EPA Air Quality Modeling Updates

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Presentation for

Association of Air Pollution Control Agencies

2017 Fall Meeting

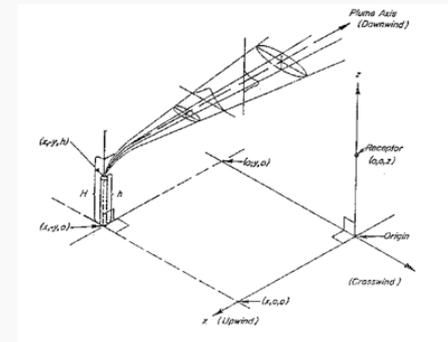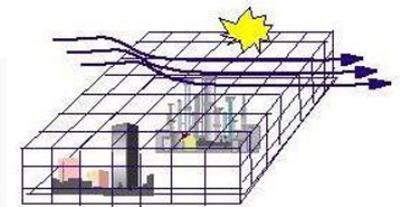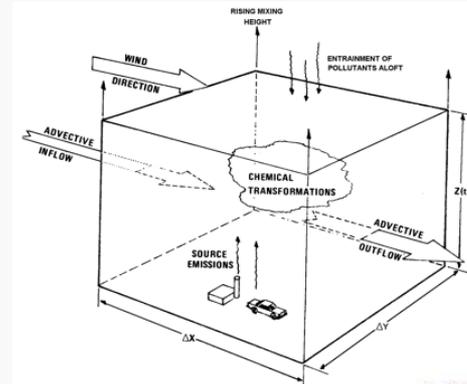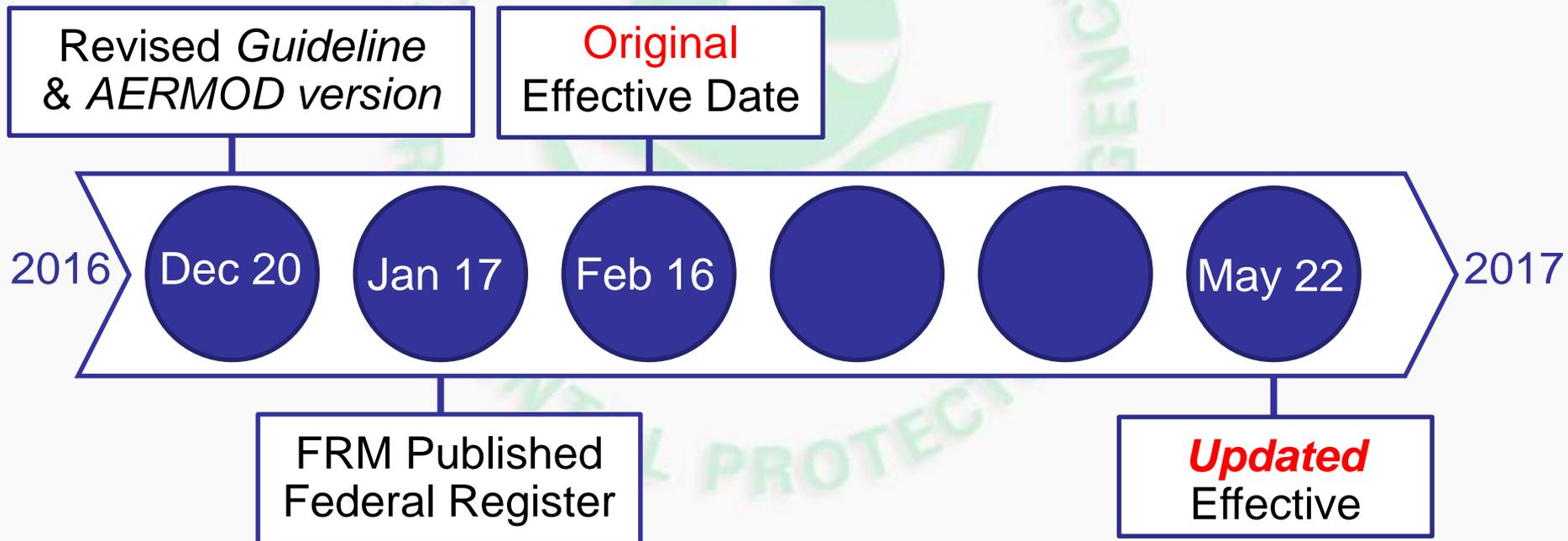September 21, 2017

