



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
RESEARCH TRIANGLE PARK, NC 27711

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OFFICE OF  
AIR QUALITY PLANNING  
AND STANDARDS

**MEMORANDUM**

SUBJECT: Proposed Approach for Demonstrating PM<sub>2.5</sub> PSD Compliance

FROM: Tyler J. Fox, Group Leader   
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Office of Air Quality Planning and Standards

TO: Proposed Regulatory Docket No. EPA-HQ-OAR-2015-0310

Introduction

To specifically assist the public in commenting on the “Revision to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter” proposed rule within the overall context of the New Source Review (NSR) program, including Prevention of Significant Deterioration (PSD), the Environmental Protection Agency (EPA) has added two memoranda to the docket of this proposed rule.<sup>1,2</sup> These memoranda provide details on how a future approach to PSD compliance demonstrations will work for secondary fine particulate matter (PM<sub>2.5</sub>) and also describe our expectations for how such an approach might work for ozone based on future, separate actions to establish a Significant Impact Level (SIL) and Model Emissions Rates for Precursors (MERPs) for PM<sub>2.5</sub> and ozone. This memorandum will focus on PM<sub>2.5</sub> and the related precursors sulfur dioxide (SO<sub>2</sub>) and nitrogen dioxide (NO<sub>2</sub>).

The complex chemistry of secondary formation of PM<sub>2.5</sub> is well-documented and has historically presented significant challenges with the identification and establishment of particular models for assessing the impacts of individual stationary sources on the formation of

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<sup>1</sup> U.S. EPA, 2015. “Proposed Approach for Demonstrating PM<sub>2.5</sub> PSD Compliance”, Memorandum to Docket No. EPA-HQ-OAR-2015-0310 by Tyler J Fox, U.S. EPA/OAQPS, Research Triangle Park, NC. June 30, 2015.

<sup>2</sup> U.S. EPA, 2015. “Proposed Approach for Demonstrating Ozone PSD Compliance”, Memorandum to Docket No. EPA-HQ-OAR-2015-0310 by Tyler J Fox, U.S. EPA/OAQPS, Research Triangle Park, NC. June 30, 2015.

this air pollutant.<sup>3, 4, 5</sup> Because of these considerations, the EPA's judgment in the past has been that it was not technically sound to assign with particularity specific models that must be used to assess the impacts of a single source on PM<sub>2.5</sub> concentrations. Instead, the EPA has chosen to satisfy the requirements of Section 165(e) (3) (D) of the Clean Air Act (CAA) by determining particular models or other analytical techniques that should be used on a case-by-case basis.<sup>6</sup> As stated in Section 5.2.2.1.c of the current *Guideline on Air Quality Models* (published as Appendix W to 40 CFR Part 51, hereafter *Guideline*), the “[c]hoice of methods used to assess the [PM<sub>2.5</sub>] impact of an individual source depends on the nature of the source and its emissions.” Under this approach, the appropriate methods for assessing PM<sub>2.5</sub> impacts are determined in consultation with the appropriate EPA Regional Office and/or permit reviewing authority on a case-by-case basis. A modeling protocol should be developed by the permit applicant and approved by the appropriate permitting authority to ensure that the analysis conducted will conform to the recommendations, requirements, and principles of Section 10.2.1 of the current *Guideline*.

In the January 2012, Sierra Club petition grant,<sup>7</sup> the EPA committed to engage in rulemaking to evaluate whether updates to the *Guideline* are warranted and, as appropriate, incorporate new analytical techniques or models for ozone and secondarily formed PM<sub>2.5</sub>. The EPA’s proposed revisions to the *Guideline* satisfies the EPA’s commitment in the petition grant. As a part of this commitment and in compliance with CAA section 320, the EPA conducted the Tenth Modeling Conference in March 2012, where there were presentations of ongoing research of single-source plume chemistry and photochemical grid modeling techniques, as well as several public forums, and the EPA subsequently received written comments pertaining to such modeling. The EPA initiated Phase 3 of the Interagency Workgroup on Air Quality Modeling (IWAQM) process in June 2013 to inform this process to update the *Guideline* to address chemically reactive pollutants for near-field and long-range transport applications. Comments received from stakeholders at the Tenth Modeling Conference supported this collaborative effort to provide additional guidance for modeling single-source impacts of secondarily formed pollutants in the near-field and for long-range transport. Stakeholder comments also supported

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<sup>3</sup> NARSTO, 2004. Particulate Matter Assessment for Policy Makers: A NARSTO Assessment. P. McMurry, M. Shepherd, and J. Vickery, eds. Cambridge University Press, Cambridge, England. ISBN 0 52 184287 5.

