

Revisions to the *Guideline on Air Quality Models*

Final Rule Webinar

February 16, 2017



Appendix W Final Rule Webinar Logistics

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Webinar Outline

- 1) Introduction and Overview to Final Rule
- 2) Updates to EPA's AERMOD Modeling System
- 3) Status of AERSCREEN
- 4) Updates to 3-Tiered Demonstration Approach for NO₂
- 5) Status of CALINE3 Models
- 6) Addressing Single-Source Impacts on Ozone and Secondary PM_{2.5}
- 7) Status of CALPUFF and Assessing Long-Range Transport for PSD Increment and Regional Haze
- 8) Role of EPA's Model Clearinghouse
- 9) Updates to Modeling Procedures for Cumulative Impact Analysis
- 10) Updates on Use of Meteorological Input Data for Regulatory Dispersion Modeling
- 11) Question and Answer Session



Introduction and Overview to Final Rule



REVISION TO THE *GUIDELINE ON AIR QUALITY MODELS*

- On December 20, 2016, the Environmental Protection Agency (EPA) finalized several additions and changes to its *Guideline on Air Quality Models* (*Guideline* or “Appendix W” to 40 CFR Part 51).
- The *Guideline* 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 20th, the EPA also released a revised regulatory version of the preferred near-field modeling system, AERMOD, reflective of the final rule (*discussed in more detail later in the webinar*).
- The EPA expects the *Guideline* revisions and associated model enhancements will increase the efficiency and accuracy of regulatory modeling demonstrations.



REVISION TO THE *GUIDELINE ON AIR QUALITY MODELS (Cont)*

- 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 a Presidential directive on January 20, 2017, the effective date for the Appendix W final rule and 29 other EPA regulations were delayed until March 21, 2017 to give Agency officials the opportunity for further review and consideration of these regulations.



REVISION TO THE *GUIDELINE ON AIR QUALITY MODELS (Cont)*

- Any unforeseen changes to the final rule or further extensions of the effective date for the regulation will be communicated through normal email communication pathways and updates on the EPA's SCRAM website.
- Early and often communications with state/local/tribal permit reviewing authorities and appropriate EPA Regional Offices is encouraged for any regulatory air quality modeling applications, e.g., PSD permit compliance demonstrations, SIP attainment demonstrations, etc...
- EPA OAQPS will continue frequent engagements with the Regional Offices and the stakeholder community on the latest status.



Updates to EPA's AERMOD Modeling System



Introduction

- 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 that were finalized in v16216

- Options now part of the regulatory default version (DFAULT)
 - ADJ_U* option in AERMET
 - Regulatory option when site-specific turbulence is not used, but NonDFAULT if turbulence data is used
 - Prognostic Met
 - Mesoscale Model Interface Program (MMIF)
 - POINTCAP, POINTHOR options
 - BLP fully integrated into AERMOD



AERMOD and AERMET options that were finalized in v16216 (cont.)

– NO₂ Conversion:

- ARM2 (replaced ARM);
- PVMRM (known as PVMRM2 in v15181);
- OLM (with OLMGROUP ALL);
- NO₂ options are “screening”. While these do not require alternative model approval, they do require approval by the appropriate reviewing authority;
- Tier 3 methods require consultation with the regional office



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:
 - Potential for under prediction of concentrations, especially if used with ADJ_U* and/or with observed turbulence data



Regulatory version of AERMOD

- December release of AERMOD v16216 was found to have bugs that did not affect concentrations:
 - BETA flag requirements, compilation issues on certain platforms
- Bug was identified that affected concentrations for AREACIRC sources in some cases;
- Need to retain 16216 version number for clarity related to versions with App W, but need to differentiate from original release of 16216 with bug fixes:
 - Output files will report “16216r” for clarity.



AERMET Bug Fixes

- Modified subroutines MPFIN and SUBST to set RANDOM as the default selection for the WIND_DIR variable under the METHOD option in Stage 3 for NWS wind directions;
- Modified ADJ_U* option in subroutine BULKRI to set a lower limit of 1.0m for Monin-Obukhov length as a criterion for exiting a DO WHILE loop to avoid NaN's for USTAR.



AERMET Bug Fixes (cont.)

- Modified ADJ_U* option in subroutine UCALST to remove code for adjusting USTAR if CHEK .GT. 1 and incorporated a lower limit of USTCR for USTAR based on Equation 26 of Qian and Venkatram (BLM, 2011);



AERMOD Bug Fixes

- Modified subroutine ALLSET to increment the array dimensions for AREA source types to accommodate more complex AREAPOLY sources;
- Modified subroutine SBLRIS to avoid potential runtime errors for calculating plume rise under stable conditions;
- Modified the BUOYLINE option to define a receptor exclusion zone in which calculations are omitted;
- Added code to allow a BUOYLINE source to be included in a SRCGROUP



AERMOD Bug Fixes (cont.)

- Corrected an issue with the emission rate being modified for AREA, LINE and OPENPIT sources if the point source approximation was used under the FASTAREA or FASTALL option;
- Modified ALLSETUP to increment array dimensions to accommodate more complex AREAPOLY sources.



Status of AERSCREEN



AERSCREEN 16216

- AERSCREEN incorporated into Appendix W as recommended screening model
- Changes since 15181
 - Bug fix related to surface meteorological file when performing AERMOD screening and fumigation options
 - When using a BPIPPRIME building input file, AERSCREEN outputs the min dimensions that are greater than zero.
 - Dimensions of zero are still used in AERMOD runs in AERSCREEN
 - Allow the use of adjusted u^* in AERSCREEN runs
 - Modified MAKEMET u^* adjustment equations to match those in 16216 AERMET



Updates to 3-Tiered Demonstration Approach for NO₂



NO₂ Tier 2 and 3 Screening Techniques

- The EPA is finalizing several modifications to the NO₂ Tier 2 and 3 screening techniques incorporated into AERMOD as proposed.
- For the Tier 2 approach, the EPA is replacing the existing Ambient Ratio Method (ARM) option with a revised ARM2 option.
- Because ARM2 is based on hourly measurements of the NO₂ to NO_x ratios and provides more detailed estimates of this ratio based on the total NO_x present, the EPA is incorporating a modified version of ARM2 as the new second tier NO_x modeling approach.
- As proposed, the default NO₂/NO_x minimum ambient ratio (MAR) is revised to 0.5, but alternative MARs should not be overly difficult to justify when appropriate justification can be made.
- The EPA reaffirms that site specific data are always preferred, but provides nation default model inputs when these data are not available.



NO₂ Tier 2 and 3 Screening Techniques (Cont)

- For the Tier 3 approach, the EPA is incorporating the existing detailed screening options of the Ozone Limiting Method (OLM) and Plume Volume Molar Ratio Method (PVMRM) into the regulatory version of AERMOD as regulatory (or DFAULT) options.
- The EPA is replacing the previous PVMRM option with a revised PVMRM option (proposed with the option name PVMRM2), that utilizes relative dispersion coefficients to estimate plume volume during convective conditions and total dispersion coefficients during stable conditions.
- Because of the additional input data requirements and complexities associated, the Tier 3 options shall be used for regulatory application in consultation (not approval as previous) with the EPA Regional Office and appropriate reviewing authority.



Status of CALINE3 Models



Summary of EPA final actions for mobile source modeling

- Replaced CALINE3 with AERMOD as the Appendix A preferred dispersion model for mobile source modeling of inert pollutants
 - AERMOD has updated dispersion science relative to CALINE3
 - Model intercomparisons show that AERMOD outperforms CALINE3
 - Simplified implementation of mobile source modeling for CAA requirements



EPA Transition Plans Under Appendix W

- 3-year grace period from CALINE3 to AERMOD
 - Proposed a 1 year transition period after final rule
 - Based on comments from external stakeholders, we extended period to 3 years
- While CALINE3 was replaced for refined modeling, CAL3QHC still allowed for screening modeling for CO



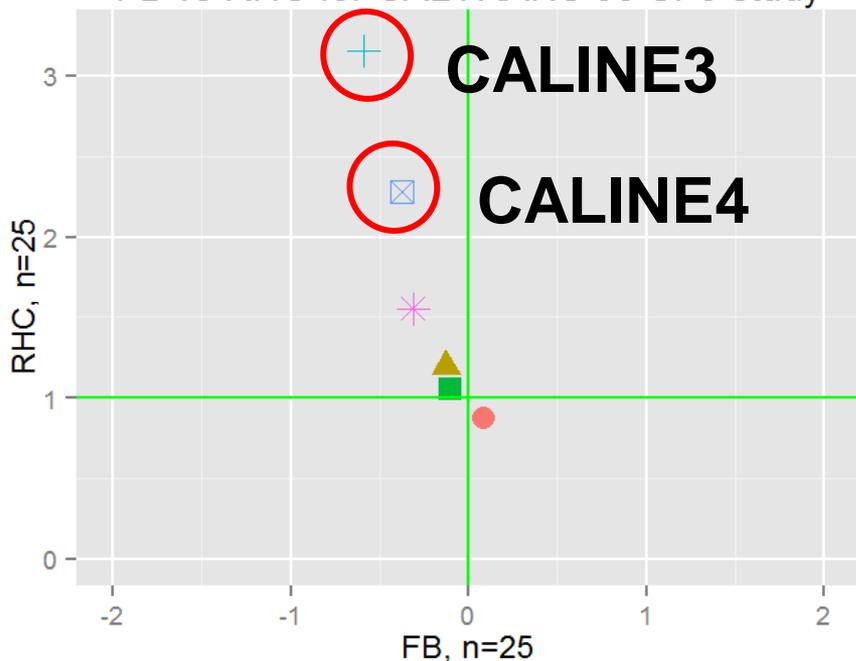
Model Performance Evaluations and Intercomparisons

