OFFICE OF AIR AND RADIATION

WASHINGTON, D.C. 20460

February 7, 2024

MEMORANDUM

SUBJECT: Initial Area Designations for the 2024 Revised Primary Annual Fine Particle National Ambient Air Quality Standard

FROM: Joseph Goffman
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TO: Regional Administrators
Regions 1-10

This memorandum provides information on the schedule and process for initially designating areas for the purpose of implementing the 2024 revised primary annual fine particulate matter ($PM_{2.5}$) national ambient air quality standard (NAAQS or standard). In addition, this memorandum identifies important factors that the Environmental Protection Agency (EPA) intends to evaluate in making area designations and nonattainment area boundary decisions for this standard. The EPA recommends that states[1] and Tribes also consider these factors in making their recommendations for area designations and nonattainment area boundaries. As in prior designations for the $PM_{2.5}$ NAAQS, the EPA will also consider other relevant information in making final designations and boundary determinations. Please share this information with state and Tribal agencies in your region.

On February 7, 2024, the EPA promulgated a revised primary annual $PM_{2.5}$ NAAQS. In that action, the EPA revised the primary annual $PM_{2.5}$ standard, strengthening it from 12.0 micrograms per cubic meter ($\mu g/m^3$) to 9.0 $\mu g/m^3$. The EPA revised the primary annual $PM_{2.5}$ standard based on an integrated assessment of an extensive body of new scientific evidence, which strengthens the EPA's body of knowledge regarding $PM_{2.5}$-related health effects. As a result of this NAAQS revision, the Clean Air Act (CAA) requires that the EPA designate all parts of the country with respect to the revised primary standard.

[1] CAA section 302(d) defines the term "State" to mean a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, and American Samoa and includes the Commonwealth of the Northern Mariana Islands.

Clean Air Act Designations Requirements

Section 107(d) of the CAA governs the process for initial area designations after the EPA establishes a new or revised NAAQS. Under CAA section 107(d), states are required to submit designations recommendations to the EPA, by a date specified by the EPA, which cannot be sooner than 120 days after promulgation of the new or revised NAAQS and cannot be later than 1 year after the promulgation of the NAAQS. If the EPA decides that it is necessary to modify a state's recommendation and to promulgate a designation different from a state's recommendation, then the EPA must notify the state at least 120 days prior to promulgating the final designation, and the EPA must provide the state an opportunity to comment on the potential modification. These modifications may relate either to the designation category of an area or to the boundaries of an area, or both. The CAA requires the EPA to complete the initial area designations process within 2 years of promulgation of a new or revised NAAQS, unless the Administrator has insufficient information to make initial designations decisions in the 2-year time frame. In such circumstances, the EPA may take up to 1 additional year to make initial area designations decisions (i.e., no later than 3 years after promulgation of the standard). If a state or Tribe does not submit designations recommendations, then the EPA will promulgate the initial designations that it deems appropriate.

While section 107(d) of the CAA specifically addresses the designations process between the EPA and states, the EPA intends to follow the same process to the extent practicable for Tribes that choose to make initial area designations recommendations pursuant to section 301(d) of the CAA regarding Tribal authority and the Tribal Authority Rule (TAR) (63 FR 7254; February 12, 1998).[2] To provide clarity and consistency, in December 2011, the EPA issued a guidance memorandum concerning collaboration between the EPA and Tribes during the designations process.[3] In accordance with the TAR, the December 2011 Tribal designations guidance memorandum and the EPA's May 2011 Tribal Consultation Policy, the EPA intends to designate Tribal areas on the same schedule as state designations.[4]

Schedule for Initial Area Designations

Consistent with the schedule in CAA section 107(d)(1), state Governors are required to submit, and Tribes can choose to submit, their initial designations recommendations to the EPA for the 2024 revised primary annual $PM_{2.5}$ NAAQS no later than 1 year following promulgation of the revised NAAQS, or by February 7, 2025. Because of the form of the 2024 revised primary annual $PM_{2.5}$ NAAQS, states or Tribes recommendations will be based on air quality data from the 3 most recent years of monitoring data available at that time. Based upon these monitoring data, as well as the weight-of-evidence approach described in this memorandum, states or Tribes should identify areas as attainment, nonattainment, or unclassifiable.

[2] Tribes are not required to have "Treatment-In-A-Similar-Manner-As-A-State" (TAS) status to submit initial area designations recommendations to the EPA.

[3] Guidance to Regions for Working with Tribes during the National Ambient Air Quality Standards (NAAQS) Designations Process. Memorandum from Stephen D. Page, Director, EPA OAQPS to Regional Administrators, Regions I-X. December 20, 2011. Available at *https://www.epa.gov/sites/default/files/2017-02/documents/12-20-11_guidance_to_regions_for_working_with_tribes_naaqs_designations.pdf*.

[4] EPA Policy on Consultation and Coordination with Indian Tribes, May 4, 2011. Available at *https://www.epa.gov/sites/default/files/2013-08/documents/cons-and-coord-with-indian-tribes-policy.pdf*.

