EPA United States Environmental Protection Agency

Support Center for Regulatory Atmospheric Modeling (SCRAM)

11th Conference on Air Quality Modeling

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Proposed Rulemaking Information:

On July 14, 2015, the Administrator signed a proposal to revise the *Guideline on Air Quality Models*. The *Guideline* provides EPA-recommended models and other techniques, as well as guidance for their use, for predicting ambient concentrations of air pollutants. EPA's proposed changes would, enhance the formulation and application of the agency's AERMOD dispersion model, prescribe modeling techniques for secondarily formed fine particle and ozone pollution for single sources and makes various editorial improvements.

- Federal Register Publication - Notice for the 11th Conference on Air Quality Modeling and Proposed Rulemaking - "Revision to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter" (PDF, 720KB)

- Docket (ID No. EPA-HQ-OAR-2015-0310) for the 11th Modeling Conference

- Fact Sheet (PDF, 25k)

EPA will accept comments on the proposal for 90 days through **October 27, 2015**. All supporting documentation and proposed model code is available through the Docket (ID No. EPA-HQ-OAR-2015-0310) and through this 11th Conference on Air Quality Modeling website.

Conference and Public Hearing Information:

On July 14, 2015, the EPA also announced the 11th Conference on Air Quality Modeling and invited the public to participate in the conference. The conference, mandated by Section 320 of the Clean Air Act, was held on the EPA RTP Campus from August 12th through 13th, 2015. The conference was focused on the proposed revisions to the *Guideline on Air Quality Models* (CFR Title 40, Part 51, Appendix W) and served as the public hearing for these proposed revisions.

The 11th Conference on Air Quality Modeling began with a morning of EPA presentations providing an overview of the various proposed revisions to the *Guideline*. The remainder of the conference was dedicated to public presentations that provided comment to the EPA on the proposed rulemaking. All of the presentations are available below. The full transcripts from both days of the conference and public hearing will be made available on this webpage as soon as possible. The presentations along with the transcripts will also be be submitted to the proposed rulemaking docket

- 11th Modeling Conference - Final Agenda (PDF, 109k)
- 11th Modeling Conference - Presentations
- 11th Modeling Conference - Attendee List (PDF, 107KB)

- 11th Modeling Conference - Day 1 Transcripts - 08/12/2015 (PDF, 1006KB)
- 11th Modeling Conference - Day 2 Transcripts - 08/13/2015 (PDF, 573KB)

- 11th Modeling Conference - Day 1 Audio Recording - Morning Part 1 - 08/12/2015 (MP3, 82.5MB)
- 11th Modeling Conference - Day 1 Audio Recording - Morning Part 2 - 08/12/2015 (MP3, 73.4MB)
- 11th Modeling Conference - Day 1 Audio Recording - Afternoon Part 1 - 08/12/2015 (MP3, 133.8MB)
- 11th Modeling Conference - Day 1 Audio Recording - Afternoon Part 2 - 08/12/2015 (MP3, 158.1MB)
- 11th Modeling Conference - Day 2 Audio Recording - Morning Part 1 - 08/13/2015 (MP3, 83.3MB)
- 11th Modeling Conference - Day 2 Audio Recording - Morning Part 2 - 08/13/2015 (MP3, 80.1MB)
- 11th Modeling Conference - Day 2 Audio Recording - Afternoon Part 1 - 08/13/2015 (MP3, 12.5MB)

Please direct any additional questions concerning the 11th Conference on Air Quality Modeling or related to the proposed rulemaking to Mr. George Bridgers, email: Bridgers.George@epa.gov.