Presentation Overview

- Final Revisions to EPA's *Guideline on Air Quality Models*
- Air Quality Modeling for Transport
- Air Quality Modeling for Regional Haze
- 2014 NATA Update

OAR - OAQPS - AQAD
Air Quality Modeling Group

- Conducts air quality modeling for Agency regulatory and policy assessments
  - e.g., NOx SIP Call, Heavy Duty Diesel, Nonroad Rule, CAIR, CAMR, NAAQS RIAs
- Provides guidance for the use of air quality models for SIP demonstrations and NSR/PSD permitting
  - O_3/PM/RH Guidance
  - Guideline on Air Quality Models (aka Appendix W)
- Partners and coordinates w/ others (e.g, ORD, NOAA, scientific community, etc) on model evaluations and development efforts

Final Rule to Revise to the
Guideline on Air Quality Models
(Appendix W to 40 CFR Part 51)

Revised *Guideline & AERMOD version*

Original Effective Date

2016   Dec 20   Jan 17   Feb 16   May 22   2017

FRM Published Federal Register

Updated Effective

Background

- The *Guideline on Air Quality Models* (*Guideline* or "Appendix W" to 40 CFR Part 51) is used by the EPA, states, tribes, and industry to prepare and review permits for new sources of air pollution. State and tribal air agencies also use the Guideline to revise their plans detailing strategies for reducing emissions and improving air quality known as State or Tribal Implementation Plans

- On December 20, 2016, the EPA . . .
  - finalized several additions and changes to its *Guideline*.
  - released a revised regulatory version of the preferred near-field modeling system, AERMOD, reflective of the final rule.

- The EPA expects the *Guideline* revisions and associated model enhancements will increase the efficiency and accuracy of regulatory modeling demonstrations.

Final Revisions to Appendix W

- The final rule was published in the **Federal Register** on January 17, 2017.
  - Rule Docket (ID No. EPA-HQ-OAR-2015-0310).
  - Federal Register Version of Final Rule is available on SCRAM.
  - Response to Comments Document can be found in the rule docket.
- 2017 Appendix W final rule information and supporting material / documentation is available via EPA's SCRAM website:
  - https://www3.epa.gov/ttn/scram/appendix_w-2016.htm
- At publication, the effective date for the final rule was February 16, 2017.
- Per Presidential directives, the effective date for the Appendix W final rule was delayed until May 22, 2017.
  - No changes to PSD and Transportation Conformity transition periods of 1 and 3 years, respectively, from publication.

Appendix W: Main Final Actions

- Science improvements to AERMOD Modeling System
  - ADJ_U* options to address technical concerns and improve model performance under extremely light winds and stable conditions
  - Enhanced treatment of horizontal and capped stacks
  - Addition of a buoyant line source option
  - Updates to the NO2 screening techniques, including a new Tier 2 Ambient Ratio Method (ARM) and revised Tier 3 Plume Volume Molar Ratio Method (PVMRM)
  - AERSCREEN as the recommended screening model for simple and complex terrain for single sources
- Long Range Transport (LRT) screening approach
- Single-Source Impacts on Ozone and Secondary $PM_{2.5}$
- Removal of BLP, CALINE, and CALPUFF as EPA preferred models

Appendix W: Main Final Actions (cont)

- Provide for use of prognostic met data in dispersion modeling for PSD compliance demonstrations
  - Effort to provide more flexibility
  - Improve meteorological inputs for areas where:
    - No representative NWS station
    - Prohibitive or infeasible to collect adequate site-specific data
  - EPA provided the Mesoscale Model InterFace Program (MMIF) that post-processes WRF simulation data for input to AERMOD
    - Also, made publicly available both national, 12km raw WRF data and MMIF processed data for 2013-2015.
    - Coordinated with Multi-Jurisdictional Organizations (MJOs) in an effort to most effectively distribute this data to the states.

Information & Outreach

- EPA Webinars
  - Appendix W Overview: Feb 16, 2017
  - Prognostic Met Data: Mar 21, 2017
  - Draft MERPs Guidance: Jan 19, 2017
  - Single Source O3 & PM2.5: July 25, 2017
  - Cumulative Impact Assessments: Aug 3, 2017
- Regional calls/mtgs with states
  - Region 5: Single Source O3 & PM2.5
  - *OAQPS strongly recommended that EPA Regions conduct such calls to engage with states*

Regulatory version of AERMOD

- The regulatory versions of the AERMOD dispersion model and AERMET meteorological processor have been updated;
  - AERMET updated to v16216, with Model Change Bulletin (MCB) MCB 7.
  - AERMOD updated to v16216r, with MCB 12.
- AERMOD and AERMET options NOT finalized in v16216
  - LOWWIND3 was proposed as a regulatory option in AERMOD but was not promulgated as a regulatory option in v16216 because it was found to have a potential for under prediction of concentrations, especially if used with ADJ_U* and/or with observed turbulence data

10

Final Action: Single-Source Impacts 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.

