

# PM<sub>2.5</sub> Precursor Demonstration Guidance EPA Webinar

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December 19, 2016



# Background

- The PM<sub>2.5</sub> SIP Requirements Rule was finalized on August 24, 2016 (81 FR 58010).
- The SIP Requirements Rule applies to all PM<sub>2.5</sub> nonattainment areas.
  - The rule establishes PM<sub>2.5</sub> precursors: NO<sub>x</sub>, SO<sub>2</sub>, VOC, and NH<sub>3</sub>.
    - These precursors must be evaluated for potential control measures in any PM<sub>2.5</sub> attainment plan and must be included in NNSR programs.
  - Consistent with CAA section 189(e), the rule allows states to submit *optional* precursor demonstrations to show that emissions of a particular precursor do “not contribute significantly to PM<sub>2.5</sub> levels which exceed the standard in the area.”
    - If the EPA approves a precursor demonstration for a particular nonattainment area, the attainment plan and/or NNSR program may exclude the precursor from certain control requirements, depending on the type of demonstration provided.



# Types of Precursor Demonstrations in the Rule

## 1. Attainment plan demonstrations

### a) Comprehensive precursor demonstration

- Analysis of the air quality impact of **all emissions** of a precursor in the nonattainment area as part of an attainment plan.
  - i. Contribution analysis of all emissions of a particular precursor
    - Ambient data analysis and/or modeling
  - ii. Sensitivity analysis
    - Model a percentage decrease in precursor emissions

### b) Major stationary source demonstration

- Analysis of the air quality impact of emissions of a precursor from major stationary sources in the nonattainment area as part of an attainment plan.
  - i. Contribution analysis of all major stationary source emissions of a particular precursor
    - Modeling analysis
  - ii. Sensitivity analysis
    - Model a percentage decrease in major stationary source precursor emissions

## 2. NNSR demonstration

- A separate demonstration which evaluates the effect of emissions *increases* from major stationary sources at (hypothetical) new and existing sources in the nonattainment area.
  - Sensitivity analysis
    - Model an increase in major stationary source precursor emissions

# PM<sub>2.5</sub> Precursor Demonstration Guidance

- The precursor demonstration guidance document is designed to assist air agencies who wish to submit **optional** precursor demonstrations, as permitted by the PM<sub>2.5</sub> SIP Requirements Rule.
  - The guidance contains details on recommended procedures for completing each of the precursor demonstrations defined in the final rule.
- EPA released a public draft version of the “PM<sub>2.5</sub> Precursor Demonstration Guidance” on November 17, 2016
  - <https://www.epa.gov/pm-pollution/draft-pm25-precursor-demonstration-guidance>
  - Comments are due by January 31, 2017
    - Send comments to [timin.brian@epa.gov](mailto:timin.brian@epa.gov) and/or [lessard.patrick@epa.gov](mailto:lessard.patrick@epa.gov)
  - Expect final guidance in Spring 2017



# Precursor Demonstration Guidance Overview

- **Policy elements**
  - Interpretation of “contribute significantly”
  - Considering additional information
  - Concentration thresholds
  - Locations at which to evaluate model results
- **Technical elements**
  - Recommended procedures for attainment plan demonstrations
    - Ambient data analysis (comprehensive analyses only)
      - Recommendations for relating precursors to PM<sub>2.5</sub> species
    - Modeling demonstrations
      - Types of models, inputs, post-processing
    - Sensitivity analyses: recommended range of percent emissions reductions
  - Recommended procedures for NNSR demonstrations
    - Modeling demonstrations
      - Types of models, inputs, post-processing
    - Sensitivity analyses: recommend based on size, location, and types of modeled emissions increases

# Policy Elements- “Contribute Significantly”

- The basis for allowing precursor demonstrations is CAA Section 189(e).
  - The demonstration must show that “sources do not *contribute significantly* to PM<sub>2.5</sub> levels which exceed the standard in the area.”
- The guidance contains EPA’s interpretation of “contribute significantly” as applied to PM<sub>2.5</sub> attainment plans and NNSR.
  - The guidance recommends using a quantitative threshold as follows:
    - A measured or modeled precursor impact that is below the recommended threshold may support a conclusion that sources do not contribute significantly.
    - A measured or modeled precursor impact that is above the threshold indicates a “contribution”, but may or may not be a “significant contribution”.
    - Whether a precursor’s contribution may be determined to be significant is “based on the facts and circumstances of the area.”