Material for Review and Presentation at the 11th Conference on Air Quality Modeling:

Updates to EPA's AERMOD Modeling System

Based on studies presented and discussed at the 10th Conference on Air Quality Modeling, and additional relevant research since 2010, the EPA and other researchers have conducted additional model evaluations and developed changes to the model formulation of the AERMOD Modeling System to improve model performance in its regulatory applications. We are proposing the following updates to the AERMOD Modeling System to address a number of technical concerns expressed by stakeholders:

1. A proposed option incorporated in AERMET to adjust the surface friction velocity (u*) to address issues with AERMOD model overprediction under stable, low wind speed conditions.

2. A proposed low wind option in AERMOD to address issues with model overprediction under low wind speed conditions. The low wind option will increase the minimum value of the lateral turbulence intensity (sigma-v) from 0.2 to 0.3 and adjusts the dispersion coefficient to account for the effects of horizontal plume meander on the plume centerline concentration. It also eliminates upwind dispersion which is incongruous with a straight-line, steady-state plume dispersion model such as AERMOD.

3. Modifications to AERMOD formulation to address issues with overprediction for applications involving relatively tall stacks located near relatively small urban areas (no user input is required).
4. Proposed regulatory default options in AERMOD to address plume rise for horizontal and capped stacks based on the July 9, 1993, Model Clearinghouse memorandum, with adjustments to account for the PRIME algorithm for sources subject to building downwash.
5. A proposed buoyant line source option, based on the BLP model, has been incorporated in AERMOD.
6. Proposed updates to the NO_2 Tier 2 and Tier 3 screening techniques coded within AERMOD, including the replacement of the Ambient Ratio Method (ARM) Tier 2 option with a revised ARM2 option and the replacement of the Plume Volume Molar Ratio Method (PVMRM) Tier 3 option with a revised PVMRM2 option. Both the PVMRM and PVMRM2 Tier 3 options are being made available in the proposed version of AERMOD to facilitate testing and evaluation of the EPA's proposed replacement of PVMRM option with new PVMRM2 option.

Model Code and Executable

- AERMET (v15181) - Executable (ZIP, 845KB)
- AERMET (v15181) - Source Code (ZIP, 458KB)

- AERMOD (v15181) - Source Code (ZIP, 506KB)
- AERMOD (v15181) - Executable (ZIP, 1.2MB)

Supporting Documentation

- AERMET User's Guide and User's Guide Addendum (ZIP, 2.0MB) - *Revised on this page on 07-29-2015*

- AERMOD User's Guide and User's Guide Addendum (ZIP, 2.3MB)
- AERMOD Implementation Guide (PDF, 133KB) - *Revised on this page on 08-03-2015*
- Model Formulation Document (PDF, 441KB)
- Addendum to the AERMOD Model Formulation Document (PDF, 44KB)
- AERMOD/BLP Development and Testing (PDF, 304KB)

- Model Change Bulletins, Test Cases, and Additional Information

Status of AERSCREEN

In the preamble of the 2005 *Guideline on Air Quality Models*, we stated that a screening version of AERMOD called AERSCREEN was being developed and, in the meantime, SCREEN3 may be used until AERSCREEN was available. In 2011, the EPA released AERSCREEN, a program that creates inputs and runs AERMOD in screening mode. AERSCREEN also interfaces with AERMOD's terrain processor, AERMAP, the building processor for AERMOD, BPIPPRIME, and can use AERSURFACE surface characteristics in the generation of meteorological data for AERMOD via the MAKEMET utility. In an April 2011 memorandum, the EPA stated that AERSCREEN was the recommended screening model for simple and complex terrain and replaced SCREEN3. Since AERSCREEN invokes AERMOD, AERSCREEN represents the state of the science in screening dispersion models. The EPA is proposing AERSCREEN as the recommended screening model for simple and complex terrain for single sources and options for multi-source screening with AERMOD in the Screening Models and Techniques subsection of the *Guideline*.

As part of the proposed update to AERSCREEN, AERSCREEN now includes inversion break-up and coastal fumigation, features that were part of SCREEN3. These fumigation algorithms also take advantage of AERMOD's boundary layer parameterizations for calculating variables needed by the algorithms.