<sup>4</sup> Seinfeld and Pandis, 1998. Atmospheric Chemistry and Physics: From Air Pollution to Climate Change. J. Seinfeld and S. Pandis. Wiley Interscience. New York, New York. ISBN 0 47 117815 2.

<sup>5</sup> Cohan and Napelenok, 2011. Atmospheric Response Modeling for Decision Support. D. Cohan and S. Napelenok. *Atmosphere*. 2011; 2(3): 407-425.

<sup>6</sup> We note that this technical judgment has no effect on the obligation of sources subject to PSD to conduct a source impact analysis and demonstrate that a proposed source or modification will not cause or contribute to a violation of any NAAQS or applicable increment. 40 CFR 51.166(k); 52.21(k). That is, the inclusion of a process rather than a specific preferred model in Appendix W does not relieve the source of the requirement to make this demonstration, which necessarily involves an analysis.

<sup>7</sup> U.S. EPA, 2012. Gina McCarthy Letter to Robert Ukeiley dated January 4, 2012, Washington, D.C. 20460. [http://www.epa.gov/ttn/scram/10thmodconf/review\\_material/Sierra\\_Club\\_Petition\\_OAR-11-002-1093.pdf](http://www.epa.gov/ttn/scram/10thmodconf/review_material/Sierra_Club_Petition_OAR-11-002-1093.pdf).

the idea of this collaborative effort occurring in parallel with stakeholders' efforts to further model development and evaluation. The EPA's recommended revisions to the *Guideline* are largely based on detailed review and assessment of this input.

The remainder of this memo provides a summary of the current approach, as described in more detail in the EPA's *Guidance for PM<sub>2.5</sub> Permit Modeling*,<sup>8</sup> and the proposed approach, as anticipated under the proposed revisions to the *Guideline* and other future EPA rulemakings and guidance, for demonstrating compliance with the PM<sub>2.5</sub> National Ambient Air Quality Standards (NAAQS) and PSD increments.

### Summary of Current Approach

The EPA provided the *Guidance on PM<sub>2.5</sub> Permit Modeling* on May 2014,<sup>8</sup> based on a previous March 2010, EPA guidance memorandum,<sup>9</sup> the National Association of Clean Air Agencies (NACAA) PM<sub>2.5</sub> Modeling Implementation Workgroup final report recommendations,<sup>10</sup> input from a mixture of stakeholders through numerous forums, comments received on the EPA's March 2013, *Draft Guidance for PM<sub>2.5</sub> Permit Modeling*,<sup>11</sup> and case-by-case involvement with recent applicant submitted PM<sub>2.5</sub> compliance demonstrations. This guidance document recommends appropriate technical approaches for conducting a PM<sub>2.5</sub> NAAQS and increment compliance demonstration which includes more adequate accounting for contributions from secondarily formed PM<sub>2.5</sub> concentrations resulting from a proposed new or modifying source's precursor emissions. The EPA has historically allowed the use of demonstration tools to help facilitate the implementation of the PSD program by reducing the

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<sup>8</sup> U.S. EPA, 2014. *Guidance for PM<sub>2.5</sub> Modeling*. May 20, 2014, Publication No. EPA-454/B-14-001. Office of Air Quality Planning & Standards, Research Triangle Park, NC.  
[http://www.epa.gov/ttn/scram/guidance/guide/Guidance\\_for\\_PM25\\_Permit\\_Modeling.pdf](http://www.epa.gov/ttn/scram/guidance/guide/Guidance_for_PM25_Permit_Modeling.pdf).

<sup>9</sup> U.S. EPA, 2010. *Modeling Procedures for Demonstrating Compliance with PM<sub>2.5</sub> NAAQS*. Tyler Fox Memorandum dated March 23, 2010, Office of Air Quality Planning & Standards, Research Triangle Park, North Carolina 27711.  
<http://www.epa.gov/ttn/scram/guidance/clarification/Official%20Signed%20Modeling%20Proc%20for%20Demo%20Compli%20w%20PM2.5.pdf>.

