2024 Revisions to the *Guideline* / AERMOD Final Rule Webinar

U.S. EPA / OAQPS / Air Quality Modeling Group

Tuesday, December 10, 2024

Outline

- Revisions to *Guideline on Air Quality Models* / AERMOD Modeling System Final Rule Overview
- Section 8.3 Revisions and Final Guidance on Development of Background Concentrations for Use in Modeling Demonstrations
- AERMOD Modeling System (v24142) Release
- Questions and Answers Session

Guideline / AERMOD Final Rule

- The EPA Administrator signed the "*Guideline on Air Quality Models*; Enhancements to the AERMOD Dispersion Modeling System" final rule on November 20, 2024.
  - The *Guideline on Air Quality Models* is published as "Appendix W" to 40 CFR Part 51
  - The *Guideline* has been incorporated into the EPA's regulations, satisfying a requirement under the Clean Air Act (CAA), for the EPA to specify, with reasonable particularity, models to be used in the Prevention of Significant Deterioration (PSD) program.
  - The *Guideline* provides EPA-preferred models and other recommended techniques, as well as guidance for their use in predicting ambient concentrations of air pollutants.

- On November 27, 2024, the final rule was published in the Federal Register.
  - **89 FR 95034:** https://www.epa.gov/system/files/documents/2024-11/appendix_w-2024.pdf
  - EPA's SCRAM webpage for final rule: https://www.epa.gov/scram/2024-appendix-w-final-rule
  - Docket: https://www.regulations.gov/docket/EPA-HQ-OAR-2022-0872

- The effective date for this action is January 28, 2025, with a 1-year transition period that ends on November 29, 2025 *(one year from publication date)*.

Guideline / AERMOD Final Rule (2)

- In this 2024 *Guideline* / AERMOD final rule, EPA is revising the scientific formulation in the AERMOD Modeling System and revising the regulatory text of the *Guideline*:
  - Adding three new non-default regulatory formulation options in the AERMOD Modeling System with corresponding revisions to the regulatory text specific to the use of these formulation options:
    1. Incorporation of COARE algorithms into AERMET for use in overwater marine boundary layer environments;
    2. Addition of a new Tier 3 detailed screening technique for NO_2 (GRSM); and
    3. Addition of RLINE as mobile source type.
       - **Only added formulation options to the model system…**
         …did not remove any existing option or impose any new requirements.
  - Refinement to the Section 8.3 recommendations regarding the determination of an appropriate background concentration for NAAQS implementation modeling.
  - "Appendix A" to Appendix W shifted to "Addendum A" due to new Federal Register requirements.
- The revisions in the final rule are consistent with everything proposed in October 2023.

Guideline / AERMOD Final Rule (3)

- In parallel to the final rule's signature, the EPA released the latest version of the AERMOD Modeling System (v24142) and the final Guidance on Developing Background Concentrations for Use in Modeling Demonstrations.
  - AERMOD Modeling System
    - Regulatory - AERMOD Modeling System (AERMOD, AERMET, AERMAP)
    - Nonregulatory - AERSURFACE, AERPLOT, and MMIF v4.1.1
    - https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models#aermod
  - Guidance on Developing Background Concentrations for Use in Modeling Demonstrations
    - https://www.epa.gov/system/files/documents/2024-11/guidance-on-developing-background-concentrations-for-use-in-modeling-demonstrations.pdf
- Please consult with the appropriate EPA Regional Office and permitting reviewing authority on any regulatory use of the three new non-default regulatory options in the AERMOD Modeling System prior to the January 28, 2025, final rule effective date.