- Result summaries in the following slides are based on Heist et al. (2013), Estimating near-road pollutant dispersion: A model inter-comparison, *Trans. Res. D.*, 93-105
- Published findings from two field studies with emissions of SF₆ tracer specifically designed for evaluation of mobile emission modeling
 - CALTRANS99 tracer experiment
 - Idaho Falls barrier tracer experiment

CALTRANS Study: Model performance summary



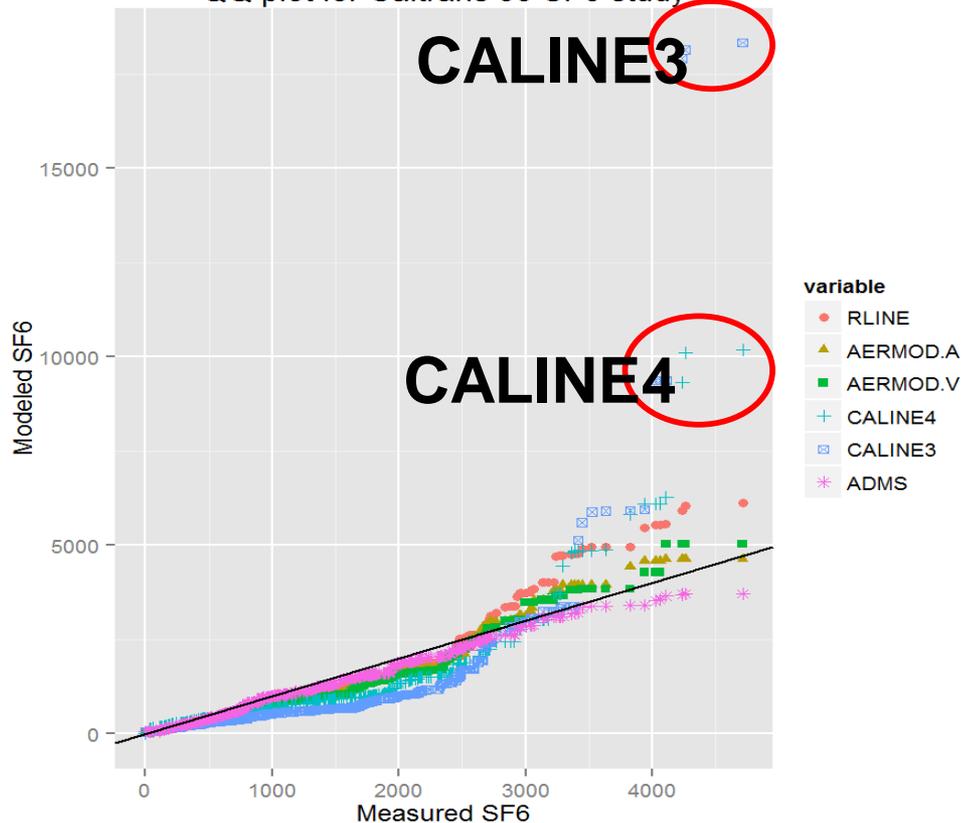
FB vs RHC for CALTRANS 99 SF6 study



- Model statistics show that AERMOD/RLINE almost identical
- CALINE overpredicts

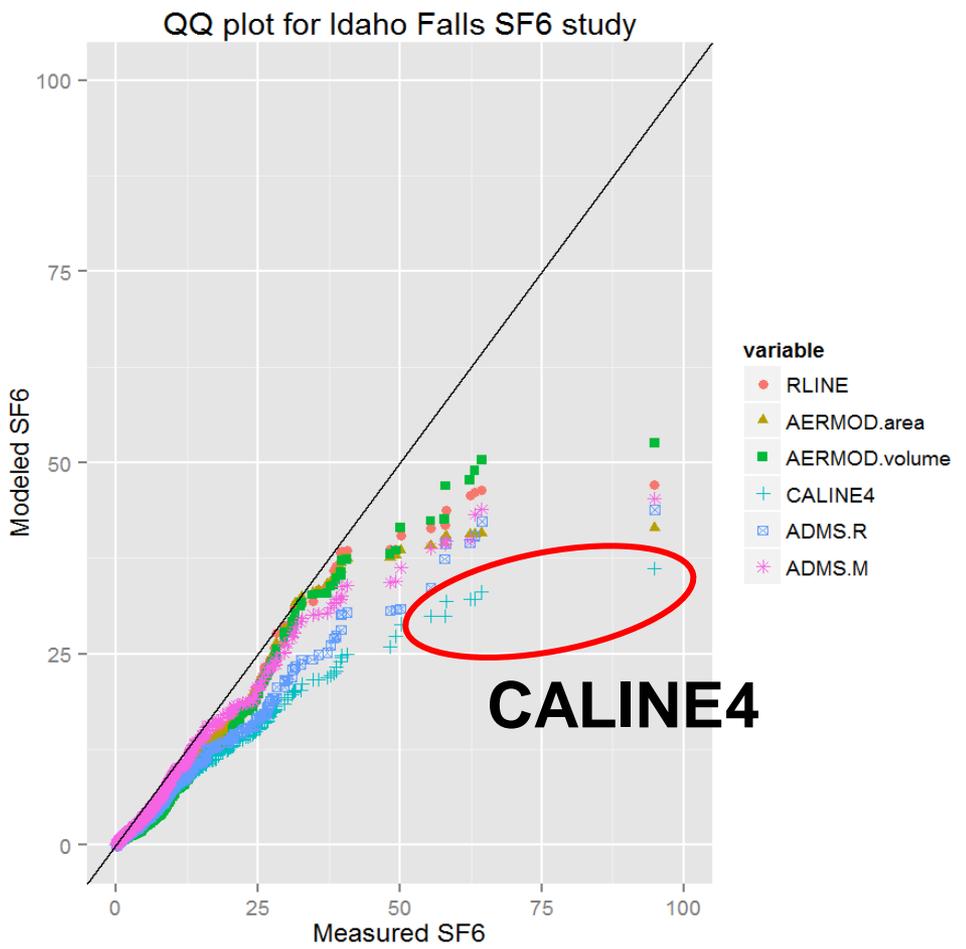
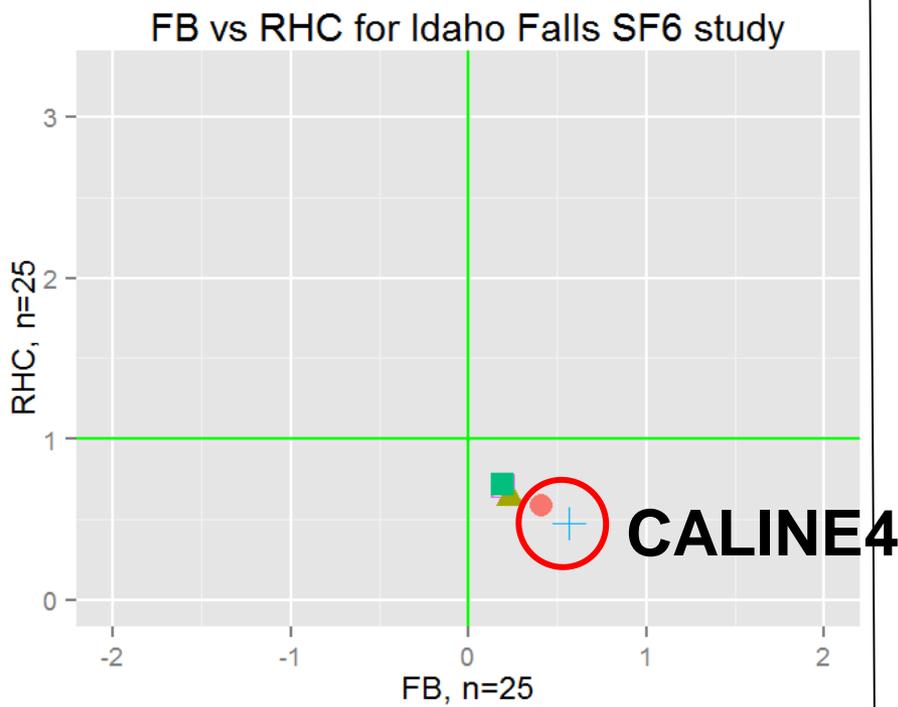
- Q-Q plot shows that AERMOD is best at highest concentrations

QQ plot for Caltrans 99 SF6 study



Idaho Falls Tracer Study: Model performance summary

- Q-Q plot shows that AERMOD/RLINE is best at highest concentrations



- Model statistics show that AERMOD/ADMS almost identical
- CALINE underpredicts



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



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 O₃ or PM_{2.5} assessments.
- The EPA has finalized a two-tiered demonstration approach for addressing single-source impacts on ozone and secondary PM_{2.5}.
 - Tier 1 demonstrations would involve use of technically credible relationships between emissions and ambient impacts based on existing modeling 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).



