



# AERMOD v21112 Release MS Teams Webinar

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

*Monday, May 24, 2021*



# General Release Information

- Version 21112 (April 22, 2021)
  - AERMOD, AERMET, AERSCREEN
- Posted to SCRAM on Tuesday, May 11, 2021
  - <https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models#aermod>
- AERMOD
  - Alpha options (Downwash, NO<sub>2</sub> Conversion, Low Wind, RLINE 2-barrier)
  - RLINE Updates
  - Multiple buoyant line groups (BUOYLINE sources)
  - Turbulence treatment options
  - Deposition parameter default values (for limited set of pollutants)
- AERMOD, AERMET, AERSCREEN
  - Bug fixes



# Alpha Options for Building Downwash

- Two new alpha options for building downwash
  - Developed by the Air & Waste Management Association (PRIME2 Subcommittee)
  - AWMAUTurbHX
  - AWMAEntrain
- Added to existing set of AWMA alpha options (keyword AWMADWNW)
  - AWAMUEff, AWMAUTurb, StreamLine
- AWMAUTurbHX (*extends AWMAUTurb*)
  - AWMAUTurb uses minimum of the final momentum plume rise or a representative PRIME plume rise height.
  - AWMAUTurbHX uses the final momentum plume rise at the downwind distance X.
- AWMAEntrain
  - Modifies beta (B) entrainment coefficient for PRIME downwash from default value of 0.60 to 0.35.
  - Enhances plume rise.



# Alpha Options for NO<sub>2</sub> Conversion

- Two new alpha options for NO<sub>2</sub> conversion
  - Travel Time Reaction Method (TTRM)
  - General Reaction Set Method (GRSM)
- TTRM
  - Limit conversion of NO to NO<sub>2</sub> based on reaction time limitations based the travel time between the source and receptor.
  - Requires ozone background (OZONEVAL, O3VALUES, or OZONEFIL keywords)
- GRSM
  - Based on equilibrium chemistry between NO, NO<sub>2</sub>, and ozone.
  - Requires ozone background (OZONEVAL, O3VALUES, or OZONEFIL keyword)
  - Requires NO<sub>x</sub> background (using new NOXVALUE, NOX\_VALS, or NOX\_FILE keyword)



# Alpha Options for Low Wind Treatment

- Two new alpha options for treatment of low winds
  - Minimum sigma-w (SWMin)
  - Time Period (BigT)
- Parameters added to LOW\_WIND keyword
- SWMin
  - Minimum standard deviation of the vertical component of the wind speed
  - User-defined value to override AERMOD default value of 0.02 m/s
  - Allowable range for user-defined value: 0.0 to 3.0 m/s
- BigT
  - Time scale at which mean wind information at the source is no longer correlated with the location of plume material at a downwind receptor
  - User-defined value to override AERMOD default value of 24.0 hours
  - Allowable range for user-defined value: 0.0 to 48.0 hours

- Updates to existing 1-barrier algorithm
  - Current algorithm updated, based on Ahangar et al. 2017 and Venkatram et al. 2021
  - Now includes effect of a barrier upwind of the roadway in addition to effect of a barrier between the roadway
  - Only applies to RLINEXT source
- Addition of 2-barrier algorithm
  - One barrier on each side of roadway for an RLINEXT source
  - Extends RBARRIER keyword with additional parameters for second barrier
- Speed Improvements
  - Minor code updates to improve processing time for RLINE and RLINEXT sources



# Turbulence Treatment Options

- New AERMOD options for the treatment of turbulence data
  - Allows AERMOD to ignore non-missing turbulence parameters ( $\sigma_\theta$  and  $\sigma_w$ ) in profile file
- Facilitate the use of site-specific meteorological data with turbulence parameters without the need for separate meteorological datasets
  - Example: Allow use of an urban meteorological site with turbulence data with the URBAN option in AERMOD **without** rerunning AERMET to ignore the site-specific turbulence
- New keywords on the ME pathway
- Two default options (can use with DFAULT keyword)
- Seven non-default options (cannot use with DFAULT keyword)
- See Section 3.5.9 in AERMOD user's guide



# Turbulence Treatment Options

- Default options
  - NOTURB: set  $\sigma_{\theta}$  and  $\sigma_w$  to missing for **all** hours
  - NOTURBST: set  $\sigma_{\theta}$  and  $\sigma_w$  to missing for **stable** hours only
- Non-default options
  - NOTURBCO: set  $\sigma_{\theta}$  and  $\sigma_w$  to missing for **convective** hours only
  - NOSA: set  $\sigma_{\theta}$  to missing for **all** hours
  - NOSW: set  $\sigma_w$  to missing for **all** hours
  - NOSAST: set  $\sigma_{\theta}$  to missing for **stable** hours only
  - NOSWST: set  $\sigma_w$  to missing for **stable** hours only
  - NOSACO: set  $\sigma_{\theta}$  to missing for **convective** hours only
  - NOSWCO set  $\sigma_w$  to missing for **convective** hours only





# Deposition Parameter Default Values

- Can set default gas or Method 2 particle deposition parameters for selected pollutants
  - Method 1 particle deposition is unchanged
  - Reminder, gas deposition and Method 2 particle deposition are still ALPHA options
- Pollutant specified via POLLUTID keyword
  - Note that pollutant HG0 is HG followed by a zero, not a capital O
- User also specifies the use of default parameters by using a 0 for the parameters
- Example: Arsenic Method 2 deposition with default fine mass fraction and diameter