<sup>10</sup> NACAA, 2011. *PM<sub>2.5</sub> Modeling Implementation for Projects Subject to National Ambient Air Quality Demonstration Requirements Pursuant to New Source Review*. Report from NACAA PM<sub>2.5</sub> Modeling Implementation Workgroup dated January 7, 2011. Washington, District of Columbia 20001.  
[http://www.epa.gov/ttn/scram/10thmodconf/review\\_material/01072011-NACAAPM2.5ModelingWorkgroupReport-FINAL.pdf](http://www.epa.gov/ttn/scram/10thmodconf/review_material/01072011-NACAAPM2.5ModelingWorkgroupReport-FINAL.pdf).

<sup>11</sup> U.S. EPA, 2013. *Draft Guidance for PM<sub>2.5</sub> Permit Modeling*. March 4, 2013. EPA-454/B-11-001. U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711.  
[http://www.epa.gov/ttn/scram/guidance/guide/Draft\\_Guidance\\_for\\_PM25\\_Permit\\_Modeling.pdf](http://www.epa.gov/ttn/scram/guidance/guide/Draft_Guidance_for_PM25_Permit_Modeling.pdf).

permit applicant's burden and streamlining the permitting process for de minimis circumstances. These tools include a significant emissions rate (SER) and a SIL.<sup>12</sup>

As shown in Figure 1 and Figure 2, once it is determined that the proposed new source or modification is significant for PM<sub>2.5</sub> based on the respective SER, an air quality impact analysis must be carried out. The SIL helps to determine the scope of the required air quality analysis that must be carried out to demonstrate that the source's emissions will not cause or contribute to a violation of any NAAQS or increment. Historically, sources have been allowed to model their proposed emissions increase to predict ambient impacts associated with that emissions increase and to compare this predicted ambient concentration of PM<sub>2.5</sub> to the applicable SIL, which is also expressed as an ambient PM<sub>2.5</sub> concentration over a prescribed averaging time consistent with the NAAQS and increments. If the source's modeled impacts are found to be at or below the level of the applicable SIL and those impacts would not otherwise cause or contribute to a violation of any NAAQS or increment, then the source impact analysis is considered sufficient to demonstrate compliance. If the source's modeled impacts are found to be greater than the level of the applicable SIL, then a cumulative impact analysis is deemed necessary to determine compliance.

Under the current permit modeling guidance, to use SILs as a demonstration tool to determine whether it is necessary to conduct a cumulative analysis of NAAQS compliance, the permitting authority must first examine background air quality concentrations to determine whether a substantial portion of the NAAQS has been consumed. If the difference between the PM<sub>2.5</sub> NAAQS and the measured PM<sub>2.5</sub> background concentrations in the area is greater than or equal to the applicable SIL then the EPA believes it would be sufficient in most cases for permitting authorities to conclude that a source with an impact equal to or below that SIL value will not cause or contribute to a violation of the NAAQS. The above comparison of background air quality concentrations and the NAAQS would not by itself provide adequate justification for the PM<sub>2.5</sub> increments. Such an approach would be inappropriate because it would not ensure that there is sufficient "headroom" within the allowable increment to absorb a source contribution equal to the SIL. As indicated in Figure 2, under this situation, a permitting authority may have sufficient reason to conclude that the impacts of the new or modified source may be compared directly to the allowable increments, without the need for a cumulative modeling analysis. Such a situation would involve the new or modified source representing the first PSD application in the area after the trigger date, which establishes the minor source baseline date and baseline area, and confirmation that no relevant major source construction has already occurred since the major source baseline date.

A cumulative impact analysis accounts for the combined impacts of the new or modifying source emissions, emissions from other nearby sources, and representative

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<sup>12</sup> On January 22, 2013, the D.C. Circuit Court of Appeals vacated the portions of two PSD regulations (40 CFR 51.166 and 40 CFR 52.21) that established a PM<sub>2.5</sub> SMC. Pending additional rulemaking or interim guidance, SMCs are not discussed further in the Draft Guidance for PM<sub>2.5</sub> Permit Modeling.