If the EPA decides it is necessary to make any modifications to a state's or Tribe's initial area designations recommendations, including area boundaries, then the EPA is required to notify the state or Tribe of this fact no later than 120 days prior to finalizing the designations. These notifications are commonly known as "120-day Letters." If a state or Tribe has additional information relevant to such an area that it wants the EPA to consider with respect to a designation recommendation that the EPA plans to modify, typically the EPA requests that such information be submitted no later than 60 days from the date of the EPA's 120-day Letter. This schedule will ensure that the EPA can fully consider any such additional information prior to issuing final designations.

Also, although CAA section 107(d) explicitly exempts the designations process from the normal public notice and comment rulemaking process, the EPA does intend to consider public input in the designations process. The EPA typically provides no less than a 30-day public comment period immediately following issuance of the 120-day Letters responding to the designations recommendations from states and Tribes. Attachment 1 summarizes an anticipated schedule based on the CAA's procedural guides.

Identifying Nonattainment Areas

Section 107(d)(1) of the CAA directs the EPA to designate an area nonattainment if it is violating the NAAQS or if it is contributing to a violation[5] of the NAAQS in a nearby area. To start the initial area designations process, states and the EPA must identify the areas that are violating the NAAQS. Thus, the first step in designating $PM_{2.5}$ nonattainment areas is to identify air quality monitoring sites with data that show a violation of the 2024 revised primary annual $PM_{2.5}$ NAAQS. For this purpose, the EPA intends to evaluate areas using the most recent complete 3 consecutive calendar years of quality-assured, certified air quality data in the EPA's Air Quality System (AQS).[6] In general, violations are identified using data from Federal Reference Method (FRM) and Federal Equivalent Method (FEM) monitors that are sited and operated in accordance with 40 CFR Part 58. Procedures for using the air quality data to determine whether a NAAQS violation has occurred are given in 40 CFR Part 50 Appendix N.

It is typical that in following a 2-year designations process, state and Tribal designations recommendations are based on one set of data years while the EPA's final designations decisions are based on an overlapping, but not identical, set of data years. This is because the most recent 3 years of certified air quality data used for final designations decisions will include 1 year of data that is not yet fully available while states and Tribes are developing their designations recommendations. The EPA expects that in providing designations recommendations, states and Tribes will review air quality data from 2021 to 2023. The EPA expects that in making final designations decisions, the EPA will rely on air quality data from 2022 to 2024. The process for determining appropriate nonattainment area boundaries, which must include areas nearby a violating monitor that are contributing to the violation, is discussed in detail in a later section of this memorandum.

[5] A violation of a NAAQS occurs when a design value is over the NAAQS level. An exceedance of a NAAQS occurs when a metric measure from a regulatory monitor is over the NAAQS level.

[6] More information on the EPA's AQS is available at *https://www.epa.gov/aqs*.

Exceptional Events and Designations

The EPA anticipates that exceptional events may be implicated during initial area designations for the 2024 revised primary annual $PM_{2.5}$ NAAQS. Initial area designations are an action of regulatory significance described in the EPA's "Treatment of Data Influenced by Exceptional Events" Final Rule (81 FR 68216; October 3, 2016) (Exceptional Events Rule or EER) and codified at 40 CFR 50.1, 50.14, and 51.930. Consistent with the Exceptional Events Rule, air quality monitoring data affected by exceptional events may be excluded from use in identifying a violation of regulatory significance at a regulatory ambient air monitoring site if the data meet the criteria for exclusion, as specified in the EER.

The EER contains general instructions and requirements for state and Tribal air agencies that wish to flag air quality data for certain days in AQS due to potential impacts from exceptional events (e.g., wildfires or high wind dust storms) and subsequently submit an exceptional events demonstration to the EPA. The EPA provides more information on the exceptional events-related deadlines as they relate to the current designations process in Attachment 2. These schedules reflect the EPA's interest in ensuring that exceptional events claims are fully considered, as appropriate, in final designations decisions. The EPA Regional offices are encouraged to work with states and Tribes with exceptional events claims to prioritize and expedite the demonstration development and review process for those claims for events in years 2022-2024 that have the potential to influence the EPA's regulatory decisions for initial area designations for the 2024 revised primary annual $PM_{2.5}$ NAAQS. Similarly, the EPA encourages states and Tribes to contact and collaborate with the appropriate EPA Regional office after identifying any exceptional events influencing ambient air quality concentrations in a way that could affect these initial area designations. The EPA may defer action on specific exceptional events requests by states or Tribes in our designations decisions if the EPA determines that concurrence on those events would not affect the designations decisions (i.e., the exceptional events claim would not have regulatory significance for initial area designations decisions). States and Tribes need not submit completed exceptional events demonstrations for data years that will not be relied upon by the EPA in making final designations decisions, however, they are expected to clearly indicate to the EPA if they believe any air quality data they rely on in their area designations recommendations were influenced by exceptional events.