# Policy Elements- Concentration Thresholds

- Recommended concentration thresholds are derived from an air quality variability analysis documented in “Technical Basis for the EPA’s Development of Significant Impact Thresholds for PM<sub>2.5</sub> and Ozone”.  
[https://www.epa.gov/sites/production/files/2016-08/documents/pm2\\_5\\_sils\\_and\\_ozone\\_technical\\_basis\\_document.pdf](https://www.epa.gov/sites/production/files/2016-08/documents/pm2_5_sils_and_ozone_technical_basis_document.pdf)
  - 0.2 µg/m<sup>3</sup> for the annual PM<sub>2.5</sub> NAAQS, and
  - 1.3 µg/m<sup>3</sup> for the 24-hr PM<sub>2.5</sub> NAAQS
- The thresholds are based on an analysis of the variability in ambient PM<sub>2.5</sub> data.
  - A perturbation of air quality that is less than the inherent variability in the measured concentration has an impact on air quality concentrations that is, from a statistical standpoint, insignificant.
- The thresholds were developed to support the PSD program, however, it is appropriate to use the same values in the manner described on slide 6, for precursor demonstrations.
  - The air quality variability analysis is a general statistical analysis of ambient air quality variability from *all sources*. It is not dependent on a particular source of anthropogenic perturbation.
    - It is therefore equally appropriate to apply in a number of circumstances, including precursor demonstrations and PSD.

# Policy Elements- Additional Information

- Additional information can be used to help determine whether an impact above the concentration threshold(s) “contribute significantly.”
  - Concentration amount above the recommended threshold(s).
  - Severity of nonattainment at relevant monitors and/or locations within the NAA.
  - Analysis of speciation data and/or emissions inventory data.
  - Chemical tracer studies.
  - Trends in ambient data and precursor emissions.
  - Source characteristics (source type, stack height/parameters, location).
  - Anticipated growth of sources/emissions.



# Policy Elements- Where to Evaluate Impacts?

- Locations at which to evaluate impacts
  - Attainment plan demonstrations (comprehensive or major stationary source)
    - Examine ambient data and model results **at monitoring locations.**
      - Consistent with the “unmonitored area analysis” policy for attainment demonstrations established in the PM<sub>2.5</sub> SIP Requirements Rule.
  - NNSR demonstrations
    - Examine modeling results **in all grid cells** in the nonattainment area
      - Consistent with PSD and NSR modeling

# Attainment Planning Demos: Technical Elements

- Guidance recommends ambient data analyses as a 1<sup>st</sup> step in all comprehensive demonstrations.
  - There are recommendations for associating measured species to precursors.
  - Compare levels of measured secondary PM<sub>2.5</sub> to the thresholds.
  - Air quality modeling (zero-out or source apportionment) is optional.
- If the contribution analysis does not demonstrate sources do not contribute significantly, the air agency can choose to conduct a sensitivity-based analysis.
  - All sensitivity-based analyses for attainment planning should evaluate emission reductions with air quality modeling.

# Ambient Data Analysis: Assignment of Precursors to PM<sub>2.5</sub> Species

- Table 1 from section 3.1.5:

PM <sub>2.5</sub> Precursor	Recommended Assignment to PM <sub>2.5</sub> Species	Comment
NO <sub>x</sub>	Nitrate ion + portion of ammonium associated with nitrate	Include all measured nitrate ion plus the ammonium that is in the form of ammonium nitrate (do not include the ammonium attached to sulfate).
SO <sub>2</sub>	Sulfate ion	All measured sulfate ion.
NH <sub>3</sub>	Ammonium + nitrate ion	Include all measured ammonium and nitrate ion.
VOC	SOA	Estimate the secondary component of OM. This can be further disaggregated into the impact on SOA from anthropogenic VOC sources.

# Air Quality Modeling

- The Guidance recommends photochemical modeling in most cases.
  - Photochemical grid models (e.g. CMAQ or CAMx) are generally recommended for comprehensive or sensitivity demonstrations.
    - In some cases, Lagrangian models may be suitable for a NNSR demonstration.
    - In limited areas (such as a small mountain/valley area), a more simplistic box model may in some cases be appropriate.
- States should follow the general procedures in the “PM<sub>2.5</sub> photochemical modeling guidance.”
  - Latest version: [https://www3.epa.gov/ttn/scram/guidance/guide/Draft\\_O3-PM-RH\\_Modeling\\_Guidance-2014.pdf](https://www3.epa.gov/ttn/scram/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf)
  - A modeling protocol is recommended to communicate the scope and details of the analysis.
- Air quality impacts can be calculated using several model approaches.
  - Brute force
    - Run the model once with all emissions, and again without a particular precursor (either “zero-out” or % emissions reduction).
  - Photochemical source apportionment
    - Single model run (using an instrumented model) which tracks the concentration impact from precursor emissions.