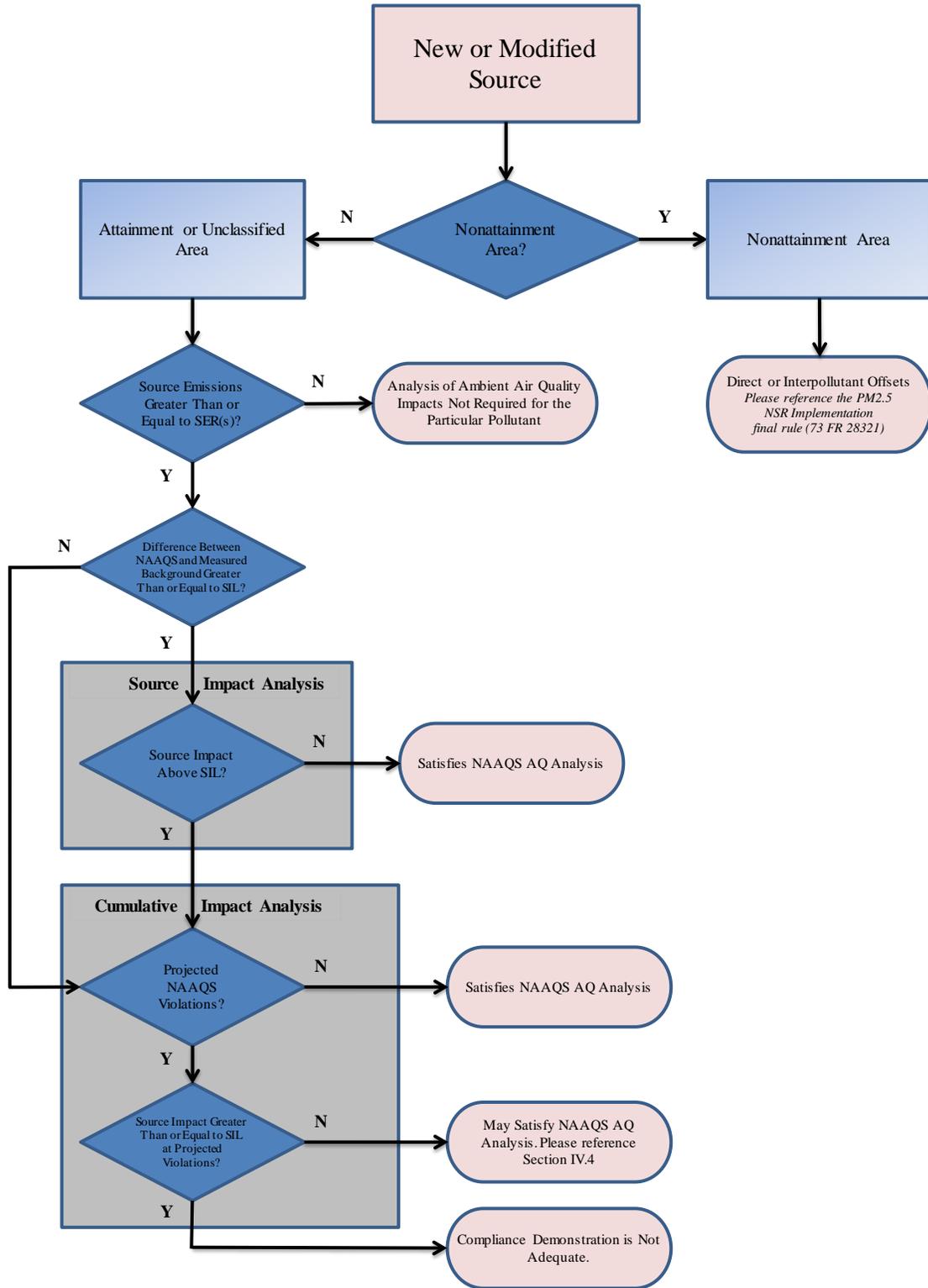
background levels of PM<sub>2.5</sub> within the modeling domain. The cumulative impacts are then compared to the NAAQS to determine whether the new or modifying source will cause or contribute to a violation of the NAAQS. Several aspects of the cumulative impact assessment for PM<sub>2.5</sub> will be comparable to assessments conducted for other criteria pollutants, while other aspects will differ due largely to its secondary formation. For PSD increment, cumulative assessment accounts for the combined impact of the new or modifying source's emissions and those emissions changes from sources that affect the increment. The cumulative impacts are then compared to the PSD increments to determine whether the new or modifying source emissions will cause or contribute to a violation of the PSD increments.