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 as well 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 O₃ or secondary PM_{2.5}.



MERPs as a Tier 1 Demonstration Tool

- In the preamble of the Appendix W NPRM, EPA discussed plans to develop a PSD compliance demonstration tool for ozone and $PM_{2.5}$ precursors called Modeled Emission Rates for Precursors (MERPs).
- MERPs can be viewed as a type of Tier 1 demonstration tool under the PSD permitting program that provides a simple way to relate maximum downwind impacts with a critical air quality threshold.
- For PSD, separate MERPs could be developed to relate:
 - volatile organic compounds (VOCs) and/or nitrogen oxides (NO_x) to O_3
 - sulfur dioxide (SO_2) and/or NO_x to secondary $PM_{2.5}$



MERPs: O₃ and Secondary PM_{2.5}

- 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 PM_{2.5} 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.
- Draft guidance was released on 12/2/16 for public comment, prior to App W FRM signature. Comment period has been extended to March 31st, 2017
- Also plan to release a memo related to data distribution.

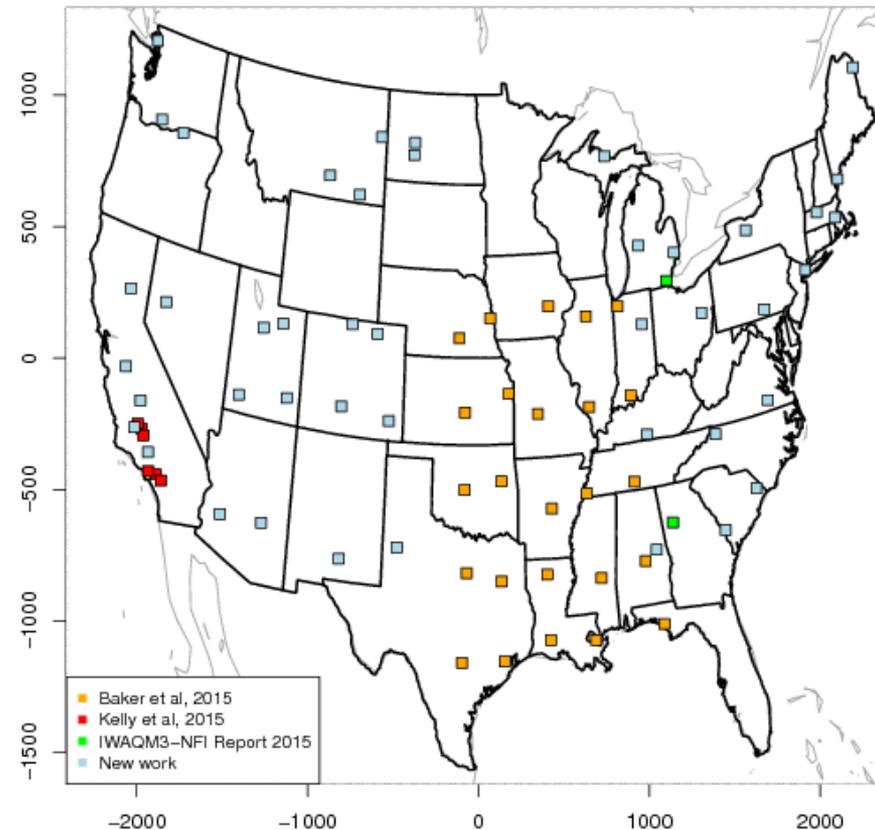


MERPs Guidance Overview

- Provides a detailed framework that permit applicants may choose to use, in consultation with the appropriate permitting authority, to estimate single source impacts on secondary pollutants under the first tier (or Tier 1) approach.
- Presents the EPA's modeling of hypothetical single source impacts on ozone and secondary $PM_{2.5}$ to illustrate how this framework can be implemented by stakeholders.
- Based on EPA modeling to inform illustrative MERPs, these values will vary across the nation reflecting different sensitivities of an area's air quality level to precursor emissions, thereby providing an appropriate basis for evaluating the impacts of these precursors to $PM_{2.5}$ and ozone formation because they reflect the regional or local atmospheric conditions for particular situations.

Single Source Impact Model Assessments

- Have documented and gotten peer-review for using photochemical grid models for single source secondary impacts
- We used single source modeling done to support Appendix W updates to examine the range of model estimated impacts for different sources in different areas
- Hypothetical source impact information generated with episodic and annual modeling
 - Episodic modeling for the central California the Los Angeles areas
 - Annual modeling for Detroit and Atlanta
 - Annual modeling for rural & suburban locations in the U.S. (see Figure at right)
- Important to continue this type of work to provide a robust estimate of single source secondary impacts



Note: The relationships provided in this guidance for these hypothetical sources are not intended to provide an exhaustive representation of all combinations of source type, chemical, and physical source environments but rather provide insightful information about secondary pollutant impacts from single sources in different parts of the U.S.



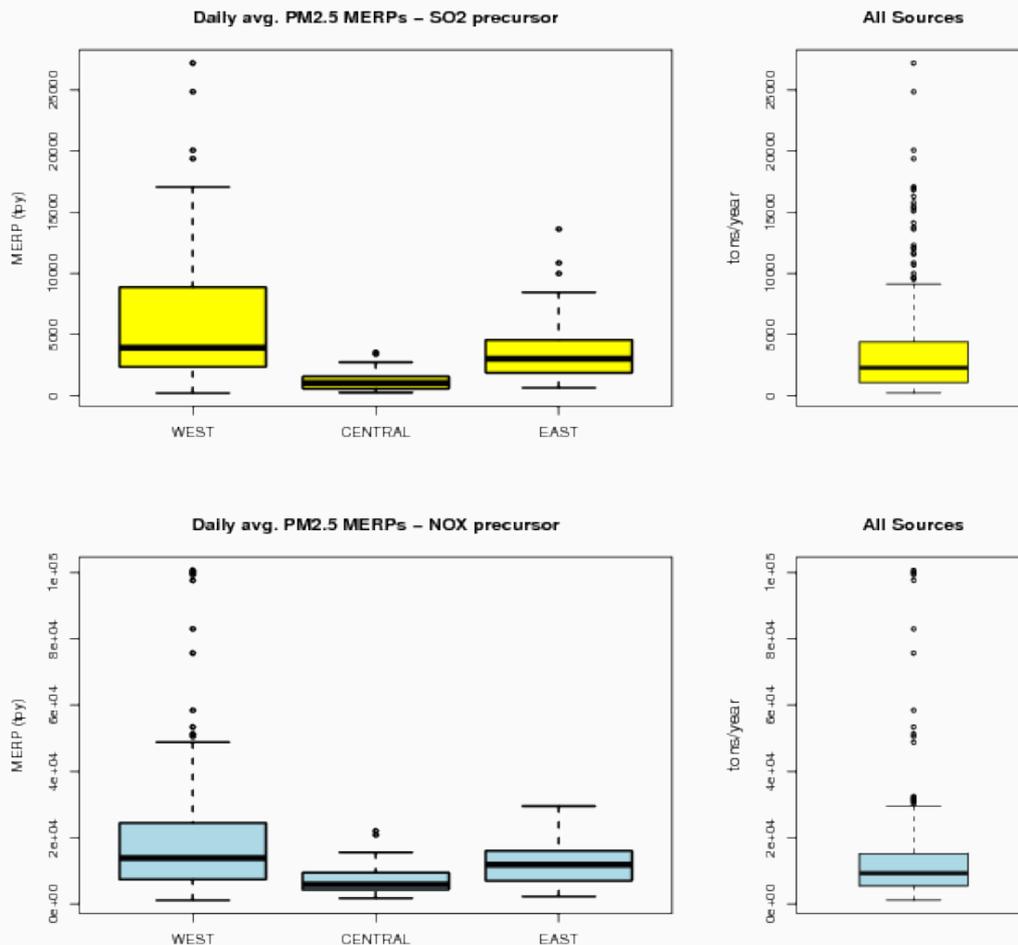
Definition of MERP value

- To derive a MERP value, the model predicted relationship between precursor emissions from hypothetical sources and their downwind maximum impacts can be combined with a critical air quality threshold using the following equation:

MERP = Critical Air Quality Threshold * (Modeled emission rate from hypothetical source / Modeled air quality impact from hypothetical source)

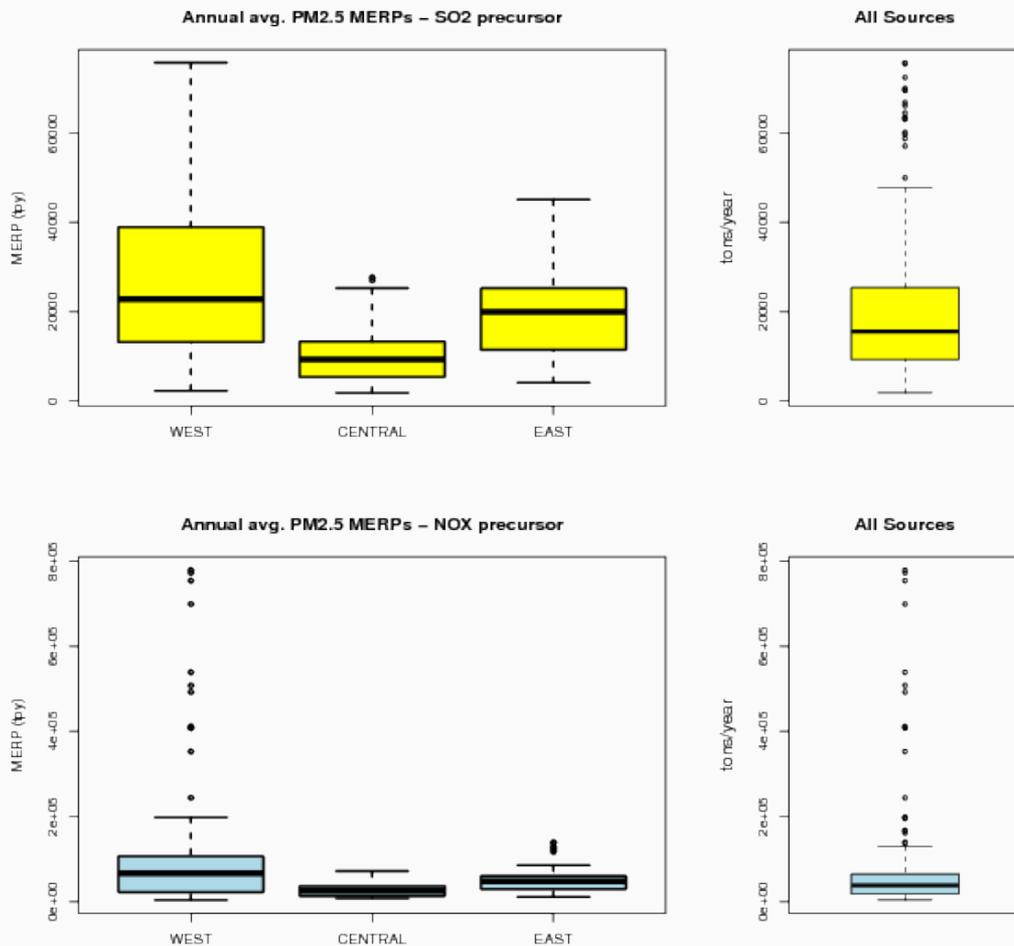
- MERPs are expressed as an annual emissions rate in tons per year consistent with the modeled emissions rates that are input to the air quality model to predict a change in pollutant concentrations.
- The critical air quality threshold is separately defined (as discussed below) and expressed as a concentration for PM_{2.5} (in µg/m³) or O₃ (in ppb or ppm)

Illustrative example of Daily PM_{2.5} MERPs



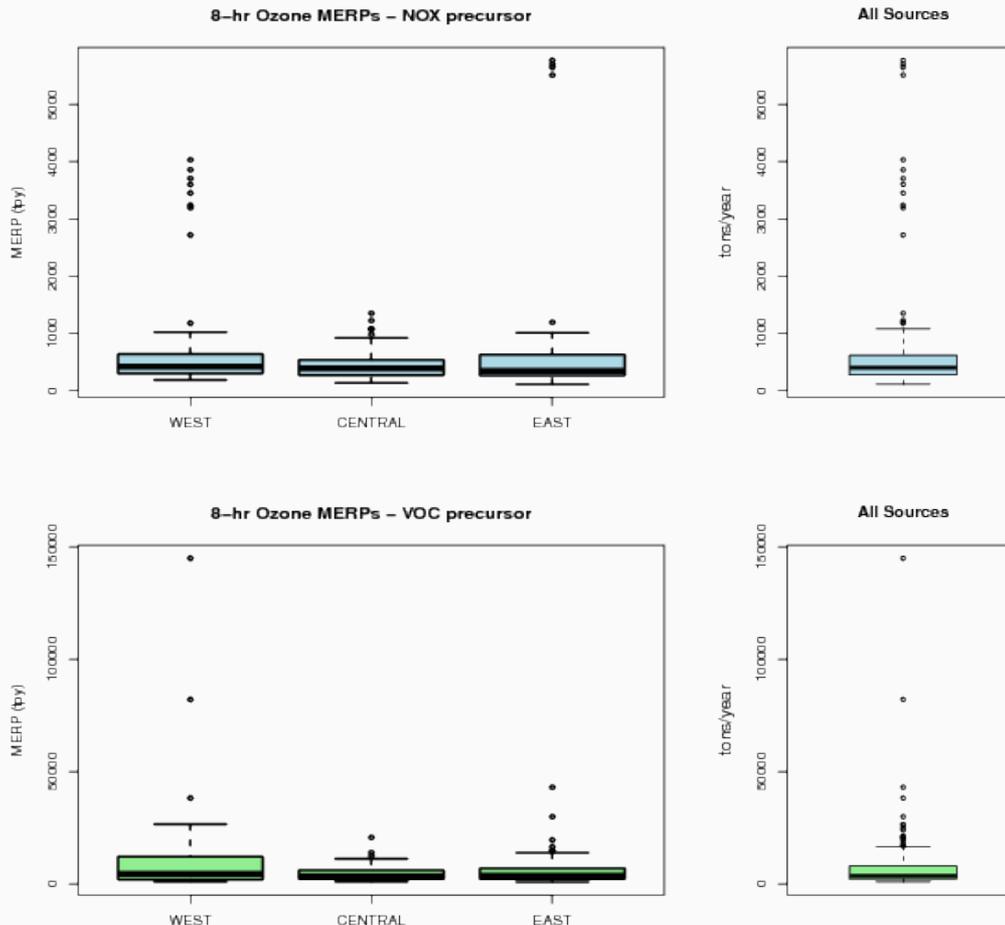
- SO₂ (top panels) and NO_x (bottom panels) daily average PM_{2.5} MERPs estimated from single source hypothetical emissions impacts on PM_{2.5} nitrate ion and PM_{2.5} sulfate ion respectively.
- Note: Daily PM_{2.5} MERPs derived here based on critical air quality threshold of 1.2 µg/m³ and neither PM_{2.5} sulfate nor nitrate is assumed to be neutralized by ammonia.
- Shown by area and over all areas

Illustrative example of Annual PM_{2.5} MERPs



- SO₂ (top panels) and NO_x (bottom panels) annual average PM_{2.5} MERPs shown by geographic region.
- Note: Annual PM_{2.5} MERPs derived here based on critical air quality threshold of 0.2 µg/m³ and neither PM_{2.5} sulfate nor nitrate is assumed to be neutralized by ammonia.
- Shown by area and over all areas

Illustrative example of 8-hr avg O₃ MERPs

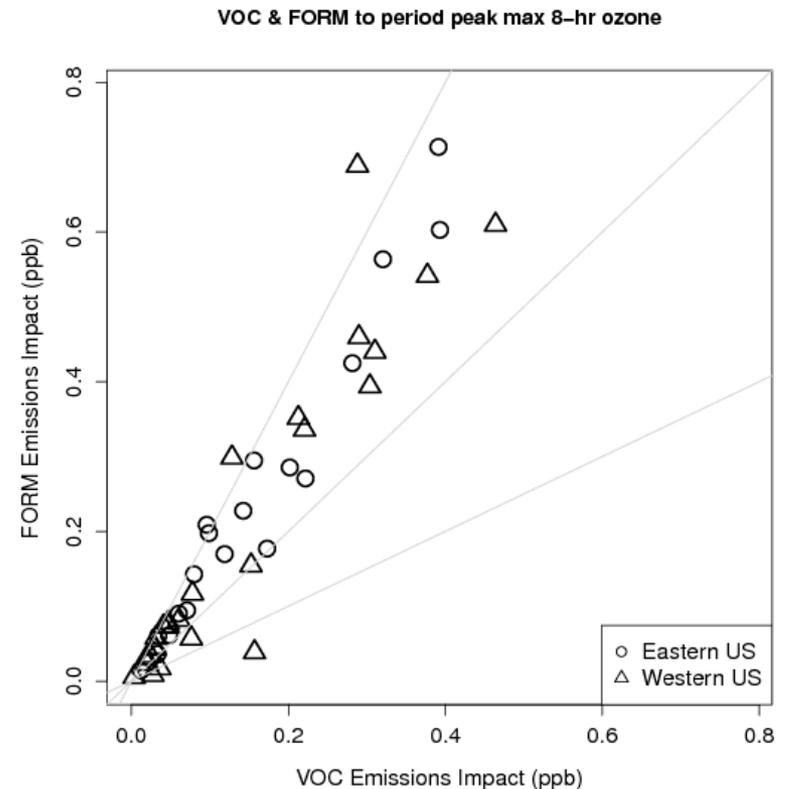


- NO_x (top panels) and VOC (bottom panels) MERPs estimated from single source hypothetical emissions impacts on daily maximum 8-hr O₃.
- Note: 8-hr O₃ MERPs derived here based on critical air quality threshold of 1.0 ppb
- Shown by area and over all areas



VOC speciation impacts on illustrative MERPs

- Maximum 8-hr ozone impacts from 500 tpy of near-surface VOC emissions using a typical industrial VOC speciation profile and assuming all VOC emissions are formaldehyde.
- Note: these impacts are for the eastern and western U.S. hypothetical sources presented here and do not include information from any other studies.





