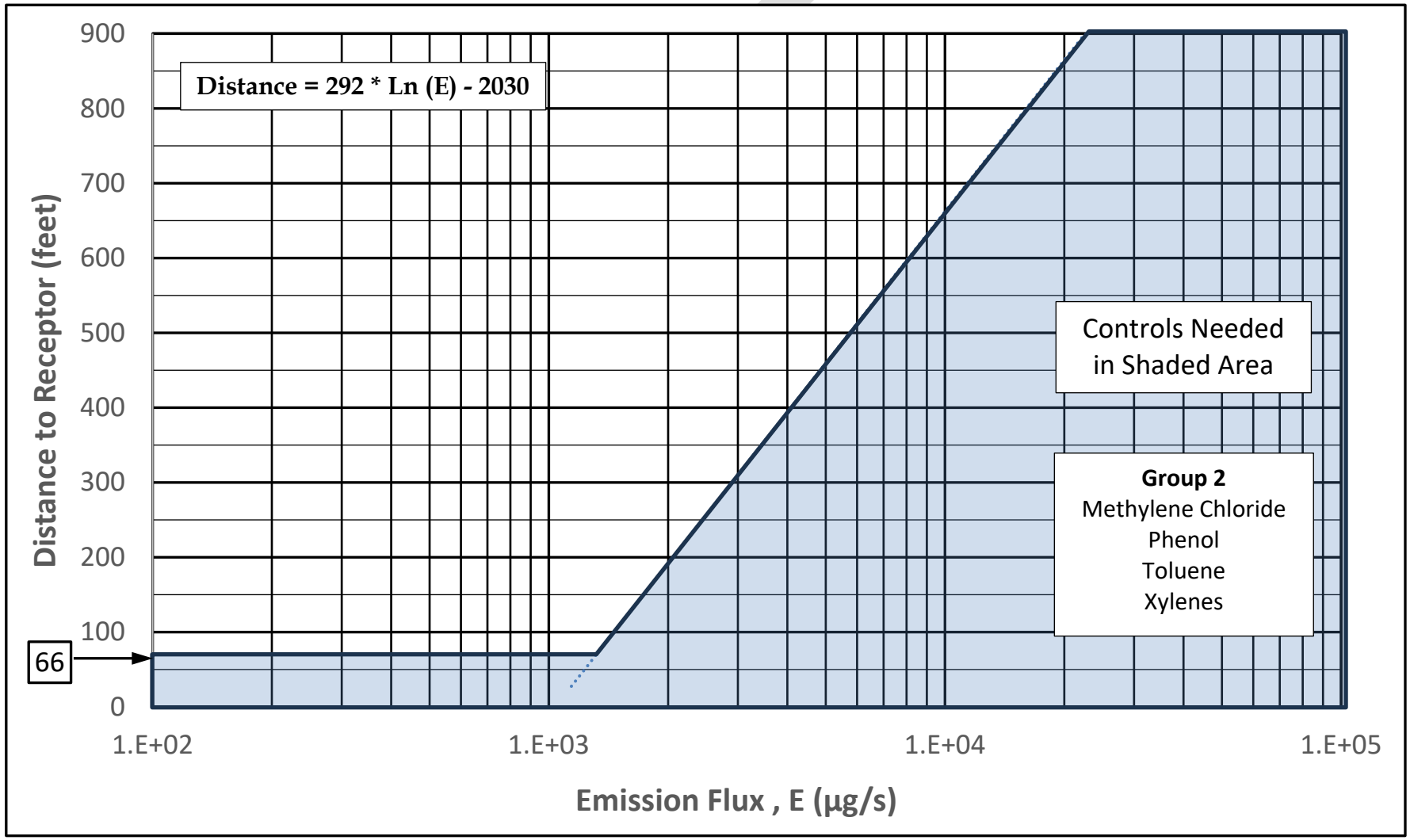

Figure 3
Emission Rate vs. Distance: Group 3

[Concentrations at receptor above shaded area projected to be < 32 µg/m^3]