Model Code and Executable

- AERSCREEN (v15181) - Source Code and Executable (ZIP, 766KB)
- MAKEMET (v15181) - Source Code and Executable (ZIP, 355KB)

Supporting Documentation

- AERSCREEN User's Guide (EPA-454/B-15-005) (PDF, 2.5MB)
- Clarification memorandum on AERSCREEN as the recommended screening model (PDF, 323KB)

- Model Change Bulletins, Test Cases, and Additional Information

Updates to 3-Tiered Demonstration Approach for NO_2

Section 5.2.4 of the 2005 *Guideline on Air Quality Models* details a 3-tiered approach for assessing NO_x sources, which was recommended to obtain annual average estimates of NO_2 from point sources for purposes of NSR analysis, including the PSD program and SIP planning purposes. This 3-tiered approach addresses the co-emissions of NO and NO_2 and the subsequent conversion of NO to NO_2 in the atmosphere. In January 2010, a new 1-hour NO_2 standard was promulgated. Prior to the adoption of the 1-hour NO_2 standard, few PSD permit applications required the use of Tier 3 options and guidance available at the time did not fully address the modeling needs for a 1-hour standard, *i.e.*, tiered approaches for NO_2 in the 2005 *Guideline* specifically targeted an annual standard. As a result, several guidance memoranda have been issued by the EPA to further inform modeling procedures for sources demonstrating compliance with the new 1-hour standard.

In response to the 1-hour NO_2 standard, the EPA is proposing several modifications to the Tier 2 and 3 NO_2 screening techniques incorporated into AERMOD. For the Tier 2 technique, the EPA is proposing to replace the existing Ambient Ratio Method (ARM) option with a revised ARM2 option. A new second tier NO_2 screening technique, ARM2, has been developed and incorporated into AERMOD. Because ARM2 is based on hourly measurements of the NO_2 to NO_x ratios and provides more detailed estimates of this ratio based on the total NO_x present, the EPA is proposing to incorporate a modified version of ARM2 as the new preferred second tier NO_x modeling approach. For the Tier 3 technique, the EPA proposes that the existing detailed screening options of the Ozone Limiting Method (OLM) and Plume Volume Molar Ratio Method (PVMRM) be formally incorporated into the regulatory version of AERMOD. In addition, the EPA is proposing to replace the existing PVMRM option with a revised PVMRM2 option, that utilizes relative dispersion coefficients to estimate plume volume during convective conditions and total dispersion coefficients during stable conditions.

Supporting Documentation

- Technical support document (TSD) for NO_2-related AERMOD modifications (EPA-454/B-15-004) (PDF, 609KB)

- Ambient Ratio Method Version 2 (ARM2) for use with AERMOD for 1-hr NO_2 Modeling - Development and Evaluation Report (PDF, 2.2MB)

Status of CALINE3 Models

The 2005 *Guideline on Air Quality Models* identified CALINE3 and its variants (CAL3QHC and CAL3QHCR) as the preferred model for mobile source modeling for carbon monoxide (CO), particulate matter (PM), and lead. CALINE3 was developed in the late 1970's using P-G stability classes as the basis for the dispersion algorithms. AERMOD, on the other hand, uses a planetary boundary layer scaling parameter to characterize stability and determine dispersion rates, which has been found to be superior to dispersion parameterizations based on P-G stability classes. In addition, the LINE and AREA source options in AERMOD implement a full numerical integration of emissions across the LINE or AREA sources, whereas the CALINE3 family of models incorporate a much less refined approach. Thus, AERMOD provides a more scientifically credible and accurate characterization of plume dispersion than CALINE3. Recent model performance studies have shown that the CALINE models performed poorly when compared to AERMOD and other modern dispersion models which also employ state-of-the-science dispersion parameters. AERMOD is also able to model multiple years in a single model run, while the CALINE3 variants are limited to either a single meteorological condition (CALINE3 and CAL3QHC) or a single year of meteorological data (CAL3QHCR). Additionally, AERMOD is able to utilize more recent, and more representative, meteorological observations than are readily available for modeling with CAL3QHCR.