Inclusion of COARE into AERMET

- Coupled Ocean Atmosphere Response Experiment (COARE) algorithms are being included in AERMOD as a non-default regulatory option for use in overwater marine boundary layer environments
  - No longer need to include BETA flag modeling option in AERMOD
  - Eliminates need for stand-alone AERCOARE processor or observed or prognostic meteorological data
- Eliminates the alternative model demonstration requirements for use of AERMOD in marine environments and its use is contingent upon consultation with the EPA Regional Office and reviewing authority to ensure platform downwash and shoreline fumigation are adequately considered in the modeling demonstration
- For situations where platform downwash and shoreline fumigation are important, the Offshore Coastal Dispersion (OCD) model is still the preferred model for overwater modeling

New Tier 3 NO2 Screening Option - GRSM

- Generic Reaction Set Method (GRSM)
  - New Tier 3 screening option, in addition to existing methods:
    - Ozone Limiting Method (OLM)
    - Plume Volume Molar Ratio Method (PVMRM)
  - GRSM implemented as alpha option in AERMOD v.21112, beta option in v.22112 and v.23132
  - GRSM includes more complete NO_X science
    - Considers travel time and chemical reaction time
    - Daytime photolysis reaction that converts NO_2 back to NO
    - NO_X conversion to NO_2 via reaction with ozone (like OLM and PVMRM)
- Revised GRSM TSD (November 2024) includes a new Appendix A that provides supporting, supplemental information on evaluation of building effects treatments added to GRSM in AERMOD v.23132, and now final in v.24142.
- Note: As per Section 4.2.3.4(e), all Tier 3 NO2 screening options and applications shall occur in consultation with the EPA Regional Office and appropriate reviewing authority.

Inclusion of RLINE Regulatory Source Type

- EPA is including RLINE as a new regulatory source type in AERMOD for mobile source modeling.
  - In addition to VOLUME, AREA, and LINE source types
  - No longer need to include BETA flag modeling option in AERMOD
  - RLINEXT source type is still an ALPHA option in AERMOD and not to be used for regulatory applications
- RLINE source type includes ability to include terrain in AERMOD modeling
  - The inclusion of terrain with AERMOD does not change EPA's recommendation in the PM Hot-spot Guidance to model transportation projects with FLAT terrain option.
- EPA will update relevant guidance (i.e., PM Hot-spot guidance) to include guidance on the use of RLINE

Section 8.3 Revisions

Background Concentration & Nearby Source Selection

- Section 8.3 of the *Guideline* provides recommendations for developing a background concentration used as model input for a cumulative impact analysis for NAAQS implementation modeling demonstrations

- The finalized revisions to Section 8.3 generally include…
  - The removal of recommendations related to selecting nearby sources that cause a significant concentration gradient
  - Recommend a framework of stepwise considerations applicable to isolated single source and multi-source scenarios supported by the *Guidance on Developing Background Concentrations for Use in Modeling Demonstrations*
  - Focus on the inherent discretion in defining a representative background concentration through qualitative and semi-quantitative considerations using available emissions, air quality and environmental data

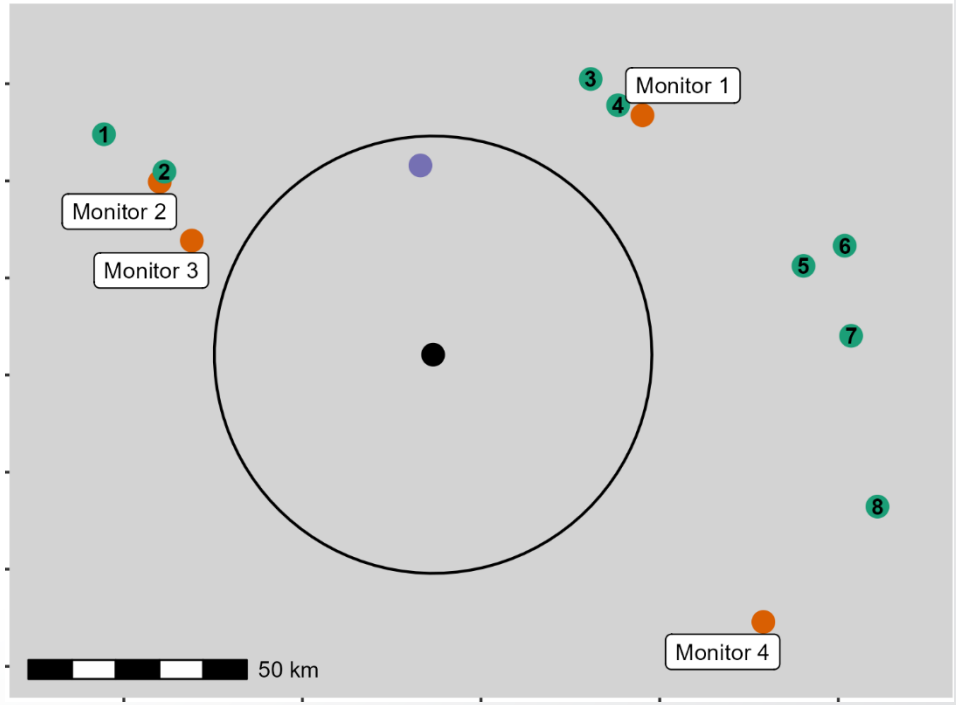
Guidance on Developing Background Concentrations

