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<u>**DRAFT**</u>
<u>**Technical Note –Dispersion Modeling for Lead (Pb) Sources**</u>

BACKGROUND

On November 12, 2008 EPA substantially strengthened the national ambient air quality standards (NAAQS) for lead (see 73 FR 66964). EPA revised the level of the primary (health-based) standard from 1.5 micrograms per cubic meter ($\mu g/m^3$) to 0.15 $\mu g/m^3$, measured as total suspended particles (TSP) and revised the secondary (welfare-based) standard to be identical in all respects to the primary standard. In conjunction with strengthening the lead (Pb) NAAQS, the EPA promulgated new monitoring requirements including new design requirements for the Pb NAAQS surveillance network (40 CFR Part 58, Appendix D, paragraph 4.5). Modeling of Pb sources will be required in order to site Pb monitors and monitoring agencies may wish to perform modeling in order to request a wavier from the monitoring requirements.

QUESTIONS AND ANSWERS

1. **What models are available?**
    A list of models and the models are available at EPA's Support Center for Regulatory Atmospheric Modeling (SCRAM) website at http://www.epa.gov/scram001/. A list of preferred dispersion models can be found at http://www.epa.gov/scram001/dispersion_prefrec.htm and a list of alternative models can be found at http://www.epa.gov/scram001/dispersion_alt.htm.

    Note that as of December 2006, AERMOD is the preferred model for near-field dispersion and has replaced ISC as the preferred model.

    Several screening models are available on SCRAM (http://www.epa.gov/scram001/dispersion_screening.htm). One of the listed models, AERSCREEN, will be made available as soon as possible. However, none of the screening models calculate monthly concentrations. Most models calculate a 1-hour concentration and scaling factors are used to calculate 3, 8, and 24-hour concentrations, as well as annual concentrations. To calculate a monthly concentration, a conservative estimate would be to use the 24-hour concentration calculated by the model. More information about screening models can be found in the screening procedures document (U.S. EPA, 1992).

2. **Where can I find guidance and recommendations on modeling?**
    Modeling guidance can be found on SCRAM at http://www.epa.gov/ttn/scram/guidanceindex.htm and http://www.epa.gov/scram001/dispersion_prefrec.htm#aermod. Some applicable guidance is:
    *   Guideline on Air Quality Models (hereafter referenced as Appendix W) (U.S. EPA, 2005) [http://www.epa.gov/scram001/guidance/guide/appw_05.pdf]. Appendix W gives guidance on the use of preferred and alternative models, model inputs (emission sources, meteorological data, terrain, etc).

- AERMOD User's Guide (U.S. EPA, 2004a) and AERMOD User's Guide Addendum (U.S. EPA, 2006).

- AERMOD Implementation Guide (U.S. EPA, 2008a)

- Example Application of Modeling Toxic Air Pollutants in Urban Areas (U.S. EPA, 2002) [http://www.epa.gov/scram001/guidance/guide/uatexample.pdf]

- Lead guidance can be found in the EPA Lead guideline (U.S. EPA, 1993) and Section 5.2.5 of Appendix W (U.S. EPA, 2005) gives guidance about models for lead.

- Receptor Model Technical Series V: Source Apportionment Techniques and Considerations in Combining Their Use (U.S. EPA, 1984)

- Receptor Model Technical Series VI: A Guide to the Use of Factor Analysis and Multiple Regression (FA/MR) Techniques in Source Apportionment (U.S. EPA, 1985)

- Protocol for Applying and Validating the CMB Model (U.S. EPA, 1987)

3. **How do I calculate the rolling 3-month averages from model output?**
EPA is creating a post-processing program that reads model output and calculates rolling 3-month averages for the period modeled and will be available for download from SCRAM once completed. The program outputs the rolling averages for each receptor and source group for each month. Also output is the overall maximum rolling average, its location and time of occurrence. The program reads ASCII output from AERMOD or a user-supplied simple text file of concentrations. Tips for running AERMOD to facilitate use of the post-processor are listed in Question 6 below. More information about the inputs and outputs are found with README file of the post-processor.

4. **Are there any recommendations or tips for running AERMOD for monitor siting or waiver request?**
For general guidance and AERMOD implementation recommendations the user should consult Appendix W (U.S. EPA, 2005), the AERMOD User's Guide (U.S. EPA, 2004a) and Addendum (U.S. EPA, 2006), and the AERMOD implementation Guide (U.S. EPA, 2008a). If you are novice user of AERMOD, reading the AERMOD User's Guide and Implementation Guide are highly recommended before running AERMOD. Also, the user is encouraged to read the AERMOD ancillary programs user guides, AERMET (U.S. EPA, 2004b), AERMAP (U.S. EPA, 2004c), and AERSURAFACE (U.S. EPA, 2008b) for other recommendations in preparation for AERMOD runs.

5. **What data is needed for an AERMOD run?**
The following data are needed for AERMOD:
- Emissions: This includes characterization of the emission source (point, area, or volume), emission rate, operating schedules (for temporal allocation of the emissions if necessary), stack parameters for point sources, and location. See Section 3.3 of the AERMOD User's Guide (U.S. EPA, 2004a) and Section 8.1 of Appendix W (U.S. EPA, 2005) for more details of what is needed.