Based on the more scientifically sound basis for AERMOD, improved model performance over CALINE3, and the availability of more representative meteorological data, the EPA is proposing to replace CALINE3 with AERMOD as the preferred appendix A model for determining near-field impacts for primary emissions from mobile sources, including $PM_{2.5}$, PM_{10}, and CO hot-spot analyses.

Supporting Documentation

- Technical Support Document (TSD) for Replacement of CALINE3 with AERMOD for Transportation Related Air Quality Analyses (EPA-454/B-15-002) (PDF, 352KB)
- Memorandum to the Docket - TSD Data Table Errata, Page 27 of Docket Id No. EPA-HQ-OAR-2015-0310-0027 (PDF, 568KB) - *Posted on this page on 10-08-2015*

Addressing Single-Source Impacts on Ozone and Secondary $PM_{2.5}$

The EPA's proposed revisions to the *Guideline on Air Quality Models* satisfies the EPA's commitment in the January 2012 grant of the Sierra Club petition that requested the EPA initiate rulemaking to establish air quality models for ozone and $PM_{2.5}$ for use by all major sources applying for a PSD permit. As a part of this commitment and in compliance with CAA section 320, the EPA conducted the 10th Modeling Conference in March 2012, where there were presentations of ongoing research of single-source plume chemistry and photochemical grid modeling techniques, as well as several public forums, and the EPA subsequently received written comments pertaining to such modeling. In addition, the EPA initiated Phase 3 of the IWAQM process in June 2013 to inform this process to update the *Guideline* to address chemically reactive pollutants for near-field and long-range transport applications.

For this proposed revision to the *Guideline*, the EPA has determined that advances in photochemical modeling science indicate it is now reasonable to provide more specific, generally-applicable guidance that identifies particular models or analytical techniques that may be used under specific circumstances for assessing the impacts of an individual source on ozone and secondary $PM_{2.5}$.

The EPA believes photochemical grid models are generally most appropriate for addressing ozone and secondary $PM_{2.5}$ because they provide a spatially and temporally dynamic realistic chemical and physical environment for plume growth and chemical transformation. Publically available and documented Eulerian photochemical grid models such as the Comprehensive Air Quality Model with Extensions (CAMx) and the Community Multiscale Air Quality (CMAQ) model treat emissions, chemical transformation, transport, and deposition using time and space variant meteorology. These modeling systems include primarily emitted species and secondarily formed pollutants such as ozone and $PM_{2.5}$. These models have been used extensively to support ozone and $PM_{2.5}$ SIPs and to explore relationships between inputs and air quality impacts in the United States and elsewhere.

For assessing secondary pollutant impacts from single sources, the degree of complexity required to assess potential impacts varies depending on the nature of the source, its emissions, and the background environment. In order to provide the user community flexibility in estimating single-source secondary pollutant impacts and given the emphasis on the use of photochemical grid models for these purposes, the EPA is proposing a two-tiered demonstration approach for addressing single-source impacts on ozone and secondary $PM_{2.5}$. The first tier involves use of technically credible relationships between precursor emissions and a source's impacts that may be published in the peer-reviewed literature; developed from modeling that was previously conducted for an area by a source, a governmental agency, or some other entity and that is deemed sufficient; or generated by a peer-reviewed reduced form model. The second tier involves application of more sophisticated case-specific chemical transport models (*e.g.*, photochemical grid models) to be determined in consultation with the EPA Regional Office and conducted consistent with new EPA single-source modeling guidance. The appropriate tier for a given application should be selected in consultation with the appropriate reviewing authority and be consistent with EPA guidance.