- Finalized the *Guidance on Developing Background Concentrations for Use in Modeling Demonstrations* to support the revisions in Section 8.3
- Provide additional guidance on developing a representative background concentration used as part of a cumulative impact analysis for NAAQS implementation modeling demonstrations
  - e.g., PSD compliance demonstrations, SIP demonstrations for inert pollutants, and SO_2 designations
- Further details the EPA-recommended framework focusing on the consideration of relevant emissions, air quality monitoring, and pre-existing air quality modeling to appropriately represent background concentrations for a cumulative impact analysis
- The final Guidance includes:
  - Minor revisions to add clarification to various topics throughout the framework of stepwise considerations
  - Addition of hypothetical examples which present the application of the framework in both an isolated source and multi-source scenario

Background Concentration Guidance Hypothetical Examples

The final Guidance includes Appendices B and C which present hypothetical examples for applying the EPA recommended framework to develop background concentrations in both isolated and multi-source scenarios

- Isolated Source Scenarios
  1. Representative regional background monitor available
  2. No regional background monitor available
  3. No representative background monitor in the vicinity of the project area
- Multi-source Scenario
  - Identification of a few nearby sources to explicitly model based on the selection of a representative regional background monitor



AERMOD Modeling System (v24142)

Regulatory Programs	Related Documentation	
• AERMOD (executable, source code)	• AERMOD User's Guide • Model Change Bulletin #18 • AERMOD Model Formulation Document • AERMOD Evaluation Document	• AERMOD Implementation Guide • AERMOD Modeling Data Resources • AERMOD Test Cases
• AERMET (executable, source code)	• AERMET User's Guide • Model Change Bulletin #14	• AERMET Test Cases
• AERMAP (executable, source code)	• AERMAP User's Guide • Model Change Bulletin #5	• Data Sources and Conversion of Elevation Data for AERMAP • AERMAP Test Cases
Non-regulatory Programs		
• AERSURFACE (executable, source code)	• AERSURFACE User's Guide • Model Change Bulletin #4	• NLCD Sources for AERSURFACE • AERSURFACE Test Cases
• AERPLOT (executable)	• README • AERPLOT Release Notes	• AERPLOT Sample Run and Instructions
• MMIF v4.1.1 (executable, source code)	• MMIF User's Guide	• MMIF Change Log - Version 4.1.1

AERMAP Updates

- **Enhancements**
  - New Source Types
    - Added capability to extract elevations for LINE, BUOYLINE, and RLINE source types.
  - Extract Source Elevations Only
    - Option to omit receptors and extract source elevations only
  - Checks for Filename Conflicts
    - Checks for conflicts between internal and user-defined filenames, during setup, prior to processing
- **Bug Fixes**
  - Flagpole Receptor Heights/Elevations
    - Mix of behaviors observed with respect use of default flagpole receptor heights/elevations based on FLAGPOLE, TERRHGTS keyword settings and whether the data provided in the control file.

AERMAP Errata / Work-arounds

- **Data Gaps – 3DEP (formerly NED) Files**
  - **Issue:** Cases where there appear to be data gaps in the 3DEP data downloaded from the USGS National Map.

