Guidance for Ozone and Fine Particulate Matter Permit Modeling

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- [https://www.epa.gov/scram/guidance-ozone-and-fine-particulate-matter-permit-modeling](https://www.epa.gov/scram/guidance-ozone-and-fine-particulate-matter-permit-modeling)
- Will refer to it as the “Ozone and PM\textsubscript{2.5} Permit Modeling Guidance” or “Final Guidance” throughout this webinar

The final guidance reflects the EPA’s recommendations for how a stationary source seeking a Prevention of Significant Deterioration (PSD) permit may demonstrate that it will not cause or contribute to a violation of the National Ambient Air Quality Standards (NAAQS) for ozone (O\textsubscript{3}) and fine particulate matter (PM\textsubscript{2.5}) and PSD increments for PM\textsubscript{2.5}, as required under Section 165(a)(3) of the Clean Air Act and 40 CFR sections 51.166(k) and 52.21(k).

Based on the feedback received to both the February 2020 draft and September 2021 revised draft guidance documents, we made a few clarifications and associated updates, but we are maintaining the “Holistic” compliance demonstration approach and all other recommendations from the revised draft guidance.
• The EPA granted a petition by the Sierra Club in 2010 and committed to engage in rulemaking to evaluate updates to the *Guideline on Air Quality Models* as published as Appendix W to 40 CFR 51, and, as appropriate, incorporate new analytical techniques or models for $O_3$ and secondary PM$_{2.5}$.

• EPA’s PM$_{10}$ Surrogate Policy officially ended in 2011.

• The PM$_{2.5}$ NAAQS (annual and daily form) was revised in 2012.

• In 2013, the U.S. Court of Appeals for the District of Columbia Circuit vacated the Significant Monitoring Concentration (SMC) for PM$_{2.5}$ and two provisions in EPA’s PSD regulations containing Significant Impact Levels (SILs) for PM$_{2.5}$.

• During this while, the EPA embarked on a multi-year effort to develop guidance on assessing single-source PM$_{2.5}$ impacts for the purposes of NSR-PSD permitting, which included co-regulator involvement and informal stakeholder comment/feedback.

• In 2014, the EPA finalized the “Guidance on PM$_{2.5}$ Permit Modeling.”
Guidance on PM$_{2.5}$ Permit Modeling

- Provided clarity and additional legal basis for the appropriate use of PM$_{2.5}$ SILs in light of the January 22, 2013, Court of Appeals Decision.
- Established 4 recommended scenarios or assessment cases based on “Pollutant Applicability” that defined what air quality analysis, *if any*, that an applicant would follow for compliance demonstrations of the PM$_{2.5}$ NAAQS or PSD Increments.
  - Only the individual components/precursors of PM$_{2.5}$ (*i.e.*, NO$_X$, SO$_2$, and/or direct PM$_{2.5}$) that would by themselves be emitted by a new or modifying source in a significant amount would be included in the air quality analysis.
- The recommended scenarios included a combination of modeling with the Appendix W preferred or approved alternative dispersion model for Direct PM$_{2.5}$ and qualitative/hybrid/quantitative approaches for adequately assessing secondarily formed PM$_{2.5}$.
In 2017, the EPA revised the *Guideline on Air Quality Models* with specific recommendations for quantitatively assessing O₃ and secondarily formed PM₂.₅ using existing chemical transport modeling tools and techniques that had been previously used in the development of nonattainment State Implementation Plans (SIPs), NAAQS assessments, and various EPA rules.

In association with the 2017 *Guideline* revisions, the EPA releases:

- **Guidance on the Development of Modeled Emissions Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and PM₂.₅ under the PSD Permitting Program** (MERPs 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** (Single-Source Chemical Transport Modeling Guidance),
- **Use of Photochemical Grid Models for Single-Source Ozone and secondary PM₂.₅ impacts for Permit Program Related Assessments and for NAAQS Attainment Demonstrations for Ozone, PM₂.₅ and Regional Haze** (Single-Source Ozone and Secondary PM₂.₅ Modeling Memorandum),
- **Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program** (SILs Guidance), and
- **Committed to releasing a revision of the 2014 Guidance on PM₂.₅ Permit Modeling that included appropriate accounting for both ozone and fine particulate matter and their respective precursors.**
• The SILs Guidance provides a policy, legal, and technical basis for recommended 8-hour O₃ and daily/annual PM₂.₅ SILs... an essential aspect of the NSR-PSD NAAQS and PSD Increments compliance program.