Supporting Documentation

- Draft Guidance on the use of models for assessing the impacts of emissions from single sources on the secondarily formed pollutants ozone and $PM_{2.5}$ (EPA-454/P-15-001) (PDF, 268KB)
- Interagency Workgroup on Air Quality Modeling Phase 3 Summary Report: Long Range Transport and Air Quality Related Values (EPA-454/P-15-003) (PDF, 219KB)
- Interagency Workgroup on Air Quality Modeling Phase 3 Summary Report: Near-Field Single Source Secondary Impacts (EPA-454/P-15-002) (PDF, 1.3MB)

- Guidance for $PM_{2.5}$ Permit Modeling (EPA 454/B-14-001) (PDF, 2.3MB)
- Memorandum to the Docket - Proposed Approach for Demonstrating $PM_{2.5}$ PSD Compliance (PDF, 656KB)
- Memorandum to the Docket - Proposed Approach for Demonstrating Ozone PSD Compliance (PDF, 664KB)

- January 4, 2012 Sierra Club Petition Grant (OAR-11-002-1093) (PDF, 352KB)

Status of CALPUFF and Assessing Long-Range Transport for PSD Increment and Regional Haze

The 2003 *Guideline on Air Quality Models* recommended the CALPUFF Modeling System as the preferred model for long-range transport (*i.e.*, source-receptor distances of 50 to several hundred kilometers) of emissions from point, volume, area, and line sources for primary criteria pollutants (*e.g.*, PM and SO_2). Since that time, as discussed in the preamble of the proposal, the EPA has received input from stakeholders and has worked through the IWAQM process on analytical techniques to address chemically reactive pollutants for near-field and long-range transport applications. As a result, in order to provide the user community flexibility in estimating single-source secondary pollutant impacts and given the availability of more appropriate modeling techniques, such as photochemical transport models

(which address limitations of models like CALPUFF), the EPA is proposing that the *Guideline* no longer contain language that requires the use of CALPUFF or another Lagrangian puff model for long-range transport assessments. Additionally, the EPA is proposing to remove the CALPUFF Modeling System as an EPA-preferred model for long-range transport due to concerns about the management and maintenance of the model code given the frequent change in ownership of the model code since promulgation in the previous version of the *Guideline*. The EPA recognizes that long-range transport assessments may be necessary in certain limited situations for PSD increment. For these situations, the EPA is proposing a screening approach where CALPUFF along with other appropriate screening tools and methods may be used to support long-range transport PSD increment assessments. This proposed change does not affect the EPA's recommendation in the 2005 BART Guidelines to use CALPUFF in the BART determination process.

Supporting Documentation

- Memorandum to the Docket - CALPUFF Ownership Chronology and Manageability Issues (PDF, 432KB)
- June 17, 2014 - "RE: CALPUFF," Martin Dodd Letter to Tyler Fox (PDF, 234KB) *Posted on this page on 07-30-2015*
- February, 2008 - "CALPUFF Chemistry Upgrade," Report prepared for American Petroleum Institute by Atmospheric & Environmental Research, Inc. (PDF, 774KB) *Posted on this page on 07-30-2015*
- May 26, 2006 - "EPA approval of CALPUFF v5.711a," Tyler Fox Letter to Joe Scire (PDF, 699KB) *Posted on this page on 07-30-2015*
- May 10, 2004 - "EPA agreement with Earth Tech regarding distribution and updates to CAPUFF," Tyler Fox Letter to Joe Scire (PDF, 774KB) *Posted on this page on 07-30-2015*
- May 10, 2004 - "Application of CALPUFF for Long-Range Transport," Memorandum from Peter Tsirigotis (PDF, 2.7MB) *Posted on this page on 07-30-2015*
- Technical Support Document (TSD) for AERMOD-Based Assessments of Long-Range Transport Impacts for Primary Pollutants (EPA-454/B-15-003) (PDF, 1.4MB)
- Memorandum to the Docket - Supplemental Information for EPA's 2009 Draft Report regarding Reassessment of IWAQM Phase 2 Recommendations (PDF, 802KB)