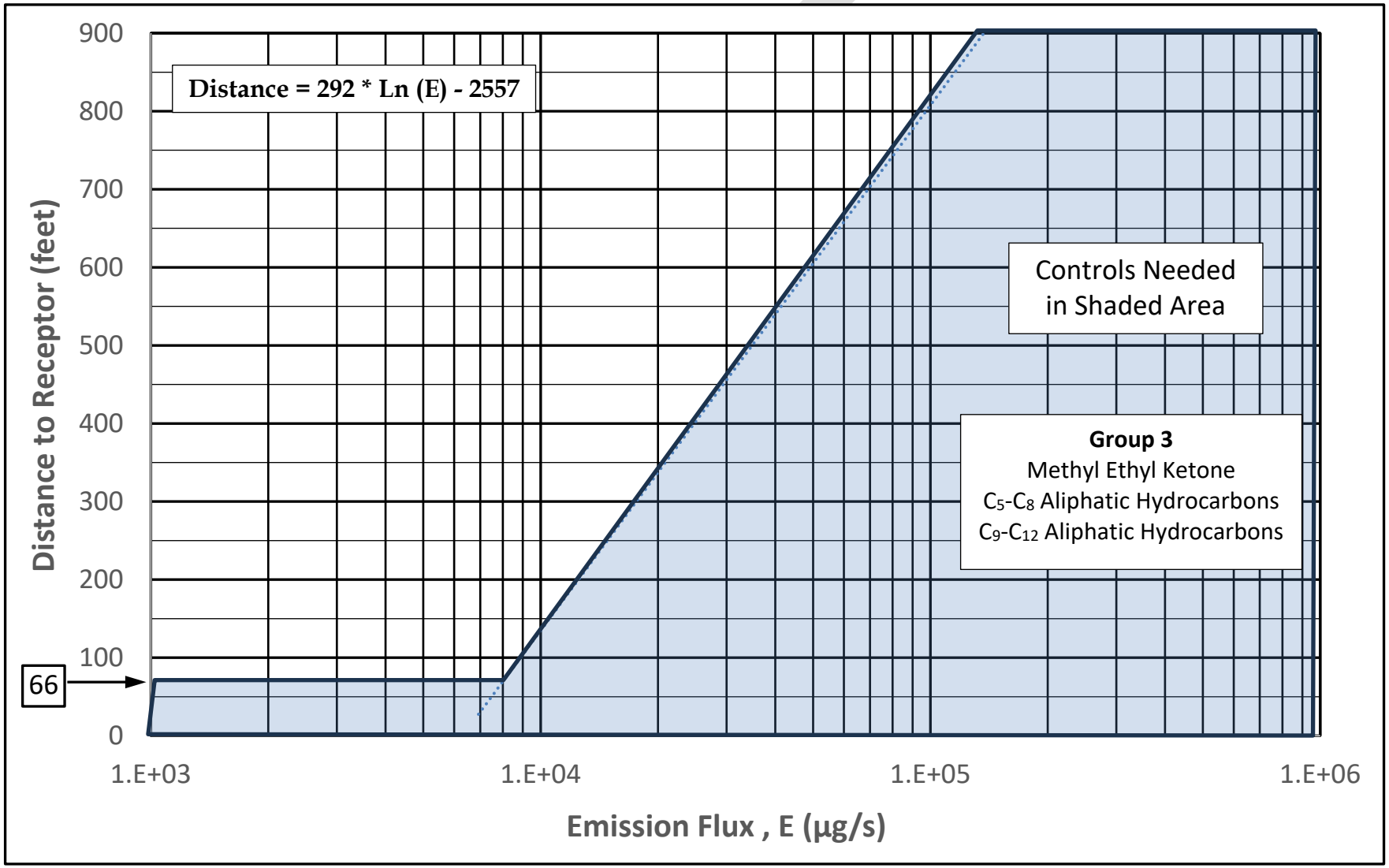

Figure 4
Emission Rate vs. Distance: Group 4

[Concentrations at receptor above shaded area projected to be < 118 µg/m^3]