• The MERPs Guidance provides a framework that permit applicants may choose to use, in conjunction with the appropriate reviewing authority, to estimate single-source impacts on secondary pollutants using a “Tier 1” approach based on existing empirical relationships between precursors and secondary impacts established using state-of-the-science chemical transport models.
  - MERPs VIEW Qlik Application – Online application to access EPA’s updated hypothetical single source inventory of modeled O₃ and PM₂.₅ impacts to support appropriate PSD applications

• The Single-Source Chemical Transport Modeling Guidance and the Single-Source Ozone and Secondary PM₂.₅ Modeling Memorandum provide the necessary basis and ability to use photochemical models to estimate the single-source impacts on chemically reactive pollutants for permit related program demonstrations and NAAQS attainment demonstrations, whether for a “Tier 2” approach or establishing Tier 1 empirical relationships.
• The draft “Guidance for Ozone and Fine Particulate Matter Permit Modeling” was released on February 10, 2020, for review and informal comment.
  • Lengthy and robust internal coordination (OAR, OAQPS-AQPD, OAQPS-AQAD, OGC, & Regional Offices)
  • It was a replacement for the 2014 Guidance for PM_{2.5} Permit Modeling and included appropriate compliance demonstration assessment recommendations for direct and secondarily formed components of O_3 and PM_{2.5} for the NAAQS and of PM_{2.5} for PSD increments.
  • Included an expanded PSD Increments for PM_{2.5} discussion (Section V) that provided a more complete explanation of the PSD Increments terminology / system and of both the Source and Cumulative Impact Assessments (SIA/CIA) for PSD Increments.
  • [https://www.epa.gov/scram/draft-guidance-ozone-and-fine-particulate-matter-permit-modeling](https://www.epa.gov/scram/draft-guidance-ozone-and-fine-particulate-matter-permit-modeling)

• The draft guidance continued to rely upon a “Pollutant Applicability” approach that was outlined in the 2014 “Guidance on PM2.5 Permit Modeling,” except being expanded to both O_3 and PM_{2.5}.
  • Only the individual components/precursors of O_3 or PM_{2.5} (i.e., NO_x, VOC, SO_2, and/or direct PM_{2.5}) that would by themselves be emitted by a new or modifying source in a significant amount would be included in the air quality analysis.

• 14 informal comment packages received from the co-regulatory (Regional Office, State, & Local) and external stakeholder communities.
Upon reconsideration by the new administration and consistent with Executive Order 13990, EPA altered an important aspect of the draft guidance and then sought additional public review and comment via a revised draft guidance document released on September 20, 2021.

- [https://www.epa.gov/scram/revised-draft-guidance-ozone-and-fine-particulate-matter-permit-modeling](https://www.epa.gov/scram/revised-draft-guidance-ozone-and-fine-particulate-matter-permit-modeling)

In the revised draft guidance, the “Pollutant Applicability” approach was replaced with a “Holistic” approach.

- In order to make the required demonstration that the allowable emissions increases from a source or modification would not cause or contribute to any NAAQS or PSD increment violation, sources should provide a **full accounting** of the combined impacts of their allowable precursor (and direct component, in the case of PM\(_{2.5}\)) emissions on ambient concentrations of the relevant NAAQS (i.e., \(O_3\) or PM\(_{2.5}\)) if any precursor(s) (or the direct component, in the case of PM\(_{2.5}\)) would be emitted in a significant amount.

This “Holistic” approach was and continues to be supported both scientifically and legally:

- Scientifically – ensures that the source provides a full accounting of its projected air quality impacts for the relevant NAAQS, including all precursor (and direct component, in the case of PM\(_{2.5}\)) emissions
- Legally – needed to meet the requirements in the PSD regulations that the owner or operator of a proposed new major stationary source or major modification demonstrate that it will not cause or contribute to a NAAQS or PSD increment violation

- 13 informal comment packages received from the co-regulatory (State, Local, & **Tribal**) and external stakeholder communities
The final “Guidance for Ozone and Fine Particulate Matter Permit Modeling” was released on July 29, 2022.

- Based on the feedback received to both the February 2020 draft and September 2021 revised draft guidance documents
- There were a few clarifications and associated updates, but the final guidance maintains the “Holistic” compliance demonstration approach and all other recommendations from the revised draft guidance.
- [https://www.epa.gov/scram/guidance-ozone-and-fine-particulate-matter-permit-modeling](https://www.epa.gov/scram/guidance-ozone-and-fine-particulate-matter-permit-modeling)

To clearly address several of the comments received... “It’s only guidance.”

“This guidance does not create any rights or obligations enforceable by any party or impose binding, enforceable requirements on any PSD permit applicant, PSD permitting authority, the EPA, or any other person. Since each permitting action will be considered on a case-by-case basis, this document does not limit or restrict any particular justifiable approach that permit applicants and permitting authorities may take to conduct the required compliance demonstrations. Each individual decision to issue a PSD permit must be supported by a record sufficient to demonstrate that the proposed construction and operation of a stationary source will not cause or contribute to a violation of the applicable NAAQS and PSD increments.”