- Lagrangian models (e.g. SCICHEM) applied with a realistic 3-dimensional field of chemical species could also be used for single source O$_3$ or PM$_{2.5}$ assessments.

- The EPA has finalized in Section 5 of revised *Guideline* a two-tiered demonstration approach for addressing single-source impacts on ozone and secondary PM$_{2.5}$.
    - Tier 1 demonstrations involve use of technically credible relationships between emissions and ambient impacts based on existing modeling results or studies deemed sufficient for evaluating a project source's impacts.
    - Tier 2 demonstrations would involve case-specific application of chemical transport modeling (e.g., with an Eulerian grid or Lagrangian model).

- Section 5 does not provide a requirement for chemical transport modeling

11

Tier 1 Demonstration Tools

- For Tier 1 assessments, EPA generally expects that applicants would use existing empirical relationships between precursors and secondary impacts based on modeling systems appropriate for this purpose.

- The use of existing credible technical information that appropriately characterize the emissions to air quality relationships will need to be determined on a case-by-case basis.

- Examples of existing relevant technical information that may be used by a permit applicant, in consultation with the appropriate permitting authority, include
    - air quality modeling conducted for the relevant geographic area reflecting emissions changes for similar source types as part of a State Implementation Plan (SIP) demonstration, other permit action, or similar policy assessment
    - air quality modeling of hypothetical industrial sources with similar source characteristics and emission rates of precursors that are located in similar atmospheric environments and for time periods that are conducive to the formation of O_3 or secondary $PM_{2.5}$.

MERPs as a Tier 1 Demonstration Tool

- EPA has provided technical guidance that will provide a framework for development of Tier 1 demonstration tools under Appendix W for PSD permitting.
  - Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM2.5 under the PSD Permitting Program (EPA-454/R-16-006 December 2016)

- The draft guidance provides a framework on how to arrive at values for MERPs based on existing relevant modeling or newly developed area specific modeling that source/states can utilize in their PSD compliance demonstrations.
  - The guidance does not endorse a specific MERP value for each precursor.
  - Public comments made available on SCRAM on May 26, 2017

- Currently reviewing comments and plan to provide a revised version of the guidance in late 2017 that addresses public comments with emphasis on:
  - More clarity on use of MERPs at national, regional and local level with more detail in the examples provided in the guidance

Tier 2 Demonstrations: Case-Specific Modeling

- EPA anticipates few situations where a Tier 2 demonstration would be necessary, we expect most situations could be demonstrated under Tier 1

- No EPA preferred model so case-specific modeling conducted consistent with EPA guidance in consultation with the appropriate permitting authority

  - No alternative model approval but documentation should generally follow criteria in Section 3.2.2(e)

  - EPA issued clarification memorandum on 8/4/17 that provides for the general applicability of the CMAQ and CAMx photochemical models for permit related program demonstrations and NAAQS attainment demonstrations.

- Applicable guidance:

  - Guidance on the Use of Models for Assessing the Impacts of Emissions from Single Sources on the Secondarily Formed Pollutants: Ozone and PM2.5 (EPA-454/R-16-005 December 2016)

14

Next Steps

- SILs Guidance: Pacing item for release of MERPs guidance and PM2.5 Precursor Demo guidance

- EPA hosting 2017 R/S/L Modelers workshop in RTP, NC on September 25th and 26th

  - https://www.epa.gov/scram/2017-regional-state-and-local-modelers-workshop

- Continue discussions to improve science in AERMOD, specifically research coordination with ORD and stakeholders on

  - LOWWIND related options

  - Downwash algorithms (updates and/or replace PRIME)

  - Mobile source modeling (RLINE)

  - Evaluation of Offshore & Coastal Dispersion Model (OCD)

- Further engagement with the stakeholder community leading up to the 12th Conference on Air Quality Models in late 2018.