Summary of illustrative MERPs

- **Most Conservative (Lowest) Illustrative MERP Values (tons per year) by Precursor, Pollutant and Region.** Note: illustrative MERP values are derived based on EPA modeling (as described in section 4 of guidance) and critical air quality thresholds (as described in Section 5 of guidance)

Precursor	Area	8-hr O3	Daily PM	Annual PM
NOX	CUS	126	1,693	5,496
	EUS	170	2,295	10,144
	WUS	184	1,075	3,184
SO2	CUS		238	839
	EUS		628	4,013
	WUS		210	2,289
VOC	CUS	948		
	EUS	1,159		
	WUS	1,049		

**table includes minor corrections from the guidance document*



Developing Area Specific MERPs

- A modeling protocol should be developed and shared with the EPA Regional office that details the planned approach for developing MERPs based on photochemical modeling to ensure a sound technical basis for development of a suitable Tier 1 demonstration tool.
 - As part of the protocol, the permit applicant should include a narrative that provides a technical justification that the existing information is relevant for their project source scenario.
- There is no minimum number of hypothetical sources to include in developing a MERPs Tier 1 demonstration tool, but the benefit of including more hypothetical sources is that more information is available for future sources to use in predicting secondary pollutant impacts from their post-construction emissions.
- Permitting authorities or permit applicants should examine the existing recent (e.g., last 5 to 10 years) permit applications in that area to determine what types of emission rates and stack characteristics (e.g., surface and elevated release) should be reflected in the hypothetical project sources included in the model simulations.
- These model simulations should include a credible representation of current or post-construction conditions in the area of the project source and key receptors.
- Pre-existing modeling conducted for an area by a source, a governmental agency, or some other entity that is deemed sufficient may be adequate for air agencies to conduct local demonstrations leading to the development of area-specific MERPs. 42



Developing Area Specific MERPs: 8-hr O₃

- The general framework for such developmental efforts for O₃ should include the following steps:
 - 1) Define the geographic area(s)
 - 2) Conduct a series of source sensitivity simulations with appropriate air quality models to develop a database of modeled O₃ impacts associated with emissions of O₃ precursors (e.g., VOC and NO_x) from typical industrial point sources within the area of interest.
 - 3) Extract the highest daily 8-hr average modeled impact anywhere in the domain from the model simulation.
 - 4) Calculate the MERP estimate(s) using the equation provided in Section 5 of this document.
 - 5) Conduct quality assurance of the resulting MERP estimate(s) and evaluate the interpretation and appropriateness given the nature of O₃ precursor emissions sources and chemical formation in the area of interest. This evaluation will likely require emissions inventory data and observed ambient data for O₃ and precursors.



Developing Area Specific MERPs: Daily PM_{2.5}

- The general framework for such developmental efforts for Daily PM_{2.5} should include the following steps:
 - 1) Define the geographic area(s)
 - 2) Conduct a series of source sensitivity simulations with appropriate air quality models to develop a database of modeled PM_{2.5} impacts associated with emissions of PM_{2.5} precursors (e.g., SO₂ and NO_x) from typical industrial point sources within the area of interest.
 - 3) Extract the highest daily 24-hr average modeled impact anywhere in the domain from the model simulation.
 - 4) Calculate the MERP estimate(s) using the equation provided in Section 5 of this document.
 - 5) Conduct quality assurance of the resulting MERP estimate(s) and evaluate the interpretation and appropriateness given the nature of PM_{2.5} precursor emissions sources and chemical formation in the area of interest. This evaluation will likely require emissions inventory data and observed ambient data for PM_{2.5} and precursors.



Developing Area Specific MERPs: Annual PM_{2.5}

- The general framework for such developmental efforts for annual PM_{2.5} should include the following steps:
 - 1) Define the geographic area(s)
 - 2) Conduct a series of source sensitivity simulations with appropriate air quality models to develop a database of modeled PM_{2.5} impacts associated with emissions of PM_{2.5} precursors (e.g., SO₂ and NO_x) from typical industrial point sources within the area of interest.
 - 3) Extract the highest annual average modeled impact anywhere in the domain from the model simulation.
 - 4) Calculate the MERP estimate(s) using the equation provided in Section 5 of this document.
 - 5) Conduct quality assurance of the resulting MERP estimate(s) and evaluate the interpretation and appropriateness given the nature of PM_{2.5} precursor emissions sources and chemical formation in the area of interest. This evaluation will likely require emissions inventory data and observed ambient data for PM_{2.5} and precursors.



Hypothetical Examples

- The draft guidance provides 4 example scenarios using modeled hypothetical sources.
- These example scenarios are intended to illustrate how applicants could use existing information to support a demonstration.
- Further, these example scenarios are intended to help illustrate how to combine impacts from multiple precursors for a single demonstration
- Examples are also provided at the end of these slides for reference



Tier 2 Demonstrations

- A Tier 1 demonstration is not a requirement before performing a Tier 2 demonstration
- EPA anticipates few situations where a Tier 2 demonstration would be necessary, we expect most situations could be demonstrated under Tier 1
- 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/R-16-005 December 2016)



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}

- For **second tier assessments** (Sections 5.3.2.c and 5.4.2.c) when necessary, guidance is provided on the air quality models, inputs, run time options, receptor placement, and application approach for the purposes of estimating the impacts on ozone and secondarily formed PM_{2.5} from single project sources
- Within the second tier described in Appendix W, applicants are provided flexibility in terms of the complexity of model application for comparison to both the SIL and NAAQS
- These sub-tiers allow for simpler approaches to be compared conservatively to the SIL and NAAQS and more sophisticated approaches could be applied to provide a more representative impact for a source's impact



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}

- For **second tier assessments**, chemical transport models are recommended for estimating single source O₃ and secondary PM_{2.5} impacts
- Chemical transport models include Lagrangian puff models and Eulerian grid (e.g. photochemical transport) models
- Lagrangian puff models need as input a realistic chemical environment
- Photochemical transport models typically estimate a realistic chemical environment
- Even though single source emissions are injected into a grid volume, comparisons with in-plume measurements indicate these types of models can capture downwind secondary pollutant impacts when applied appropriately for this purpose
- Further testing is needed for both types of chemical transport modeling systems (Lagrangian and Eulerian) to best understand the configurations appropriate for permit related assessments



Extra Slides



Scenario A: VOC and NO_x precursor assessment for PM_{2.5} and additive O₃ impacts

- In this scenario, a facility with a proposed increase in emissions of 0 TPY of primary PM_{2.5}, 130 TPY of VOC, 72 TPY of NO_x, and 0 TPY of SO₂ located in the upper midwest region. Only VOC and NO_x emissions are above the level of the SER and therefore require a PSD compliance demonstration.
- O₃ analysis: The NO_x and VOC emissions from the project source are well below the lowest (most conservative) O₃ MERP value shown in Table 7-1 of any source modeled by EPA in the central or any other region in the continental U.S. In this case, air quality impacts of O₃ from this source would be expected to be below the critical air quality threshold.
 - However, the NO_x and VOC precursor contributions to 8-hr daily maximum O₃ are considered together to determine if the source's air quality impact would exceed the critical air quality threshold. In such a case, the proposed emissions increase can be expressed as a percent of the lowest MERP for each precursor and then summed. A value less than 100% indicates that the critical air quality threshold will not be exceeded when considering the combined impacts of these precursors on 8-hr daily maximum O₃.
 - Example calculation for additive secondary impacts on 8-hr daily maximum O₃:
– (72 tpy NO_x from source/169 tpy NO_x 8-hr daily maximum O₃ MERP) + (130 tpy VOC from source/1159 TPY VOC 8-hr daily maximum O₃ MERP) = .43 + .11 = .54 * 100 = 54%
- PM_{2.5} analysis: The NO_x emissions of 72 tpy from the hypothetical project source are also well below the lowest (most conservative) PM_{2.5} MERP value for the daily and annual NAAQS shown in Table 7-1 of any source modeled by EPA across the continental US. In this case, air quality impacts of PM_{2.5} from this source are expected to be below the critical