In the final guidance, EPA is basing our recommended compliance demonstration approaches on our legal and policy definition of the NAAQS pollutants, $O_3$ and $PM_{2.5}$. 
Final Guidance – O₃ Assessments

• Table III-1. EPA Recommended Approaches for Assessing O₃ Impacts by Assessment Case
  
  • There is not a primary impacts approach for O₃. Only the secondary formation from NOx and VOC is considered.
  
  • Given the reasonable particularity for which quantitative assessments of secondarily formed O₃ can be made (e.g., MERPs), qualitative assessments are no longer recommended in most situations.

<table>
<thead>
<tr>
<th>Assessment Case</th>
<th>Description of Assessment Case</th>
<th>Secondary Impacts Approach*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1: No Air Quality Analysis</td>
<td>NOₓ emissions and VOC emissions &lt; 40 tpy SER</td>
<td>N/A</td>
</tr>
<tr>
<td>Case 2*: Secondary Air Quality Impacts</td>
<td>NOₓ emissions or VOC emissions = 40 tpy SER</td>
<td>Include both precursors of O₃, see Section II.2.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Tier 1 Approach (e.g., MERPs)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Tier 2 Approach (e.g., Chemical Transport Modeling)</td>
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</tbody>
</table>

* In unique situations (e.g., in parts of Alaska where photochemistry is not possible for portions of the year), it may be acceptable for the applicant to rely upon a qualitative approach to assess the secondary impacts. Any qualitative assessments should be justified on a case-by-case basis in consultation with the appropriate permitting authority and the appropriate EPA Regional Office.

• Note: Do not sum precursor emissions levels to compare to the SER.
### Final Guidance – PM$_{2.5}$ Assessments

- **Table III-2.** EPA Recommended Approaches for Assessing Primary and Secondary PM$_{2.5}$ Impacts by Assessment Case
  - Essentially identical to Table III-1 for O$_3$ with the exception of the assessment of Direct PM$_{2.5}$.
  - Given the reasonable particularity for which quantitative assessments of secondarily formed PM$_{2.5}$ can be made (e.g., MERPs), qualitative assessments are no longer recommended in most situations.

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<tr>
<td>Case 1: No Air Quality Analysis</td>
<td>Direct PM$_{2.5}$ emissions &lt; 10 tpy SER and NO$_X$ emissions and SO$_2$ emissions &lt; 40 tpy SER</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Case 2*: Primary and Secondary Air Quality Impacts</td>
<td>Direct PM$_{2.5}$ emissions $\geq$ 10 tpy SER or NO$_X$ emissions or SO$_2$ emissions $\geq$ 40 tpy SER</td>
<td>Appendix W preferred or approved alternative dispersion model</td>
<td>Include both precursors of PM$_{2.5}$, see Section II.2.</td>
</tr>
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* In unique situations (e.g., in parts of Alaska where photochemistry is not possible for portions of the year), it may be acceptable for the applicant to rely upon a qualitative approach to assess the secondary impacts. Any qualitative assessments should be justified on a case-by-case basis in consultation with the appropriate EPA Regional Office or other applicable permitting authority.

**Note:** Do not sum direct component and precursor emissions levels to compare to the SER.
Don’t Stress Precursor Assessment...

- Take advantage of the [MERPs Guidance](#) and related hypothetical source modeling readily available from EPA via the [MERPs VIEW Qlik Application](#)

- The empirical relationship that is established in the development of a MERP for a particular precursor in a region/area can be used to reasonably estimate the impact of that precursor from other sources in that region/area when the equation is rewritten to solve for the “modeled air quality impact.”
  - Original MERPs equation as presented in the MERPs Guidance
    \[
    \text{MERP} = \text{Critical Air Quality Threshold} \times \left( \frac{\text{Modeled emission rate from hypothetical source}}{\text{Modeled air quality impact from hypothetical source}} \right)
    \]
  - Modified MERPs equation to solve for modeled air quality impact
    \[
    \frac{\text{Modeled air quality impact from hypothetical source}}{\text{Critical Air Quality Threshold}} = \frac{\text{Modeled emission rate from hypothetical source}}{\text{MERP}}
    \]

- Note: Permit authorities are free to develop other Tier 1 approaches, but MERPs are our current recommendation.
For an O₃ SIA, one would add the MERP calculated modeled impact for each precursor (NOₓ and VOC).

- If the combined O₃ impact for both precursors is less than the O₃ SIL, then you have an adequate O₃ compliance demonstration... otherwise an O₃ CIA is required.