The EPA's *Guidance for PM<sub>2.5</sub> Permit Modeling*<sup>8</sup> provides more details on the recommended approaches for assessing the impacts of precursor emissions on secondary PM<sub>2.5</sub> formation including:

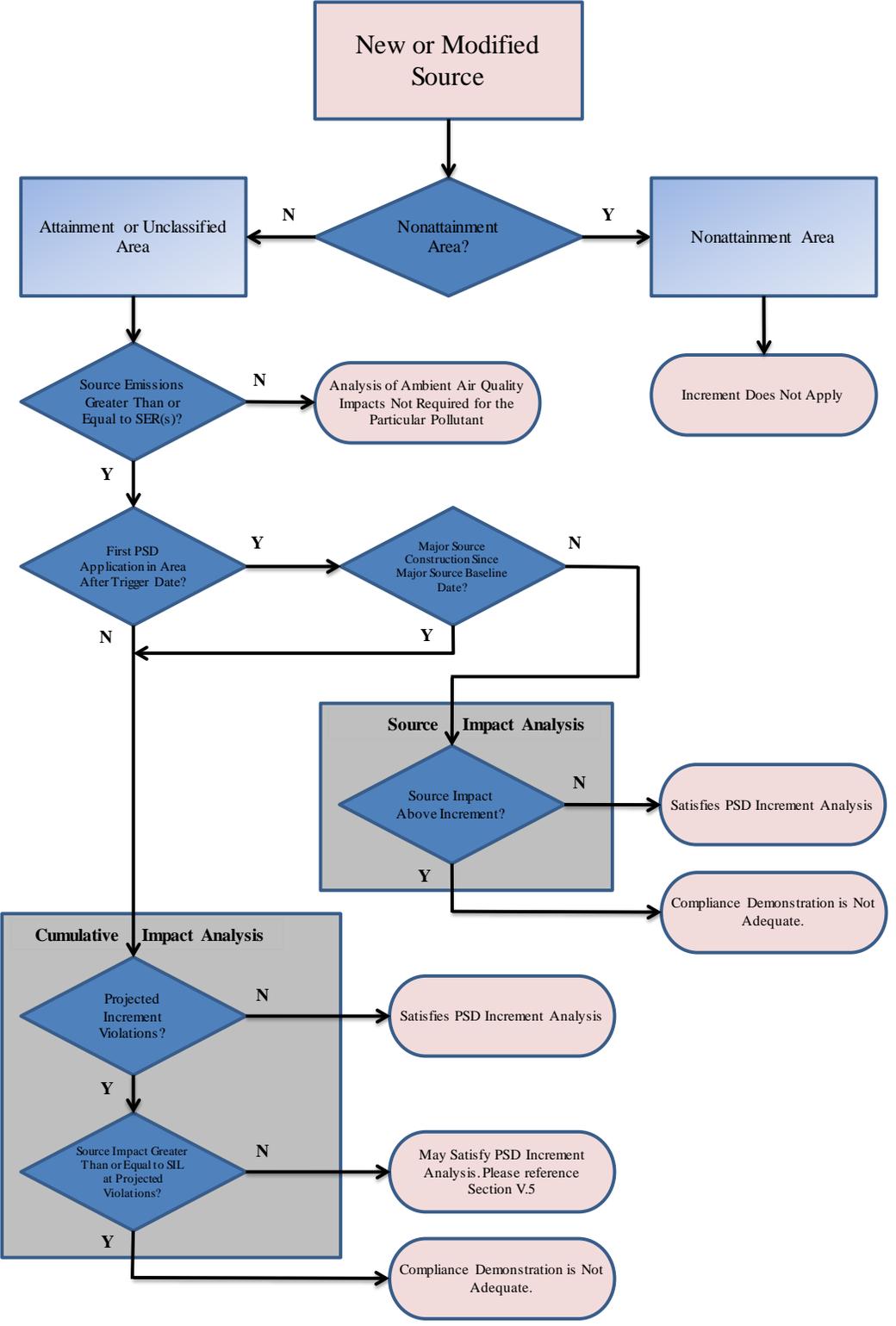
- a qualitative assessment;
- a hybrid of qualitative and quantitative assessments utilizing existing technical work; and
- a full quantitative chemical transport modeling exercise.

The EPA anticipates only a few situations would require explicit full chemical transport modeling.

**Figure 1. Overview of NAAQS Compliance Demonstration for New or Modifying Sources under NSR/PSD Programs: Under Current EPA Rulemakings & Guidance**



**Figure 2. Overview of PSD Increments Compliance Demonstration for New or Modifying Sources under NSR/PSD Programs: Under Current EPA Rulemakings & Guidance**



## Summary of Proposed Approach under Future EPA Rulemakings

For the proposed revisions to the *Guideline*, the EPA has determined that advances in photochemical modeling science indicate it is now reasonable to provide more specific, generally-applicable guidance that identifies particular models or analytical techniques that may be used under specific circumstances for assessing the impacts of an individual source on secondary PM<sub>2.5</sub>. For assessing secondary pollutant impacts from single sources, the degree of complexity required to assess potential impacts varies depending on the nature of the source, its emissions, and the background environment. In order to provide the user community flexibility in estimating single-source secondary pollutant impacts and given the emphasis on the use of chemical transport (*e.g.*, photochemical grid) models for these purposes, the EPA is proposing a two-tiered demonstration approach for addressing single-source impacts on secondary PM<sub>2.5</sub>, *i.e.*,