    Though rare, we have experienced this internally when running AERMAP for national scale toxics modeling. This can happen when a receptor falls on the boundary of an elevation file. AERMAP will identify the receptor where there are no data and generate a fatal error message.

  - **Work-around:** Move the location of the receptor.

    A move as much as 5-10m may be required. Move either east-west or north-south depending on the orientation of the elevation files to one another. Using 1-arcsecond data, this will usually keep the receptor within the same 30mx30m grid cell. In the AERMOD run, assign the elevation from AERMAP to the original receptor location.

AERMET Updates

- **Enhancements**
  - New and updated messages related to COARE processing
  - Update to accommodate missing surface level elevation in IGRA upper air data format
- **Bug Fixes**
  - COARE Default Mixing Heights
    - MIX_DFAULT (AERMET default mixing height calculations) for COARE were not being invoked correctly
  - COARE Zo
    - Require Zo method selection rather than assume a default
  - CD144 Format Temperature Conversion
    - Negative temperatures not being converted from Fahrenheit to Celsius
  - Non-numeric Values
    - Modify AERMET to write out unsuccessful completion of AERMET when non-numeric characters (e.g., ****, NaN) generated in the SFC and PFL files.

AERMET Upper Air Data Availability

- Since AERMOD's promulgation main source of upper air data has been the Forecast Systems Laboratory (FSL) data
  - No longer available after September 30, 2024
- Main source of data will now be the Integrated Radiosonde Archive (IGRA) available from National Centers for Environmental Information (NCEI)
  - https://www.ncei.noaa.gov/products/weather-balloon/integrated-global-radiosonde-archive

AERMET Upper Air Data Elevation

- New to AERMET 24142, the user must enter the upper air station's elevation on the LOCATION keyword or AERMET will issue an error and abort
  - This is to get the user's attention to make sure elevation is added
- Station elevation needed to substitute for missing heights in first (surface) level of a sounding
  - If first level's height is missing, sounding is skipped and no convective calculations made for the day
  - Height is used to convert sounding heights from geopotential heights to height above ground
- Missing surface level heights more prevalent in IGRA sounding data especially since 2022

AERMET Upper Air Data Elevation Bug

- Bug only affects stations with elevations ≥ 1,000 m
- Elevation is read from the LOCATION keyword correctly and used internally correctly
- Output elevation to EXTRACT or QAOUT LOCATION header will appear as series of asterisks
- User will need to manually edit the LOCATION line in the EXTRACT or QAOUT file to correct the elevation if the file is to be used later in AERMET Stage 2 (separate run from Stage 1)
- Not a problem with calculations if running AERMET with Stage 1 and 2 in combined run
    - Should still manually edit the LOCATION line in EXTRACT or QAOUT file

AERMOD Updates

- **AERMOD**
  - Remove BETA flag requirement for use of COARE (AERMET), RLINE, GRSM
- **Bug Fixes**
  - Y2K (surface data spanned across 12/31/1999 – 1/1/2000
    - Introduced in 23132 when fixing a previous bug
  - EMISUNIT w/ BUOYLINE
    - Emission rate units assumed to be g/s and were not being converted if different units were specified with EMISUNIT keyword
  - RLINE Concentrations Vary
    - Concentrations sometimes varying by small amount (thousandths) based on receptor order due to mixing height being reset when it should not be reset
  - GRSM NaN in Output
    - Not a Number (NaN) is output at some receptors for ground level releases from area, volume, and open pit source types

AERMOD Errata / Work-arounds

- **Gap in Meteorological File – Fatal Error**
  - **Issue:** A fatal error may be encountered stating a meteorological record is out of sequence when though not the case.
  - **Work-around:** Ensure SFC and PFL files are synchronized (same data period) and SURFDATA and UAIRDATA keywords specify the earliest year of data represented in both files. Use the STARTEND keyword on the ME pathway to model a subset of the meteorological data provided.
- **BUOYLINE – FLAT Terrain**
  - **Issue:** When modeling BUOYLINE source(s) with FLAT terrain option, BUOYLINE source elevation is incorrectly set to zero while receptor elevations are correctly set to PROFBASE elevation specified on the ME pathway.
  - **Work-around:** Model BUOYLINE sources with elevated (ELEV) terrain option. If FLAT terrain needs to be simulated, model with ELEV option and set BUOYLINE source elevation equal to PROFBASE value. We recommend not modeling a mix of flat and elevated modeling runs that includes one or more BUOYLINE source types.