Air Quality Modeling for Ozone Transport

Update on EPA's Ozone Transport Modeling

- EPA issued a NODA in January 2017 with ozone transport data based on air quality modeling using 2023 as the future analytic year
- We are updating this modeling based on NODA comments and other factors to identify nonattainment and maintenance receptors and interstate "linkages" for 2023
  - Key revisions have been made to the methodologies for projecting emissions for EGUs and the oil and gas sector in addition to updates on plant closures
- The updated modeling will utilize the latest public release version of CAMx (v6.40) with the CB6r4 chemical mechanism
- We believe this modeling can serve multiple purposes in helping states develop SIPs for their 2008 obligations
- This modeling will also be informative for future 2015 ozone NAAQS transport SIPs
- The air quality modeling is in-progress
- We are currently providing the updated emissions inventories to the MJOs and states

Air Quality Modeling for Regional Haze

Regional Haze Air Quality Modeling

- To complement proposed rule and draft guidance related to Regional Haze program, EPA conducted modeling for a 2028 future year that provides updated information on regional haze visibility impairment for use by EPA and states.

- Overview of EPA modeling platform
  - 2011 base year, meteorology and boundary conditions
  - 12km national modeling domain
  - 2028 future year emissions
    - Extension of the 2023 emissions projections used for the recent ozone transport NODA (see: *https://www.epa.gov/air-emissions-modeling/2011-version-63-platform*)
  - 2028 CAMx source apportionment (PSAT) by major national source sectors (not by state)
    - 19 tags including EGUs, on-road mobile, fires, etc.
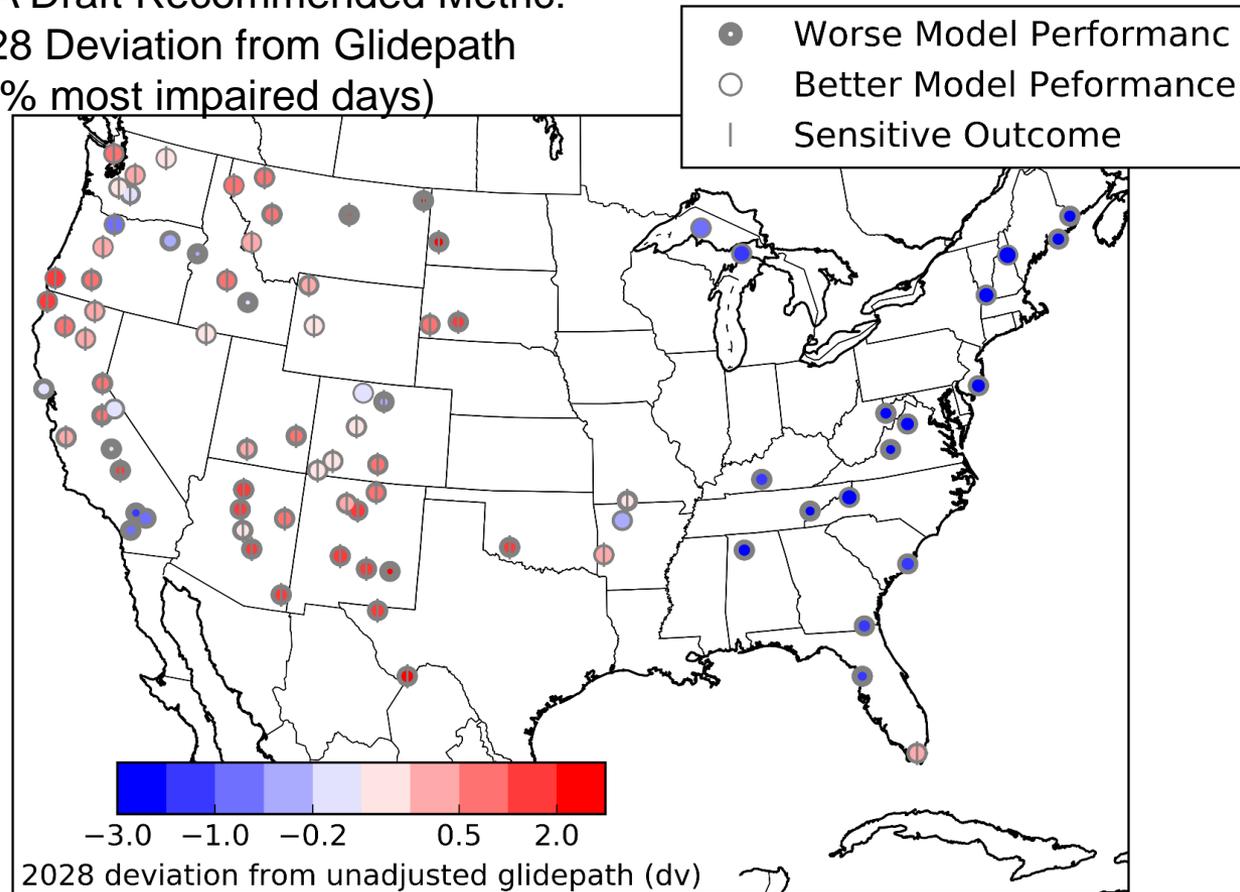
2028 Regional Haze Modeling Caveats