For a PM₂.₅ SIA, one would run AERMOD (or approved alternative) for the direct PM₂.₅ sources at the new or modifying facility. Add the high-first-high (H₁H) value from AERMOD to the MERP calculated modeled impact for each precursor (NOₓ and SO₂).

- If the combined PM₂.₅ impact for the direct and both precursors is less than the appropriate PM₂.₅ SIL, then you have an adequate PM₂.₅ compliance demonstration... otherwise a PM₂.₅ CIA is required.

Note: It is strongly encouraged that the most representative MERP relationship for the region/area is used and not the most conservative relationships for the entire country.
For an O$_3$ CIA, the secondary impacts from the modified MERP equation for each precursor (NO$_x$ and VOC) would be combined with background.

- If the combined value is less than the NAAQS or PSD Increment, then an adequate O$_3$ compliance demonstration has been made.
- If violations are found, then a Tier 2 analysis would be required. Please contact the EPA Regional Office and OAQPS through the appropriate permit review authority.

In a PM$_{2.5}$ CIA, the secondary impacts from the modified MERP equation for each precursor (NO$_x$ and SO$_2$) would be added to the background that is included with the traditional AERMOD modeling of the direct PM$_{2.5}$ from the new or modifying source and any nearby sources.

- If no violations of the NAAQS or PSD Increment are found in the domain, then an adequate PM$_{2.5}$ compliance demonstration has been made.
- If violations are found, then the traditional culpability analysis would ensue.

• Note: A misconception has been that cumulative modeling meant that a Tier 2 assessment and the need for chemical transport modeling (e.g., CMAQ or CAMx). This is not the case... one can continue using a Tier 1 approach with the modified MERP equation, even in situation when the SIL is exceeded and/or the precursor pollutant emissions rate is above the MERP threshold for that region/area.
Hourly Pairing of Background is Still Out

- Considering the spatial and temporal variability throughout a typical modeling domain on an hourly basis and the complexities and limitations of hourly observations from the current PM$_{2.5}$ ambient monitoring network, we do not recommend a "paired sums" approach on an hour-by-hour basis.
- The pairing of daily monitored background and 24-hour average modeled concentrations is not recommended except in rare cases of relatively isolated sources where the available 1-in-1 day FRM/FEM monitor can be shown to be representative of the ambient concentration levels in the areas of maximum impact from the proposed new source.

The EPA also does not endorse or recommend any ‘scaling’ techniques for the assessment of primary PM$_{2.5}$ when less than 10 tpy and an air quality assessment is necessary.

- If one needs to or is required to assess primary PM$_{2.5}$, then it should be done with the EPA recommended screening model, AERSCREEN, or the EPA preferred model, AERMOD, as described in Section 4.2.3.5 of Appendix W.
- AERSCREEN/AERMOD modeling will already be necessary for the 1-hour NO$_x$ or SO$_2$ sources that are above the respective SERs, so only marginal increase in computational and operational costs.
- Accurate/appropriate source and emissions characterizations will become increasingly important!
- Reliance upon old or overly conservative emissions factors could easily cause compliance demonstration issues.
• The July 29, 2022, “Guidance for Ozone and Fine Particulate Matter Permit Modeling” fully replaces the previous September 20, 2021, revised draft and February 10, 2020, draft guidance documents and the recommendations contained within them.

• The 2014 “Guidance on PM<sub>2.5</sub> Permit Modeling” is completely retired at this point and has been replaced with new guidance and clarifications presented throughout this webinar.

• As additional experience is gained with O<sub>3</sub> and PM<sub>2.5</sub> PSD compliance demonstrations, the EPA may update this and related guidance and provide further specificity on procedures for assessing the impacts of a single source on O<sub>3</sub> and secondary PM<sub>2.5</sub> concentrations.

• The EPA continues to recommend that permit applicants engage early with the appropriate reviewing authority and that the co-regulatory agencies consult with the appropriate EPA Regional Office regarding all O<sub>3</sub> and PM<sub>2.5</sub> compliance demonstrations, especially if a permit applicant feels compelled to perform any chemical transport modeling.

Final Thoughts on the Final Guidance
Questions?

• I’ll circumvent the first question(s):
  • Yes, this release webinar presentation will be posted on SCRAM within the next 24-hours... same web page as the final guidance posting.
  • No, we do not have / are not going to post a recording of today’s webinar.

• We have time for a few additional questions during this webinar.
  • Please unmute your microphone to ask your question or use the chat box.
  • We will make every attempt to answer your question today or will follow-up after this engagement.

• Further questions or needed clarifications in the future can be directed to George Bridgers, Bridgers.George@epa.gov.