- First tier involves use of technically credible relationships between precursor emissions and a source's impacts that may be published in the peer-reviewed literature; developed from modeling that was previously conducted for an area by a source, a governmental agency, or some other entity and that is deemed sufficient; or generated by a peer-reviewed reduced form model.
- Second tier involves application of more sophisticated case-specific chemical transport models (*e.g.*, photochemical grid models) to be determined in consultation with the EPA Regional Office and conducted consistent with new EPA single-source modeling guidance.<sup>13</sup>

To fully implement these proposed changes to the *Guideline* related to addressing secondary PM<sub>2.5</sub> impacts, the EPA intends to pursue a separate rulemaking to establish a technical basis and new values for PM<sub>2.5</sub> Significant Impact Levels (SILs) and to introduce a new demonstration tool for PM<sub>2.5</sub> precursors referred to as Model Emissions Rates for Precursors (MERP). As shown in Figure 3 and Figure 4, when completed, this rule would differ from the current process recommended in the EPA's *Guidance for PM<sub>2.5</sub> Permit Modeling*.<sup>8</sup> A MERP would neither replace the existing Significant Emissions Rates (SERs) for these pollutants nor serve as the basis for the applicability of PSD requirements to sources with emissions above the SER. However, a MERP would represent a level of emissions of precursors that is not expected to contribute significantly to concentrations of secondarily-formed PM<sub>2.5</sub>. Our present understanding of the atmospheric science of secondary PM<sub>2.5</sub> formation indicates that MERP values for NO<sub>x</sub> and SO<sub>2</sub> will likely be higher than their SERs as criteria pollutants and more appropriate for evaluating their impacts as precursor pollutants to PM<sub>2.5</sub> formation. As part of the separate rulemaking, the EPA intends to demonstrate that a source with precursor emissions of NO<sub>x</sub> or SO<sub>2</sub> below the MERP level will have ambient impacts that will be less than the SIL and,

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<sup>13</sup> U.S. EPA, 2015. Guidance on the use of models for assessing the impacts from single sources on secondarily formed pollutants ozone and PM<sub>2.5</sub>. Publication No. EPA 454/P-15-001. Office of Air Quality Planning & Standards, Research Triangle Park, North Carolina 27711.

thereby, provide a sufficient demonstration that the source will not cause or contribute to a violation of the PM<sub>2.5</sub> NAAQS or PSD increments.