Scenario B: NO_x and SO₂ precursor assessment for comparable source O₃ impacts and additive secondary PM_{2.5} impacts

- In this scenario, a facility with a proposed increase in emissions of 0 TPY of primary PM_{2.5}, 0 TPY of VOC, 310 TPY of NO_x, and 75 TPY of SO₂ located in the southeast region. Only NO_x and SO₂ emissions are above the level of the SER and therefore require a PSD compliance demonstration.
- O₃ analysis: The NO_x emissions of 310 tpy are larger than the lowest (most conservative) NO_x MERP for 8-hr O₃ in the eastern and other regions of the U.S. A comparable hypothetical source is identified that may be representative of this source (e.g., EUS region, source 19 with elevated emissions release as shown in Appendix A) and has source derived NO_x MERPs for 8-hr O₃ ranging from 327 to 462 TPY, which are larger than the project source's post-construction emissions. The MERPs equation is used with the modeled emissions rates and air quality impact information from source 19 of the EUS region with an elevated release (as detailed in Appendix Table A-1). Since multiple hypothetical sources were modeled at this location with an elevated release the source with the lowest MERP was selected for comparison with the project source, i.e.,
 - *MERP for source 19 EUS region elevated release (tpy) = 1.0 ppb * (500 tpy / 1.52 ppb) = 327 tpy*
 - In this case, based on modeling results for a more similar hypothetical source from Appendix A, the project source emissions are less than the calculated NO_x to 8-hr O₃ MERP such that air quality impacts of O₃ from this source would be expected to be less than the critical air quality threshold.



Scenario B: NO_x and SO₂ precursor assessment for comparable source O₃ impacts and additive secondary PM_{2.5} impacts (cont)

- PM_{2.5} analysis: Both the NO_x and SO₂ emissions are well below the lowest (most conservative) daily and annual PM_{2.5} MERP values of any source modeled in the eastern or any other region in the continental U.S. However, the NO_x and SO₂ precursor contributions to both daily average PM_{2.5} are considered together to determine if the source's air quality impact of PM_{2.5} would exceed the critical air quality threshold. In this case, the proposed emissions increase can be expressed as a percent of the lowest MERP for each precursor and then summed. A value less than 100% indicates that the critical air quality threshold would not be exceeded when considering the combined impacts of these precursors on daily and/or annual PM_{2.5}.
 - Example calculation for additive secondary impacts on daily PM_{2.5}:
– (310 tpy NO_x from source/1075 tpy NO_x daily PM_{2.5} MERP) + (75 tpy SO₂ from source/210 TPY SO₂ daily PM_{2.5} MERP) = .29 + .36 = .65 * 100 = 65%
 - Example calculation for additive secondary impacts on annual PM_{2.5}:
– (310 tpy NO_x from source/3184 tpy NO_x annual PM_{2.5} MERP) + (75 tpy SO₂ from source/839 TPY SO₂ annual PM_{2.5} MERP) = .097 + .089 = .19 * 100 = 19%



Scenario C: NO_x and SO₂ precursor assessment for comparable source O₃ and PM_{2.5} impacts

- In this scenario, a facility with a proposed increase in emissions of 0 TPY of primary PM_{2.5}, 22 TPY of VOC, 920 TPY of NO_x, and 259 TPY of SO₂ located in the western region. Only NO_x and SO₂ emissions are above the level of the SER and therefore require a PSD compliance demonstration.
- O₃ analysis: The NO_x emissions of 920 tpy are larger than the lowest (most conservative) NO_x MERP for 8-hr O₃ in the western and other regions of the U.S. A comparable hypothetical source is identified that may be representative of this source (e.g., WUS region, source 16 elevated release as shown in Appendix A) had a range of NO_x MERPs for 8-hr O₃ of 761 to 1,020 TPY, which are all larger than the source emissions modification. The general formula for estimating MERPs is provided in section 5. The MERPs equation is used with the modeled emissions rates and air quality impact information from source 19 of the EUS region with an elevated release (as detailed in Appendix Table A-1). Since multiple hypothetical sources were modeled at this location with an elevated release the source with the lowest MERP was selected for comparison with the project source, i.e.,
 - $MERP \text{ for source 16 WUS region elev. release (tpy)} = 1.0 \text{ ppb} * (1000 \text{ tpy} / 1.31 \text{ ppb}) = 763 \text{ tpy}$
 - In this case, based on modeling results for a more similar hypothetical source from Appendix A, the project source emissions are still greater than the calculated NO_x to 8-hr O₃ MERP such that air quality impacts of O₃ from this source are expected to exceed the critical air quality threshold.



Scenario C: NO_x and SO₂ precursor assessment for comparable source O₃ and PM_{2.5} impacts (cont)

- PM_{2.5} analysis: The NO_x emissions of 920 are marginally below the lowest (most conservative) daily and annual PM_{2.5} MERP value of any source modeled in the continental U.S., while the SO₂ emissions of 259 tpy are above the lowest daily PM_{2.5} MERP value of any source modeled in the western U.S. region.
- A hypothetical source considered more similar (e.g., WUS region, source 16 elevated release as shown in Appendix A) has a lowest NO_x MERP for daily PM_{2.5} and SO₂ MERP for daily PM_{2.5} which are both much larger than the increase in emissions of the project such that the source's impact on PM_{2.5} would be expected to be less than the critical air quality threshold.



Scenario D: NO_x and SO₂ precursor assessment for additive secondary PM_{2.5} impacts along with direct PM_{2.5}

- In this scenario, a facility with a proposed increase in emissions of 250 TPY of primary PM_{2.5}, 0 TPY of VOC, 310 TPY of NO_x, and 75 TPY of SO₂ located in the southeast region. Only NO_x and SO₂ emissions are above the level of the SER and therefore require a PSD compliance demonstration. This scenario is similar to Scenario B above, except that the primary PM_{2.5} emissions must be accounted for in assessing PM_{2.5} along with the secondary impacts of NO_x and SO₂ precursor emissions as part of the Tier 1 demonstration. (Ozone analysis similar to Scenario B above.)
- PM_{2.5} analysis: Similar to Scenario B, when considering NO_x and SO₂ contributions to daily average PM_{2.5} together, the proposed emissions increased expressed as a percent of the lowest (most conservative) MERP and summed is less than 100% indicating the critical air quality threshold would not be exceeded when considering the additive impacts of these precursors. However, in this example, the primary PM_{2.5} impacts need to be added to the secondary impacts for an appropriate account of total PM_{2.5} impacts for the comparison to the air quality threshold.



Scenario D: NO_x and SO₂ precursor assessment for additive secondary PM_{2.5} impacts along with direct PM_{2.5} (cont)

- The primary PM_{2.5} impacts should be estimated using AERMOD or an approved alternative model as outlined in the *Guideline* ([U.S. Environmental Protection Agency, 2015a](#)) and consistent with EPA guidance for combining primary and secondary impacts of PM_{2.5} for permit program assessments. In this scenario, a representative secondary impact for this source is added to the appropriately estimated primary PM_{2.5} impacts. The highest impact at any receptor for primary PM_{2.5} should be divided by the air quality threshold to estimate the percent contribution and determine if that primary contribution exceeds the 35% remaining after secondary impacts are accounted for using MERPs demonstration tool.
- For example, a peak primary PM_{2.5} impact from AERMOD is estimated to be 0.35 ug/m³ for the scenario above. Compared with a 1.2 ug/m³ critical air quality threshold means that the primary impact is 29% of the critical air quality threshold. When this primary impact is summed with the secondary impacts of 65% the total is below 100% suggesting this source impact is below the critical air quality threshold.
- Alternatively, if the peak primary PM_{2.5} impact from AERMOD is estimated to be 0.8 ug/m³ for the above scenario then the percent primary contribution to the critical air quality threshold would be 62%. When summed with the secondary contribution of 65%, the total source impact exceeds 100% and therefore is greater than the critical air quality threshold.



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



Background

- The 2003 Guideline recommended CALPUFF as the preferred model for long-range transport (*i.e.*, source receptor distances of 50 km to several hundred km) for primary criteria pollutants.
 - Largely applied to address PSD increment.
- CALPUFF also considered on case-by-case basis as an alternative model subject to approval under Section 3.2 for near-field applications where complex winds or terrain warranted use of a puff model.