AERMOD 64-bit EXE Refresh

- After release of AERMOD v24142, Model Development Team alerted of minor differences in modeled concentrations comparing results in some cases using the 32-bit and 64-bit AERMOD executables.
  - Related to compiler differences with more recent versions of the Intel Fortran compiler in the compilation of 32-bit and 64-bit programs (Classic compiler vs oneAPI)
  - Intel transitioning away from supporting 32-bit (no longer included in Intel oneAPI)
- The AERMOD 64-bit executable was recompiled and refreshed on SCRAM on 12/4/2024
  - Ensures overall consistency with the regulatory posting of the Modeling System
  - **Recommendation to redownload AERMOD 64-bit executable from SCRAM website at: https://gaftp.epa.gov/Air/aqmg/SCRAM/models/preferred/aermod/aermod_exe.zip**
- Beginning with the next release (2025), EPA will no longer provide 32-bit executables for any components of the AERMOD Modeling System

AERSURFACE Updates

The updates to AERSURFACE in version 24142 include:

- RUNORNOT File Check
  - Added file checks for use input files for both the RUN or NOT, RUNORNOT keyword settings
- Datatype-Year Keywords
  - Decoupled the datatype and year parts of the DATAFILE keyword to allow compatibility with all current and future NLCD years
- Renaming Airport/Non-Airport Flag
  - Airport (AP) and Non-Airport (NONAP) flags have been renamed to LOWZ0 and HIGHZ0 respectively
- Bug Fix – MRLC File Resolution Differences
  - Increased the NLCD file resolution tolerance from 0.01 to 0.1 to accommodate for NLCD files downloaded from the MRLC that do not have an exact 30m x 30m resolution
  - Updated code to prevent grid sizes less than or equal to 10km x 10km due to bowen ratio and albedo calculation requirements

New Annual National Land Cover Database

- New Annual National Land Cover Database
  - https://www.usgs.gov/centers/eros/science/annual-national-land-cover-database
  - Land cover and percent impervious data available for the CONUS for all years from 1985 – 2023
  - All years now use the 16 Anderson Level II land cover classes (i.e., the classes used since 2001)
  - Tree canopy data available for 2011 – 2021
- Running new NLCD with AERSURFACE version 24142

NLCD Edition & Years	Corresponding DATAFILE keyword
New 1985 to 1992	Any post 1993 year – e.g. "NLCD1993"
New 1993 to 2023	Appropriate corresponding year – e.g. "NLCD1993", "NLCD2023"
Old 1992	"NLCD1992"

** Future versions beyond v24142 of AERSURFACE will no longer have capabilities to process old editions of the 1992 NLCD and EPA will no longer house this data **

MMIF / AERPLOT Updates

- MMIF (v4.1.1)
  - Updated to include location elevation on UPPERAIR pathway in AERMET control file to accommodate missing surface level elevation in IGRA data

- AERPLOT
  - Updated to include RLINE and RLINEXT source types

Final Thoughts & Questions?

- The 2024 *Guideline* / AERMOD final rule information is available on EPA's SCRAM website at: https://www.epa.gov/scram/2024-appendix-w-final-rule.
- The effective date for this action is January 28, 2025, with a 1-year transition period that ends on November 29, 2025.
- Questions? *(Feel free to use the chat box or come off mute to ask your question)*
  - For further questions or clarifications regarding the 2024 *Guideline on Air Quality Models*, please contact: George Bridgers (Bridgers.George@epa.gov).
  - For further questions or clarifications regarding the AERMOD Modeling System, please contact: Clint Tillerson (Tillerson.Clint@epa.gov).

Thank you for your attention and participation!