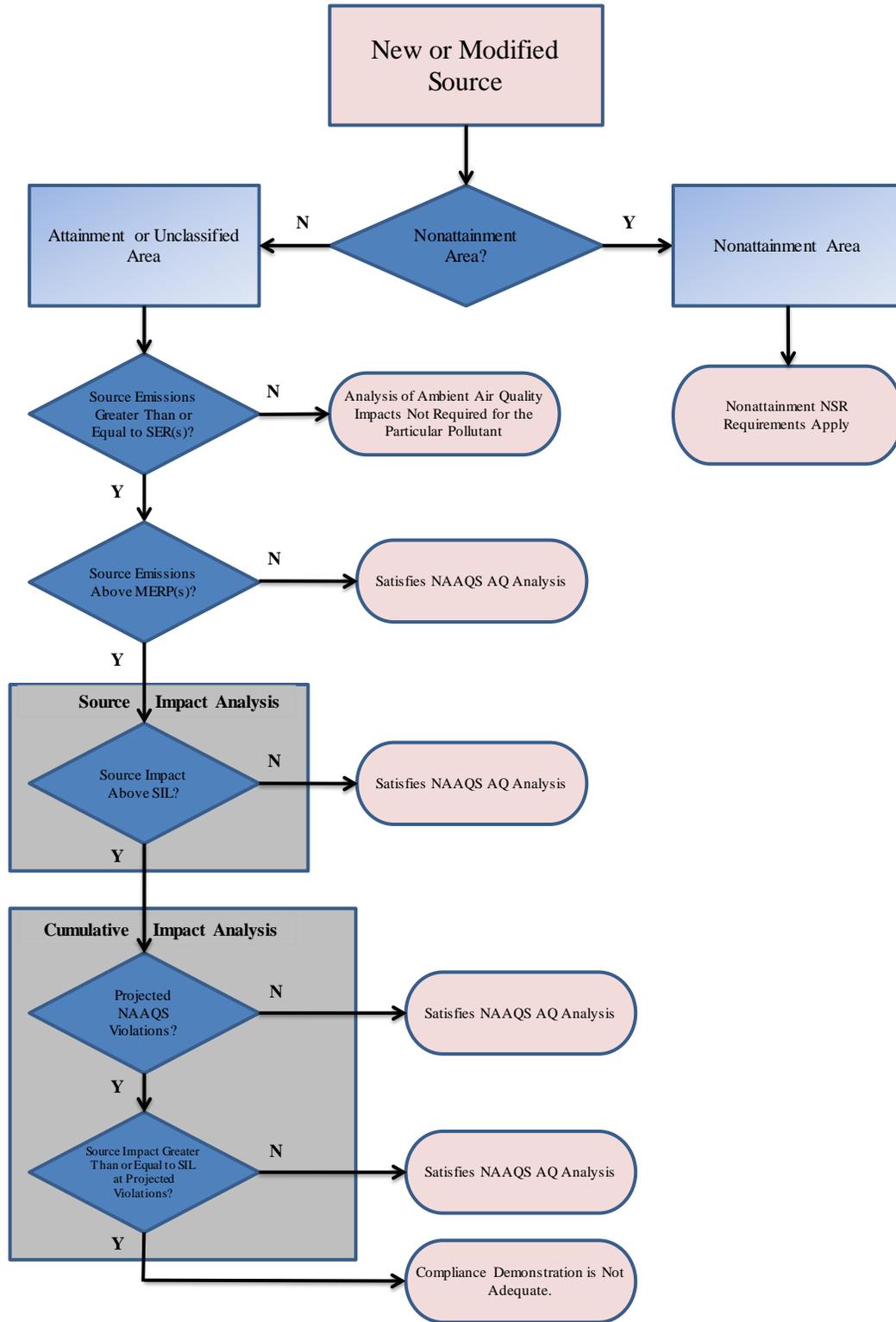
As noted above, the EPA's *Guidance for PM<sub>2.5</sub> Permit Modeling*<sup>8</sup> provides for a three-tiered approach to address secondary PM<sub>2.5</sub> that includes:

- 1) a qualitative assessment;
- 2) a hybrid qualitative/quantitative assessment utilizing existing technical work; and
- 3) a full quantitative modeling exercise.