# Sensitivity Based Analyses

- **Sensitivity-based analysis:** emissions reductions
  - The guidance recommends modeling a 30-70% reduction in precursor emissions.
    - Air agencies should model a range (30/50/70%) to examine the PM<sub>2.5</sub> impact relative to the recommended threshold.
    - Recommend starting at the high end of the range (70%) and working back down, if necessary.
      - The higher the emissions % reduction, the stronger the demonstration.
    - The guidance discourages modeling of very small % reductions based on available controls.
      - The modeled reduction should be large enough to test the interaction and non-linearity of the secondary PM<sub>2.5</sub> components.
      - Consistent with the rule, the EPA may in some cases require air agencies to evaluate available emissions controls in support of a modeled sensitivity analysis.

# NNSR Demonstrations: Technical Elements

- The guidance recommends modeling (with a photochemical model) a fixed ton per year *increase* (i.e., not a percentage increase) at multiple existing and/or “hypothetical” major point source locations in the nonattainment area.
  - Modeling of “hypothetical” new sources may be important in areas which have zero or very few existing major sources.
- The guidance does not recommend a specific tonnage or number of sources.
  - The emissions increase to be modeled at each location should be determined on a case-by-case basis, considering the size of the area, the existing sources in the area, the types of sources that are most likely to locate in the area, and the magnitude of recent permitted sources in the region.
    - All of these factors are too variable to make default recommendations for all NAAs.

# NNSR Demonstrations: Technical Elements (cont)

- The NNSR demonstration should include a conservative representation of potential emissions increases.
  - The goal of the analysis is to examine whether the NAA is sensitive to increases in precursor emissions.
    - Existing major source information can be the starting point of the analysis, with additional “hypothetical” sources located in parts of the NAA, as necessary.
    - Examples of modeling of hypothetical sources can be found in the draft “Modeled Emissions Rates for Precursors (MERPs) guidance”:  
[https://www3.epa.gov/ttn/scram/guidance/guide/EPA454\\_R\\_16\\_006.pdf](https://www3.epa.gov/ttn/scram/guidance/guide/EPA454_R_16_006.pdf)
- States will need to work closely with their EPA Regional Office to decide on the appropriate parameters for the modeling analysis.

# Modeling Details: Base or Future Year Modeling?

- Default recommendation is to model the base (or current) year for attainment plan precursor demonstrations.
  - Demonstrations based on projected future year emissions may also be appropriate, depending on the specific circumstances of the NAA.
  - In some cases, the “base” year may be relatively old and the future year may be closer to current.
- There is no default recommendation for NNSR demonstrations.
  - Consider the timing when emissions increases from new permitted sources and/or major modifications may occur.
- Consult with your EPA Regional office to decide what is appropriate for a particular demonstration.





# Modeling Details:

## Absolute or relative model results?

- Absolute model results are the direct concentration outputs from the model.
- Relative model results are calculated as a modeled impact, relative to observed ambient PM<sub>2.5</sub> data (and species data).
  - Ambient data times the % modeled impact of a particular precursor.
- The guidance discusses the pros and cons of both techniques.
  - Default recommendation for NNSR demonstrations is to use absolute model results.
    - Consistent with recommended dispersion modeling approaches for PSD analyses.
    - Easy to examine model results in all grid cells.
    - In some cases, relative model results may be appropriate, especially if the model under-predicts species concentrations.
  - There is no default recommendation for attainment plan demonstrations.
    - Either absolute or relative impacts could be appropriate.
    - Consult with your EPA Regional office to decide what is appropriate for a particular demonstration.

# Summary

- The PM<sub>2.5</sub> Precursor Demonstration Guidance provides details on how to perform the *optional* demonstrations that are outlined in the PM<sub>2.5</sub> SIP Requirements Rule.
- The guidance provides default recommendations. Air agencies will need to work closely with their EPA Regional Office to work out details.
- Comments on the draft guidance are due by January 31, 2017 to Brian Timin ([timin.brian@epa.gov](mailto:timin.brian@epa.gov)) and Patrick Lessard ([lessard.patrick@epa.gov](mailto:lessard.patrick@epa.gov)) in the Office of Air Quality Planning and Standards.

