Effluent Vapor Modeling Guidance

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Purpose:	The purpose of this document is to provide potentially liable persons (PLPs) and/or voluntary cleanup applicants with guidance on evaluating and demonstrating whether treatment of effluent vapors from remediation systems remains necessary prior to discharge to the atmosphere.
Scope:	This guidance provides information applicable to set-up and performance of air quality dispersion modeling to demonstrate that release of contaminated vapors from remediation systems is protective of human health and the environment without effluent treatment.

Revision Date	Revision Description
April 2020	Original Guidance

Background:

The State Superfund Unit (SSU) of the Montana Department of Environmental Quality (DEQ) has generally required that all effluent vapor associated with sub-slab depressurization (SSD) systems, or similar remedial technologies associated with extracting contaminated vapors from the subsurface and releasing the vapor to the atmosphere, be treated before release. SSU was asked to evaluate options for potentially liable persons (PLPs) and/or voluntary cleanup applicants to demonstrate that treatment is not/no longer necessary. SSU has determined that effluent vapor discharge from these extraction systems can be modeled using AERSCREEN, an air quality dispersion model used by the United States Environmental Protection Agency (EPA). This model can be used to determine if the release of contaminated vapor from these systems at concentrations exceeding EPA's Regional Screening Levels (RSLs) is protective of human health and the environment without effluent treatment. AERSCREEN is a free, downloadable program that can be found on EPA's website at: https://www.epa.gov/scram/air-quality-dispersion-modeling-screening-models.

System Startup Requirements:

Upon startup, SSD and similar systems require time to equilibrate before effluent vapor concentrations stabilize. SSU will continue to require that effluent vapor be treated prior to a system demonstrating equilibration. To determine whether effluent vapor contaminant concentrations have equilibrated, SSU allows the use of a photoionization detector (PID) to screen effluent vapor. PID readings collected from effluent vapor, prior to treatment, should show stable results before analytical data is collected for use in a dispersion model. Stable PID results include three consecutive readings where concentrations fall within 10% of each other. Laboratory analysis may be needed to confirm/correlate PID readings.

Once PID readings show effluent concentrations have stabilized and it is demonstrated that the extraction system has equilibrated, it is appropriate to collect analytical data from the effluent vapor, prior to treatment, for use in a dispersion model. Please coordinate with SSU to determine what analytical methods are appropriate as each site may be different based on known or historic contamination; however, collection of vapor samples via a Summa canister followed by laboratory analysis using an appropriate method will typically be required. Please submit validated data to SSU to demonstrate the usability of the data. DEQ's data validation form can be found here:
http://deq.mt.gov/Portals/112/Land/StateSuperFund/Documents/Data%20Validation%20Forms/2018-01-26%20DV%20Guidance%20Checklist%20PDF%20Version%201.3.0%20Distributed.pdf?ver=2018-01-26-161931-823

Please see SSU's frequently asked questions (FAQs) for additional guidance on data validation: https://deq.mt.gov/Land/StateSuperfund/FrequentlyAskedQuestions. System start up data should be submitted to SSU. If the analytical data shows effluent vapor concentrations are below applicable screening levels, modeling and continued treatment of effluent vapors may not be necessary. SSU approval/concurrence is needed prior to removal of a treatment system.

Model Parameters:

Once PID readings show that the system has stabilized and at least one round of analytical data has been collected, the analytical data, in combination with the following site-specific parameters, will be used in AERSCREEN:

A. Stack Emission Rate – Please use site-specific parameters.
B. Stack Height – Please use site-specific parameters.
C. Stack Temperature – Please use site-specific parameters. Ambient temperature may also be used, as this is more conservative than actual stack temperature.
D. Stack Diameter – Please use site-specific parameters.
E. Stack Cross-Sectional Area – Please use site-specific parameters.
F. Plume Exit Velocity – Please use site-specific parameters.
G. Stack Air Flow Rate – Please use site-specific parameters.
H. Stack Cap – Please use site-specific parameters.
I. Land Use – Due to Montana's lack of population/low density land use (even in the larger cities), it is only appropriate to use rural land use within the model.
J. Source Type – Model the SSD system or other extraction system as a point source.
K. Buildings – In an area where the extraction system is adjacent to one or more buildings, two sets of model results are needed: one identifying the existing building conditions and one with no surrounding buildings. Both sets of results will allow for data comparison and will help SSU determine the effect the existing buildings have on the model. If there are no buildings surrounding the extraction system, the model does not need to include buildings; in this instance, only one model is required. If more than one building is near the extraction system, the model should be run to represent each nearby building within a distance of <5L, where L is the lesser of the height or width dimension of the structure, but not exceeding ½ mile.[1] In addition, please include the following site-specific parameters when modeling:
    a. Building Height
    b. Maximum Horizontal Dimension
    c. Minimum Horizontal Dimension