Role of EPA's Model Clearinghouse

The EPA's Model Clearinghouse has been a fundamental aspect of communication between the EPA Region Offices and with the broader permitting community on technical modeling and compliance demonstration issues for almost three decades. The Model Clearinghouse serves a critical role in helping resolve issues that arise from unique situations that are not specifically addressed in the *Guideline on Air Quality Models* or necessitate the consideration of an alternative model or technique for a specific application or range of applications. The Model Clearinghouse ensures that fairness, consistency, and transparency in modeling decisions are fostered among the Regional Offices and the state, local, and tribal agencies.

The EPA is proposing to codify the long-standing process of the Regional Offices consulting and coordinating with the Model Clearinghouse on all approvals of alternative models or techniques. While the Regional Administrators are the delegated authority to issue such approvals under section 3.2 of the *Guideline*, all alternative model approvals will only be issued after consultation with the EPA's Model Clearinghouse and formal documentation through a concurrence memorandum which demonstrates that the requirements within section 3.2 for use of an alternative model have been met.

Supporting Documentation

- 1988 Memorandum - Revised Model Clearinghouse Operational Plan (PDF, 9.9MB)
- EPA's Model Clearinghouse Website
- EPA's Model Clearinghouse Information Storage and Retrieval System (MHISRS)

Updates on Use of Meteorological Input Data for Regulatory Dispersion Modeling

For a near-field dispersion modeling application where there is no representative NWS station, and it is prohibitive or not feasible to collect adequately representative site-specific data, it may be necessary to use prognostic meteorological data for regulatory applications. The EPA is proposing to incorporate the option for the use of prognostic mesoscale meteorological models to provide meteorological input for regulatory dispersion modeling applications in the Meteorological Input Data subsection of the *Guideline on Air Quality Models*.

The EPA has released the Mesoscale Model Interface Program (MMIF) program that converts the prognostic meteorological data into a format suitable for dispersion modeling applications. The most recent 3 years of prognostic data are recommended for regulatory model applications. Use of the prognostic data is contingent on the concurrence of the appropriate reviewing authorities and collaborating agencies that the data are of acceptable quality and representative of the modeling application.

Model Code

- MMIF (v3.2) - Source Code - *Beta* (1.9MB,ZIP) - *Revised on this page on 07-29-2015*

Supporting Documentation

- MMIF User's Guide (422KB,PDF) - *Revised on this page on 07-29-2015*
- Draft Guidance on the Use of the Mesoscale Model Interface Program (MMIF) for AERMOD Applications (EPA-454/B-15-001) (PDF, 359KB)
- Evaluation of Prognostic Meteorological Data in AERMOD Applications (EPA-454/R-15-004) (PDF, 5.6MB)
- Model Change Bulletin, Test Cases, and Additional Information

10th Conference on Air Quality Modeling

The 10th Conference on Air Quality Modeling, mandated by Section 320 of the Clean Air Act, was held on the EPA RTP Campus from March 13th through 15th, 2012. The information below is provided for reference in the consideration of comments to the proposed rulemaking docket. A full summary of the Conference proceedings, all of the presentations, and a summary of comments document can be found at the links provided.

Conference Information

- Federal Register Notice for the 10th Modeling Conference (PDF, 168KB)
- Docket for the 10th Modeling Conference

- 10th Modeling Conference - Final Agenda (PDF, 72KB)
- 10th Modeling Conference - Presentations
- 10th Modeling Conference - Summary of Comments (PDF, 903KB)

- 10th Modeling Conference - Day 1 Transcripts - 03/13/2012 (PDF, 2.1MB)
- 10th Modeling Conference - Day 2 Transcripts - 03/14/2012 (PDF, 2.1MB)
- 10th Modeling Conference - Day 3 Transcripts - 03/15/2012 (PDF, 1.6MB)

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