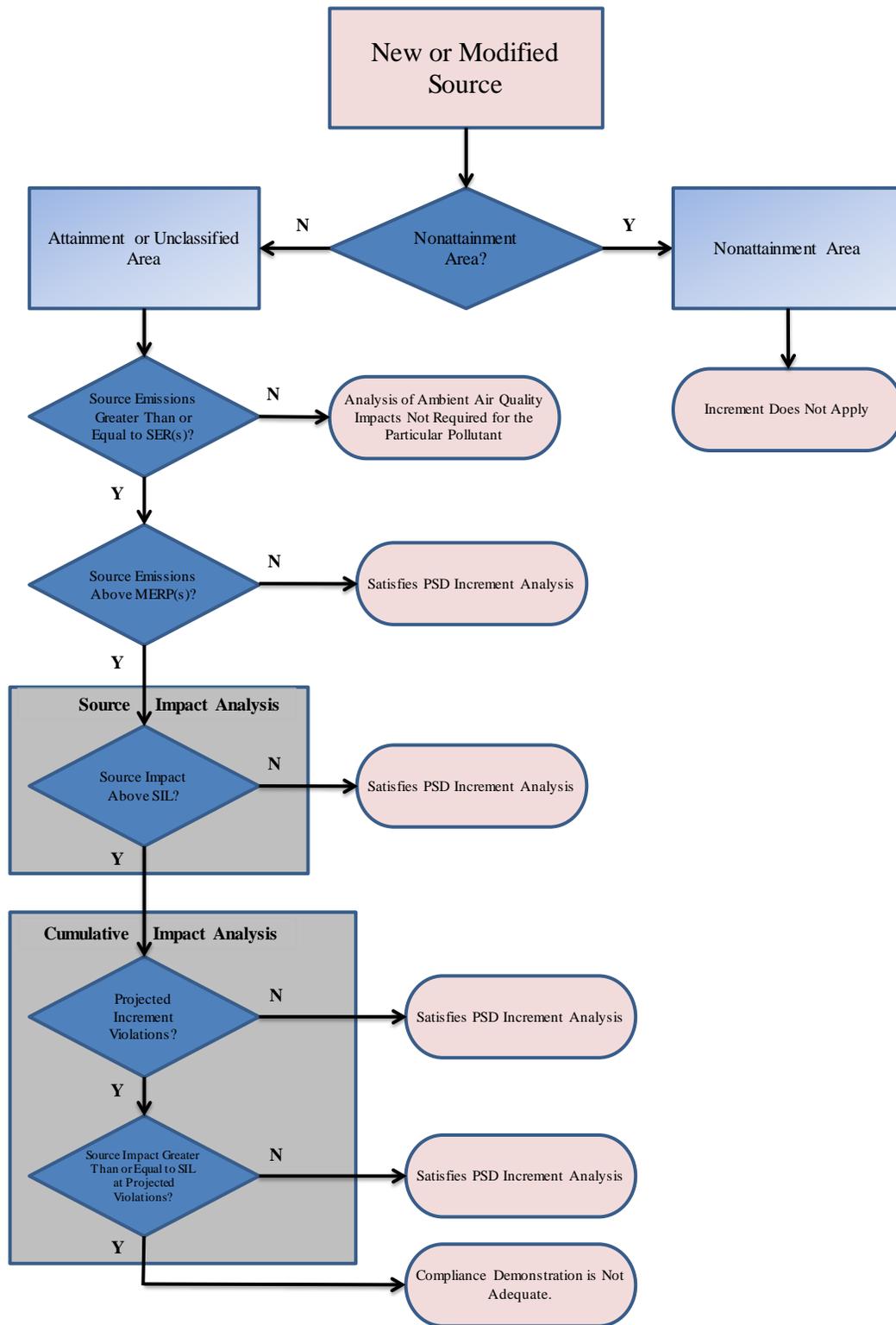
The EPA expects that MERPs as a demonstration tool will replace the first tier of a qualitative assessment as sources that currently would provide a qualitative assessment are expected to have precursor emissions levels below the MERP. The second and third tier of assessment will then be consistent with the EPA's proposed two-tiered demonstration approach for PM<sub>2.5</sub> reflected in Section 5.4.2 of today's proposed revisions to the *Guideline*.

While the development of MERPs for secondary PM<sub>2.5</sub> precursors is expected to address a number of PSD permitting situations, the EPA believes that most of the remaining situations in which a source must demonstrate compliance under the proposed *Guideline* will be addressed sufficiently under the proposed first tier where existing technical information could be used in combination with other supportive information and analysis for the purposes of estimating secondary impacts from a particular source. The existing technical information should provide a credible and representative estimate of the secondary impacts from the project source. In these situations, a more refined approach for estimating secondary pollutant impacts from project sources may not be necessary. The EPA has been compiling and reviewing screening approaches that are based on technically credible tools (*e.g.*, photochemical grid models) that relate source precursor emissions to secondary impacts. In review of existing approaches detailed in peer reviewed journal articles and non-peer reviewed forms (*e.g.*, technical reports, conference presentations), it is not clear that a single approach has been clearly proposed to and evaluated by the modeling community for estimating screening level secondary impacts from single sources. Other screening level alternatives to chemical transport model application may include the use of existing credible photochemical model impacts for sources deemed to be similar in terms of emission rates, release parameters, and background environment. The EPA will continue to engage with the modeling community to identify credible alternative approaches for estimating single-source secondary pollutant impacts which provide flexibility and are less resource intensive for permit demonstration purposes.

**Figure 3. Overview of NAAQS Compliance Demonstration for New or Modifying Sources Under NSR/PSD Programs: Under Future EPA Rulemakings & Guidance**



**Figure 4. Overview of PSD Increments Compliance Demonstration for New or Modifying Sources under NSR/PSD Programs: Under Future EPA Rulemakings & Guidance**



## Summary

To summarize, the EPA is providing this memorandum to the docket of the “Revision to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter” proposed rule to specifically assist the public in providing comment. This memoranda provides details within the overall context of the NSR program, including PSD, on how a future approach to PSD compliance demonstrations will work for secondary PM<sub>2.5</sub> based on a future action to establish a SIL and MERPs for PM<sub>2.5</sub> and its precursors. If you have additional questions regarding this memorandum or the proposed rulemaking, please feel free to contact me, (919) 541-5562 or fox.tyler@epa.gov, or contact George Bridgers, (919) 541-5563 or bridgers.george@epa.gov.

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