CO POLLUTID AS

SO METHOD\_2 0 0

- This invokes a fine mass fraction of 0.75 and mean diameter of 0.5 microns
- See Sections 3.3.3 (gas deposition) and 3.3.4.2 (Method 2 particle deposition) in AERMOD User's Guide



# Deposition Parameter Default Values

- Optional default gas deposition parameters (selected pollutants)

Pollutant	POLLUTID	Diffusivity in air (Da) (cm <sup>2</sup> /s)	Diffusivity in water (Dw) (cm <sup>2</sup> /s)	Cuticular resistance (rcI) (s/cm)	Henry's Law (Henry) (Pa m <sup>3</sup> /mol)
Elemental Mercury	HG0	0.055	6.4E-6	100000	719
Divalent Mercury	HGII	0.045	5.2E-6	100000	0.000072
Dioxin (as TCDD)	TCDD	0.05196	4.39E-6	9.67	1.46
PAH (as BaP)	BAP	0.0513	4.44E-6	0.441	0.046
SO <sub>2</sub>	SO2	0.1122	1.83E-5	732	72
NO <sub>2</sub>	NO2	0.1361	1.4E-5	12000	8444



# Deposition Parameter Default Values

- Optional default Method 2 particle deposition parameters (selected pollutants)

Pollutant	POLLUTID	Fine mass fraction	Mean particle diameter (Dmm)
Arsenic	AS	0.75	0.5
Cadmium	CD	0.70	0.6
Lead	PB	0.75	0.5
Mercury	HG	0.80	0.4
PAH (as POC)	POC	0.90	0.1



# Multiple Buoyant Line Groups (MBLG)

- Capability to group individual lines (BUOYLINE sources) into multiple groups of lines
- Previous versions of AERMOD
  - Allowed multiple lines (BUOYLINE source definitions) in the control file
  - Considered all BUOYLINE sources part of a **single** source (averaged dimensions and buoyancy entered with BLPINPUT keyword)
  - Assumed all BUOYLINE sources were parallel to each other
- Version 21112
  - Individual lines (BUOYLINE sources) can be segregated into separate BLPGROUPs (not to be confused with SRCGROUPs)
  - All BUOYLINEs within a BLPGROUP should be parallel and have similar characteristics (averaged dimensions and buoyancy entered with BLPINPUT keyword grouped with a BLPGroupID)



## AERMOD Bug Fixes/Misc

- Add flagpole receptors for buoyant line sources
- Correction to source order listing when modeling buoyant line sources when all sources are rural
- Add use of EMISFACT keyword with RLINE sources
- Correction to convert background concentrations using BACKUNIT keyword
- Remove comparison of direction-specific GEP formula height to stack height and associated warning message when stack height  $\geq$  formula height (not true GEP formula height)
- Correction to use of INCLUDED keyword with RLINE/RLINEXT LOCATION inputs



## AERMET Bug Fixes/Misc

- Updates to station parameters for various NWS/FAA ASOS stations (e.g., anemometer heights, WBANs, coordinates)
- Update to not substitute a valid wind observation with a missing wind observation when reading ISHD data
- Correction to code when reading ISHD data and checking for duplicate observations for ISHD data to make sure the observations are for the same day and hour
- Correction to treatment of measurement heights for sub-hourly site-specific data
- Correction to check for missing heat flux values when checking for negative heat flux values throughout the day to determine the last convective hour of the day for heat flux integration to calculate convective mixing heights
- Correction to check that the previous hour is also the same day as the current hour when smoothing the mechanical mixing height
- Correction to only interpolate missing heat flux values for convective hours if the hour is already determined to be convective based on solar angle



## AERSCREEN Bug Fixes/Misc

- Set Chi to zero if distance to maximum concentration is less than 2 km in INVMAX for inversion break-up fumigation
- Correction so AERSCREEN does not try to write to a non-default log filename if AERSCREEN aborts prior to determining if non-default names are used
- Output a message to the debug file if the distance to shore for the maximum concentration is less than 200 m



# 2021 Virtual RSL Modelers' Workshops

- We will be hosting 2 virtual segments of the annual Regional, State, and Local (RSL) Modelers' Workshops in 2021:
  - June 21-23, 2021 (Afternoons EDT) for Dispersion Modeling Topics
    - June 21<sup>st</sup> – “Stakeholder Day”
      - Open to industry and outside stakeholders in addition to the co-regulatory agencies
      - More detailed presentations on the various AERMOD Modeling System updates highlighted today, discussions concerning the next steps in regulatory dispersion model development, status updates on pending modeling guidance, and overview of any recent alternative model / Model Clearinghouse actions
    - June 22<sup>nd</sup> and 23<sup>rd</sup> – Co-regulatory agencies only
    - Agenda, specific times, and webinar links to be posted to SCRAM in the coming weeks
  - Late Aug / Sept 2021 for Photochemical Modeling Topics
    - Likely 2 afternoon sessions for the co-regulatory agencies, but all the details are still TBD





## Q & A

Questions?