Long-Range Transport Assessments: Section 4

- EPA has finalized the removal of CALPUFF as a preferred model for long-range transport and now considers it a screening technique along with other Lagrangian models for addressing PSD increment beyond 50 km from a new or modifying source without alternative model approval (per Section 4.2.1).
- For NAAQS demonstrations: Near-field modeling is sufficient to address whether a source will cause or contribute to a NAAQS violation so EPA does not consider a LRT assessment beyond 50 km necessary for inert pollutants.
 - CALPUFF or other Lagrangian models still available for use in near-field as an alternative model subject to approval under Section 3.2 for situations of complex terrain or complex winds (per Section 7.2.1.2).



Screening Approach for PSD Increment: Section 4

- EPA recognizes that LRT assessments may be necessary in limited situations so recommends a screening approach for PSD increment and for NAAQS where near-field compliance is not required or receptors of concern > 50 km (e.g., Outer-continental shelf).
 - First step: Based on near-field application of appropriate model, determine significance of ambient impact at or about 50 km from new/modifying source.
 - Second step: In consultation with EPA Regional Office, determine appropriate screening approach using CALPUFF or other Lagrangian model to determine significance of impacts at specific receptors such as Class I areas of concern.
- For very limited situations where a cumulative impact assessment is necessary, then selection and use of an alternative model by applicant with appropriate approval under Section 3.2.2(e).



Addressing secondary pollutant impacts: Section 5

- Provides flexibility to the user community in estimating single-source secondary pollutant impacts with more appropriate modeling techniques, such as photochemical models, that address science issues of models like CALPUFF.
- Based on IWAQM Phase 3 reports & published literature, EPA has placed emphasis on using chemical transport models or techniques that reflect state of science atmospheric chemistry.
- Preamble discusses future considerations for visibility modeling with full chemistry photochemical models in regulatory applications consistent with EPA's final revisions for addressing O₃ and secondary PM_{2.5}.



Regional Haze Program

- In 2005, EPA issued guidelines for implementing BART requirements under Regional Haze Rule and recommended the use of CALPUFF for single-source assessments despite the lack of full evaluation for secondary pollutant formation.
- States could use alternative approaches, including photochemical model, if done in consultation with EPA Regional Office.
- Final revisions to the *Guideline* do not affect the EPA's recommendation in the 2005 BART Guidelines to use CALPUFF in the BART determination process.



Summary

- EPA has removed CALPUFF as a preferred model for long-range transport and now considers it a screening technique along with other Lagrangian models without alternative model approval (per Section 4.2.1) for addressing PSD increment beyond 50 km from a new or modifying source.
- For NAAQS demonstrations, EPA does not consider a LRT assessment necessary beyond 50 km for inert pollutants except for situations where near-field compliance is not required (e.g., OCS source).
- No change in ability to use CALPUFF in the near-field as an alternative model if appropriately approved under Section 3.2.
- Flexibility to the user community in estimating single-source secondary pollutant impacts with emphasis on chemical transport models that include Lagrangian puff models and Eulerian grid (e.g., photochemical transport) models.



Role of EPA's Model Clearinghouse



EPA's Model Clearinghouse

- In the final revisions to the *Guideline*, the EPA is codify the long-standing process of the Regional Offices consulting and coordinating with the Model Clearinghouse (MCH) on all approvals of alternative models and techniques.
- Restated... while the Regional Administrators are the delegated authority to issue such approvals under Section 3.2.2 of the *Guideline*, all alternative model approvals will be issued only after consultation with the EPA's MCH and formal documentation through a concurrence memorandum that indicates that the alternative model requirements in section 3.2.2 have been met.



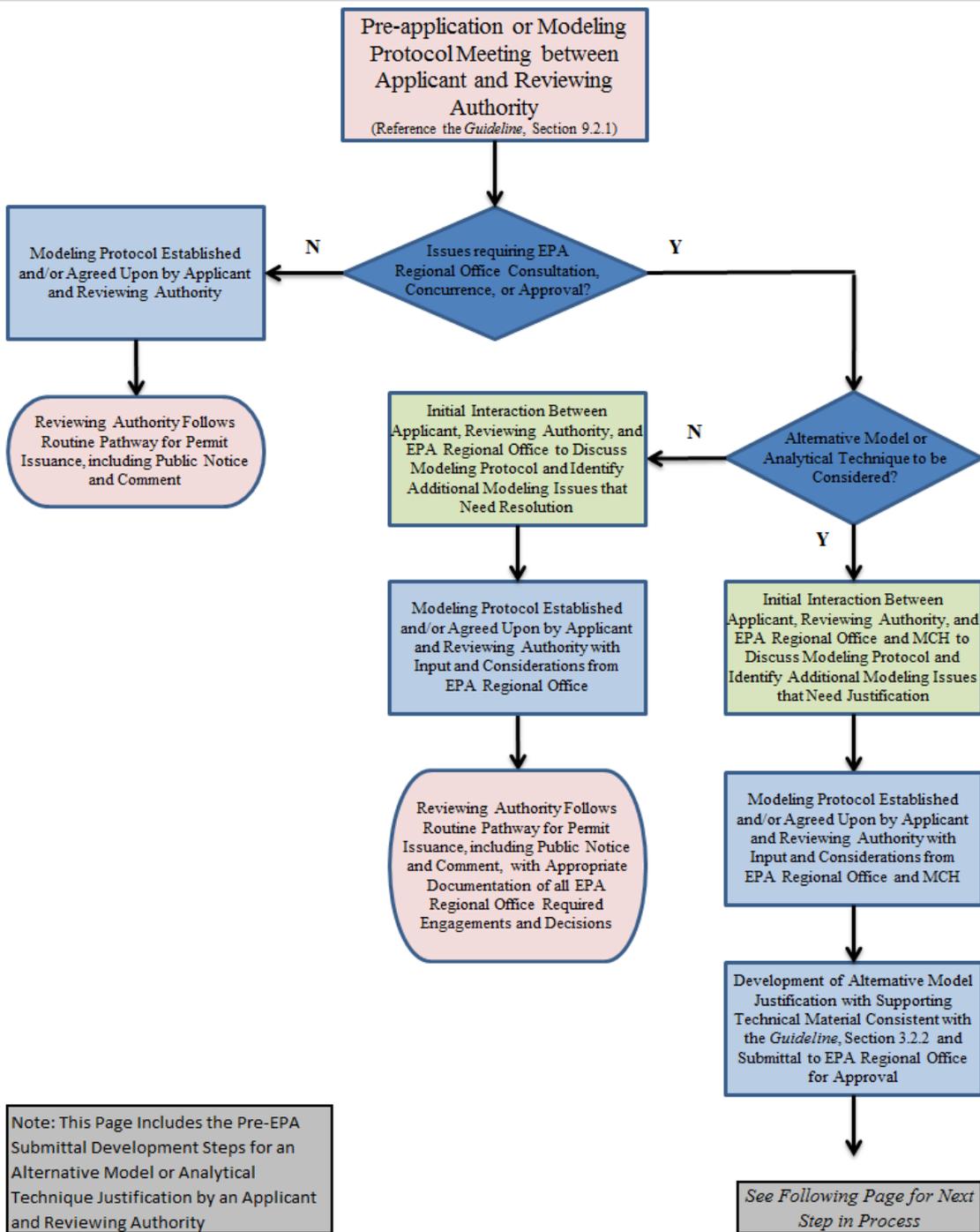
EPA's Model Clearinghouse (Cont)

- The 1988 Model Clearinghouse Operational Plan was substantially revised and reissued with the Appendix W final rule.
 - [Model Clearinghouse: Operational Plan - \[EPA-454/B-16-008\]](#)
- It is anticipated that the action in the final rule along with the revision and public dissemination of the MCH Operational Plan will further streamline the MCH process and alternative model and technique approvals by clarifying it for the regulatory modeling community.
- Additionally, the revisions will ensure fairness, consistency, and transparency in modeling decisions across all EPA Regional Offices.