- Building information: For point sources, AERMOD can include building downwash effects. In order to more accurately represent the model plume, building information should be included in AERMOD where applicable. AERMOD building dimensions can be generated using BPIPPRIME (available at http://www.epa.gov/scram001/dispersion_related.htm#bpipprm).

- Deposition parameters: AERMOD can simulate deposition (dry and wet) and plume depletion for particles. Two methods are used for particle deposition, Method 1 and Method 2. Method 1 is usually when a significant fraction (> 10%) of the total particulate mass has a diameter of 10 microns or larger. The particle size distribution of must be well known in order to use Method 1. Method 2 is used when the particle size distribution is not well known and when a small fraction (< 10%) of the mass is greater than 10 microns. Section 2.2.5 of the Addendum to the AERMOD User's Guide (U.S. EPA, 2006) and Wesely et al., 2002) gives more information about particle deposition in AERMOD and particle size information for Method 2 can be found in AERMOD Depositions Parameterizations Document (http://www.epa.gov/scram001/7thconf/aermod/driscdep.zip

- Urban/rural determination: Sources are run as urban or rural sources using the URBANOPT with urban population and URBANSRC keywords in AERMOD. The urban option accounts for the "convective-like" boundary layer that forms during nighttime hours due to the urban heat island. Section 7.2.3 of Appendix W (U.S. EPA, 2005) and Section 5.1 of the AERMOD Implementation Guide (U.S. EPA, 2008a) give guidance about urban/rural determination and input urban population.

- Meteorological data: AERMOD needs surface and upper air meteorological data in order to appropriately characterize the planetary boundary layer (PBL) and the dispersion of the atmosphere. The data is processed through AERMET (U.S. EPA, 2004b) to create the AERMOD input files. The surface data should be representative of the domain being modeled. This can be thought of in terms of the actual data, i.e. winds and temperature, as well as surface characteristics. Surface characteristics are the albedo (fraction of incident solar radiation reflected by the surface), Bowen ratio (ratio of sensible heat flux to latent heat flux, an indicator of surface moisture), and surface roughness (height at which mean horizontal wind speed is zero based on a logarithmic profile). Surface characteristics can be objectively determined using AERSURFACE (U.S. EPA, 2008b).

  Surface data can be onsite or from a National Weather Service (NWS) data. For NWS data, this is often the closest station, but this may not always be the case. See Section 8.3 of Appendix W, Section 3 of the AERMOD Implementation Guide (U.S. EPA, 2008a) and the AERSURFACE User's Guide (U.S. EPA, 2008b) for more details. For regulatory modeling Appendix W states that five years of data are required when using NWS data and one year of data for onsite data (see Section 8.3.1.2 of Appendix W for details).

- Terrain: When running AERMOD in complex terrain, source and receptor elevations can be determined using AERMAP (U.S. EPA, 2004c), which reads USGS DEM and in the soon to be released update (via SCRAM), National Elevation Data (NED) to calculate elevations, and hill heights.

6. **What are some tips/recommendations for running AERMOD for Pb?**
    The following are not official guidance but are recommendations for running AERMOD in order to calculate rolling 3-month averages using the EPA lead post-processor.

    - For averaging time, MONTH should be included as well as any other times desired (1-hour, 24-hour, etc.) since the averages needed by the post-processing program are monthly averages.

    - If more than one facility is being modeled and contributions from each facility are desired, the SRCGROUP keyword in the SO pathway can be used to identify the facilities. Stacks associated with a facility can be assigned to the same source group. Individual stacks can also be assigned to their own source groups if contributions from individual stacks are needed. The user should also use the SRCGROUP ALL keywords to get a total concentration from all emission sources being modeled at each receptor. See Section 3.3.11 of the AERMOD User's Guide (U.S., EPA 2004a) for more information about source groupings.

    - For receptors, there are many options for receptor placement in AERMOD. Section 3.4 of the AERMOD User's Guide (U.S., EPA 2004a) explains the various ways of entering receptor locations. However, the user may not want to place receptors in areas that are not considered ambient air, as this may give misleading results.

    - For regulatory modeling, Appendix W (Section 8.3.1) requires five years of meteorological data when using National Weather Service (NWS) station data or one year of onsite data. When modeling using NWS data the entire period can be modeled in one AERMOD run. This is done by concatenating or copying and pasting the surface meteorological files (.SFC) files in chronological order into one text file and doing the same for the profile files (.PFL). The start and end dates can be included in the AERMOD.INP file in the ME pathway using the STARTEND keyword [see page 3-59 of the AERMOD User's Guide (U.S. EPA, 2004a)]. Since the lead standard is based on a 3-month rolling average, the first 3-month average will be for March of the first model year. For a five year meteorological period, this will result in 58 3-month rolling averages and for one year of onsite data, 10 months of rolling averages.

    - For concentration output, the POSTFILE option for monthly averages will yield output that is in a format read by the lead post-processing program. The user can specify separate POSTFILEs for each source group for which output is wanted, or put all source groups into one file by specifying the same output filename file unit number for each source group. Section 3.7 of the AERMOD User's Guide (U.S., EPA 2004a) gives details about the POSTFILE options.

For FURTHER INFORMATION

This document and other documents intended to assist monitoring agencies implement the Pb monitoring requirements can be found at - http://www.epa.gov/ttn/amtic/pb-monitoring.html

For additional information, please contact Kevin Cavender of the Air Quality Assessment Division, Ambient Air Monitoring Group, 919-541-2364, cavender.kevin@epa.gov.

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