[1] This is consistent with the definition of "nearby" as it exists in 40 CFR 51.100 (jj)(1), good engineering stack height regulations.

d. Maximum Dimension Angle to North
e. Direction of Stack from Building Center
f. Distance from Building Center to Stack

L. Terrain - In cases where receptors are between zero and 100 yards from the extraction system, use of Terrain data is not needed in the model. However, if the area around the source is very hilly or has unusual characteristics, it may be appropriate to include Terrain data in the model. Please coordinate with SSU if the modeler is uncertain if it is appropriate to include Terrain data within the model.

M. Receptors – the model should evaluate maximum impact points (locations where the model determines the receptor experiences maximum exposure concentrations) in all directions (based on site-specific parameters). Please also ensure all receptors are evaluated by including the following information:
   a. Minimum Distance to Ambient Air (i.e. roof intakes)
   b. Maximum Distance to Probe (receptor)
   c. Distance (bearings) to any appropriate Discrete Receptors, or the distance to a location that is evaluated in the model, i.e. a playground, outdoor employee break area/lunch spot, employee parking area, nearest residence, etc.

N. Meteorology – MAKEMET should be used in conjunction with AERSCREEN. The MAKEMET program works with AERSCREEN to generate a matrix of meteorological conditions, in the form of AERMET-ready surface (AERSCREEN.sfc) and profile (AERSCREEN.pfl) files, based on user specified surface characteristics, ambient temperatures, minimum wind speed, and anemometer height.[2] AERMET acts as the meteorological preprocessor for the model.[3] If the model does not pass this way, then site-specific meteorology data may be used in the model. Please use data from the National Weather Service (NWS) and the closest weather station available in proximity to the site. It may be appropriate to set up a temporary weather station to collect site-specific data if appropriate National Weather Service data is not available.

O. Surface Friction – If MAKEMET is used in the model, surface characteristics from the AERMET seasonal tables of common land use types should be used as they relate to the site location.[4] If AERMET is used with NWS data, the surface characteristics should be calculated with AERSURFACE and the National Land Cover Database (NLCD) data at the

[2] EPA, AERSCREEN User's Guide. Section 1.2, pages 5-7. December 2016. https://www3.epa.gov/scram001/models/screen/aerscreen_userguide.pdf.
[3] EPA, User's Guide for the AERMOD Meteorological Preprocessor (AERMET). August 2019. https://www3.epa.gov/ttn/scram/7thconf/aermod/aermet_userguide.pdf.
[4] EPA, AERSCREEN User's Guide. Section 2.3, pages 21-24. December 2016. https://www3.epa.gov/scram001/models/screen/aerscreen_userguide.pdf.

NWS (Metrologic tower) site. Please see the following link for NLCD land use data: https://www.mrlc.gov/viewer/ for an interactive website.

The parameters should accurately represent the SSD or extraction system. If the modeler does not believe the above parameters represents existing conditions, please contact SSU to discuss how to address. Please also reference EPA's *AERSCREEN User's Guide* for more detailed information: https://www3.epa.gov/ttn/scram/models/screen/aerscreen_userguide.pdf.

Model Results:

All model results submitted to SSU should be based on site-specific parameters and analytical data as discussed above. These parameters and data may be modeled using AERSCREEN to determine the maximum exposure of all relevant receptors. If appropriate, EPA's RSLs may be used to represent acceptable concentrations receptors may be exposed to in order to determine if stack emission concentrations should be treated.

Once the model has been run, all model variables, input/output files, and results should be provided to SSU. The resulting exposure concentrations calculated by the model will be compared directly to EPA's RSLs for indoor air to determine whether effluent vapor exceeds acceptable exposure limits.

Operation and Maintenance:

If AERSCREEN indicates that treatment is not necessary and SSU concurs with this conclusion, regular operation and maintenance (O&M) of the extraction system should continue. These O&M activities include monthly PID readings from effluent vapor and annual (at a minimum, depending on site-specific circumstances) analytical data collected from effluent vapor to ensure conditions are not changing.

If either the PID readings or analytical data show significant changes, or there is reason to believe existing conditions have changed, vapors may need to be treated until the data shows conditions have stabilized. Vapors may also need to be treated in instances where the system has been shut down for a period of time and is restarted as initial vapor contaminant concentrations are typically very high and then decline asymptotically over time. If conditions change significantly, a new model may need to be run to account for these changes. While a new model is run, vapors should continue to be treated.

Modeling does not supersede any applicable permitting required for an extraction system or larger site-specific requirements. If you have any questions, please speak with your SSU project contact.