- EPA learned a great deal from this initial 2028 regional haze modeling.
  - We are releasing this information because we want to work collaboratively with MJOs, states, and FLMs to improve the technical foundation of the modeling before it is used for regional haze SIP development.
- EPA has identified a number of uncertainties associated with the initial 2028 regional haze modeling analysis.
  - Important model performance issues that need to be addressed before the results can be confidently used in some areas.
  - The visibility impairment contribution from some source categories is uncertain and likely to change with platform updates
  - The analysis uses the EPA draft recommended natural conditions to calculate the glidepath (i.e., the "unadjusted glidepath").
- EPA recommends using these initial results only as a first step in the process of developing technically sound regional haze modeling for the 2nd implementation period.
  - EPA expects to work collaboratively with MJOs, states, and FLMs to make necessary improvements and ultimately update this modeling.

Deviation from 2028 Unadjusted Glidepath

- The color in the middle of the circle represents the deviation from the 2028 unadjusted glidepath.

- The gray shading represents model performance; the wider the gray outer circle, the worse the model performance.

- The vertical line represents an estimate of uncertainty, indicating whether the site may potentially flip from above the glidepath to below or vice versa.

EPA Draft Recommended Metric:
2028 Deviation from Glidepath
(20% most impaired days)

Legend:
- ● Worse Model Performanc
- ○ Better Model Peformance
- I Sensitive Outcome

2028 deviation from unadjusted glidepath (dv)

−3.0   −1.0   −0.2   0.5   2.0

Note that results could also differ if the glidepath endpoint is adjusted to account for international anthropogenic and prescribed fire impacts

Working with MJOs/States/FLMs

- Coordinate with MJOs, FLMs, and states, in an effort to improve inputs to the base case and 2028 regional haze modeling platform(s).
  - Base year emissions inventory improvements
  - Updates to emissions projections
  - Issues related to appropriate fire and windblown dust inputs for RH modeling
  - Boundary condition updates
  - Post-processing of modeling results
    - Recommended procedures in the photochemical modeling guidance
  - Estimation of "natural conditions" and possible adjustments to draft recommended values
  - Adjustments to glidepath endpoint to account for international anthropogenic and prescribed fire impacts

Regional Haze Modeling: Next Steps

- EPA will provide technical support document that summarizes the platform and initial modeling results along with modeling files by end of September
  - 2011 model performance
  - 2028 visibility impairment and glidepath results
  - 2028 source apportionment results
- Engage in more detailed discussions of modeling issues and improvements
  - Subsequent MJO calls/special calls by region
  - Western Modeling Workshop, Sept 6-8th in Boulder, CO
  - December Regional Haze National Workshop
  - Other FLM calls/workgroups

2014 NATA Update

National Air Toxics Assessment (NATA)

- NATA is a screening-level characterization of air toxics across the nation

- Designed to help state, local agencies and tribes identify locations, sources and pollutants of interest for further study

2011 NATA released
Dec 2015
www.epa.gov/nata

Using **LEAN** for 2014
NATA

2014 NATA Update

- Based on 2014 NEI Version 2 with hybrid modeling approach using photochemical (CMAQ) and dispersion (AERMOD) models
  - Scheffe et al. *Hybrid Modeling Approach to Estimate Exposures of Hazardous Air Pollutants (HAPs) for the National Air Toxics Assessment (NATA)*. Environmental Science & Technology. pp. 12356−12364, October 2016.

- Emissions & modeling improvements from 2011 NATA
  - Improved spatial allocation for nonpoint, onroad and nonroad categories
  - Improved meteorological inputs (WRF prognostic met data via MMIF tool)
  - Added more CMAQ HAPs

- Conducted NATA review process with State/local/tribal agencies
  - Point: Sept 2016-June 2017, other categories: June 2017-Aug 2017
  - Held several webinars, provided documentation and draft results in Map App and other formats
  - Incorporating comments into the NEI and v2 modeling
  - Will provide a preview for SLT before it is released to the public

- Targeting completion in 2018