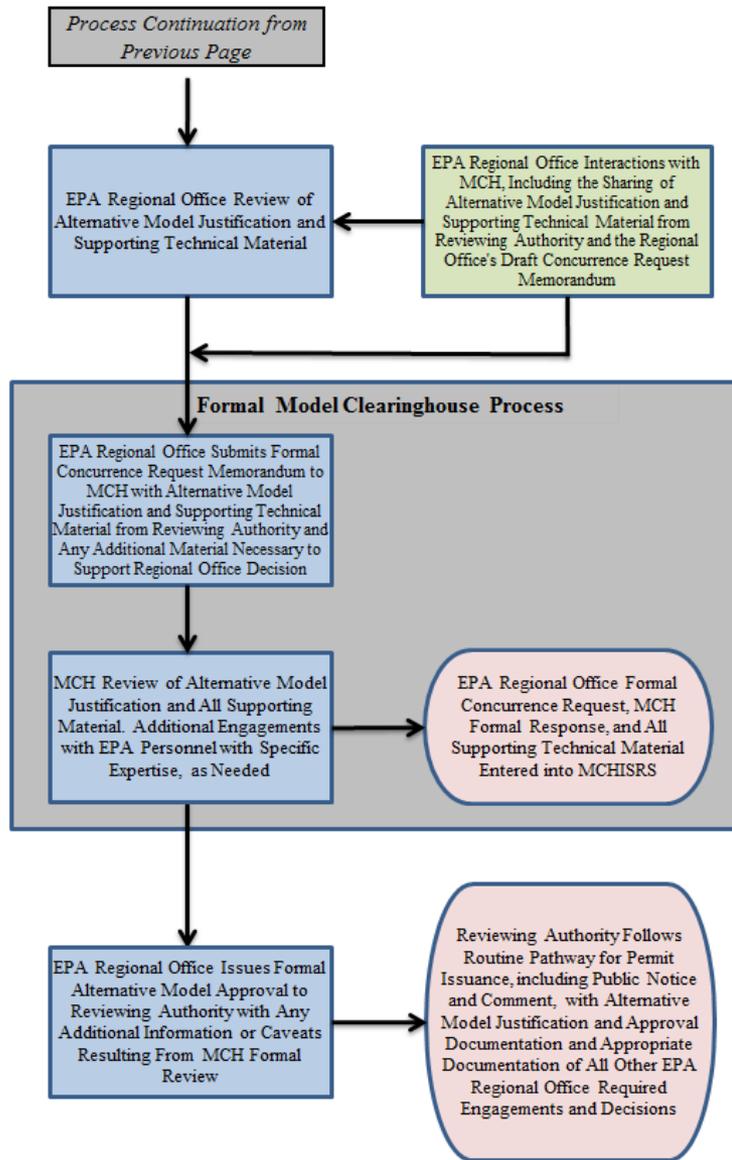
EPA's Model Clearinghouse (Cont)

- Consideration for future MCH Operational Plan updates will be based on ongoing feedback from the EPA Regional Offices and stakeholder community, especially with regards to additional templates, organizational shifts, and changing information flows.
- Please reference the Model Clearinghouse Status Update presentation from the November 2016 Regional, State, and Local Modelers' Workshop in New Orleans, LA and read the revised MCH Operation Plan for a thorough discussion on the MCH Process
 - http://www.cleanairinfo.com/regionalstatelocalmodelingworkshop/archive/2016/Presentations/1-5_Update_on_Model_Clearinghouse-2016RSL-GMB.pdf



Note: This Page Includes the Pre-EPA Submittal Development Steps for an Alternative Model or Analytical Technique Justification by an Applicant and Reviewing Authority

See Following Page for Next Step in Process



Note: This Page Includes the Post-EPA Submittal Approval Steps for an Alternative Model or Analytical Technique Justification by the EPA Regional Office and MCH



Updates to Modeling Procedures for Cumulative Impact Analysis



Final Revisions to Sections 8 and 9

- The EPA continues to caution against the literal and uncritical application of very prescriptive procedures for conducting NAAQS and PSD increments modeling compliance demonstrations as described in Chapter C of the 1990 *draft* New Source Review Workshop Manual.
 - Following such procedures in a literal and uncritical manner has led to practices that are overly conservative and unnecessarily complicate the permitting process.
- The EPA provided a renewed emphasis on the development and vetting of a **modeling protocol** with the appropriate reviewing authority to discuss aspects of the input data and assessment technique, to identify potential issues, and to help streamline the entire compliance demonstration process.
 - To assist with model protocol development, we revised the [Air Quality Analysis Checklist](#) and will continue to update based on Regional Office and reviewing authority feedback.



Final Revisions to Sections 8 and 9 (Cont)

- The **modeling domain** or proposed project's impact area is defined as an area with a radius extending from the new or modifying source to:
 - (1) The most distant location where air quality modeling predicts a significant ambient impact will occur, or
 - (2) the nominal 50 km distance considered applicable for Gaussian dispersion models, ***whichever is less***.
 - In most situations, the extent to which a significant ambient impact could occur from a new or modifying source likely will be *considerably less* than 50 km.



Final Revisions to Sections 8 and 9 (Cont)

- As proposed, an expanded discussion on the establishment of **receptor sites** (density and location) in the modeling domain is provided in Section 9 to prevent issues with numerous and unreasonable successive revisions of the receptor network.
- In the final rule, there is an increased emphasis on understanding **background concentrations**.
 - In many case, numerous “other” sources in proximity to the new or modifying source are represented with background monitoring data.
 - The discussion of significant concentrations gradient is expanded to help better identify the “nearby” source(s) that should also be explicitly modeled in the compliance demonstration.
 - The EPA signaled in the preamble of the final rule that it would continue to work with the stakeholder community to clarify and improve upon the existing technical guidance with respect to the development and analysis of significant concentration gradients from nearby sources.



Final Revisions to Sections 8 and 9 (Cont)

- A brief discussion (Section 8.3.1(c) and 8.3.2(f)) on the use of photochemical gird modeling to appropriately characterize **background concentrations** in certain situations has also been added.
- Tables **8-1** and **8-2** have been amended as proposed with typographical error corrections to allow modeling of nearby sources using average actual emissions (operating level) based on the most recent 2-years of normal source operation.



Final Revisions to Sections 8 and 9 (Cont)

- The discussion of **design concentrations** was substantially updated and unified from the previous version of the Guideline.
 - For many cases, the best starting point would be use of the current design value for the applicable NAAQS as a uniform monitored background contribution across the project area. However, there are cases in which the current design value may not be appropriate.
 - EPA does not recommend hourly or daily pairing of monitored background and modeled concentrations except in rare cases.
 - The seasonal (or quarterly) pairing of monitored and modeled concentrations should sufficiently address situations to which the impacts from modeled emissions are not temporally correlated with background monitored levels.
 - In all situations, additional considerations for the calculation of design concentrations should be discussed with the appropriate reviewing authority.



Final Revisions to Sections 8 and 9 (Cont)

- The EPA updated the recommendations in Section 9.2.3 (NAAQS and PSD Increment Compliance Demonstrations for New or Modifying Sources) to more clearly and accurately reflect the longstanding practice of performing a **single-source impact analysis** (SIA) as a first stage of the NAAQS and PSD increments compliance demonstration and, as necessary, conducting a more comprehensive **cumulative impact analysis** (CIA) as the second stage.
- Each stage should involve increasing complexity and details, as required, to fully demonstrate that a new or modifying source will not cause or contribute to a violation of any NAAQS or PSD increment.
- The appropriate considerations and applications of screening and/or refined model are described in each stage throughout Section 9.2.3.



Updates on Use of Meteorological Input Data for Regulatory Dispersion Modeling



Meteorological Inputs

- Types of Meteorological Input Data Available
 - 1 year of observed site-specific/representative data
 - 5 years of National Weather Service/ASOS
 - 3 years of prognostic meteorological data
- Use of AERMINUTE
 - Captures data previously lost in hourly observations due to calm and variable wind METAR coding
 - Guideline recommends the routine use of AERMINUTE output when processing meteorological data from NWS ASOS sites
 - Latest version: 15272
 - Allows for the use of 5-minute data in conjunction with 1-minute data
 - Use of 5-minute data is completely optional
 - Fill data gaps in 1-minute data



Prognostic Meteorology

- EPA Finalized Use of Prognostic Data
 - Effort to provide more flexibility
 - Improve meteorological inputs for areas where:
 - No representative NWS station
 - Prohibitive or infeasible to collect adequate site -specific data
 - Requires best professional judgement and consultation with reviewing authority.
 - Observed site-specific or adequately representative NWS data still preferred
- Mesoscale Model InterFace Program (MMIF)
 - Translates meteorological model output into dispersion model inputs
 - Generates inputs for AERMET/AERMOD, SCICHEM, etc.
 - Works on Linux and Windows-based systems



Prognostic Meteorology

- Three Most Recent Consecutive Years Recommended
 - Compared to 1yr site-specific and 5yr of NWS data
 - Observed data still preferred over prognostic
 - EPA has generated AERMET input files for 2013-2015 for the entire CONUS
- Model Results Should be Evaluated for Applicability
 - Raw WRF output can be run through various evaluation tools
 - Can also compare MMIF output at airport locations to observations in a regional analysis
 - Guidance likely to evolve over time



Prognostic Meteorology

- MMIFv3.3 available on SCRAM released with Final Signature
 - MMIF Guidance -
https://www3.epa.gov/ttn/scram/appendix_w/2016/MMIF_Guidance.pdf
 - Evaluation of Prognostic Meteorological Data in AERMOD Applications -
https://www3.epa.gov/ttn/scram/appendix_w/2016/MMIF_Evaluation_TSD.pdf
- MMIF Webinar in March
 - In depth review of prognostic meteorological data approach
 - WRF data generation/distribution
 - MMIF options and approaches
 - Evaluation of data for suitability
 - Analysis of AERMOD applications using MMIF as compared to site -specific/NWS data



Question and Answer Session

- Please use the chat window within the webinar interface to submit questions. We will attempt to answer as many questions as possible and follow-up with others offline.
- For questions regarding the Appendix W final rule after the webinar, please contact:

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