In the context of initial area designations, the EPA acknowledges the possibility that the EPA will receive exceptional events demonstrations associated with Canadian wildfire smoke during the Summer 2023, as well as other types of events. The EPA is committed to ensuring a timely and efficient process for evaluating and making exceptional events determinations. The EPA intends to release additional tools and resources to assist air agencies developing PM-related exceptional events demonstrations, including events involving wildland fire. Additional information, resources, and best practice materials can be found at the EPA's exceptional events website located at *https://www.epa.gov/air-quality-analysis/final-2016-exceptional-events-rule-supporting-guidance-documents-updated-faqs*.

Nonattainment Area Analyses and Boundary Determinations

CAA section 107(d) explicitly requires that the EPA designate as nonattainment not only the area that is violating the standard at issue, but also those nearby areas that contribute to the violation(s). The EPA evaluates the boundaries for each nonattainment area on a case-by-case basis considering the specific facts and circumstances unique to the area.

After identifying each regulatory monitor or group of monitors that indicate a violation of the standard in an area, the EPA intends to begin its analysis of what nearby areas contribute to the violation(s) by considering those counties in the entire metropolitan area (i.e., Core Based Statistical Area (CBSA) or Combined Statistical Area (CSA)) in which the violating monitor(s) is (are) located.[7] The EPA also intends to evaluate any adjacent counties to the CBSA or CSA that have the potential to contribute. It is appropriate to start the analysis with the relevant CBSA or CSA for the area because measured ambient $PM_{2.5}$ concentrations across urban-scale distances tend to be highly correlated and composed of direct emissions and multiple secondarily-formed pollutants attributable to a variety of sources commonly found throughout urbanized areas.[8] Violations of the annual $PM_{2.5}$ NAAQS are usually the result of emissions from a broad variety of sources that are typically located across a metropolitan area. The CBSA or CSA for that area is thus a reasonable starting point for gathering information to conduct an analysis of what nearby areas may be contributing to the violation of the NAAQS at a given monitor or monitors in a violating area. Although the CBSA or CSA is the starting point for the EPA's evaluation of contributions to a violation, the EPA does not intend it to be a presumed nonattainment area boundary.

As a framework for area-specific analyses, the EPA intends to use, and recommends that states and Tribes base their nonattainment area boundary recommendations on, an evaluation of information relevant to five factors:[9] air quality data, emissions and emissions-related data, meteorology, geography/topography, and jurisdictional boundaries. Attachment 3 describes these factors and provides guidance regarding analyses relevant to each, consistent with those used in the designations processes for the 1997, 2006, and 2012 $PM_{2.5}$ standards and in designations for other NAAQS. Additionally, states and Tribes may identify and evaluate other relevant information or circumstances specific to a particular area to support nonattainment area boundary recommendations. For cases in which states and Tribes choose not to conduct an analysis justifying their boundary recommendation, or the EPA finds the analysis insufficient, the EPA will establish those boundaries that it determines to be appropriate based upon the five factor analysis and any other relevant information for a given area. While it is generally appropriate to include the entirety of a violating or contributing county in a $PM_{2.5}$ nonattainment area, the EPA recognizes that, in some cases, an assessment of relevant information may support inclusion of only part of a county. Specifically, the EPA intends to evaluate the five factors as applied to federal lands (such as national forests, national parks and/or wilderness areas) that may be fully or partially located within the bounds of a county otherwise identified as nonattainment. The EPA encourages states to also consider the relevance of federal lands and federal land boundaries and provide information and/or explanations for including federal lands within any nonattainment area

[7] The Office of Management and Budget (OMB) adopted standards for delineating metropolitan and micropolitan statistical areas on December 27, 2000 (65 FR 82229). These delineation standards established the terms CBSAs and CSAs. On July 16, 2021, OMB published their 2020 standards for delineating metropolitan and micropolitan statistical areas (86 FR 37770). The EPA intends to use the most recent list of CBSAs and CSAs in this designations process, published in March 2020.

[8] U.S. EPA (2019). Integrated Science Assessment for Particulate Matter: Final Report. National Center for Environmental Assessment-RTP Division, Office of Research and Development, Research Triangle Park, NC. EPA/600/R-19/188. December 2019. Available at *https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=347534*.

[9] These factors are derived, in part, from the CAA's ozone pollution provisions identifying factors the Administrator is to consider in determining portions of metropolitan areas that may be excluded from an ozone nonattainment area. (CAA section 107(d)(4)(A)(v)). These CAA factors include population density, traffic congestion, commercial development, industrial development, meteorological conditions, and pollution transport. The EPA finds these factors, and other information as indicated in this memorandum, relevant to evaluating areas potentially contributing to NAAQS violations more generally, including in the context of $PM_{2.5}$ pollution.

boundary recommendations to the EPA. For defining any partial county boundaries included in a nonattainment area, the EPA recommends the use of other well-defined legal jurisdictional boundaries, such as townships, tax maps, immovable landmarks such as major roadways, or other permanent and readily identifiable boundaries.

In addition, as provided for in the December 2011 guidance titled, "Policy for Establishing Separate Air Quality Designations for Areas of Indian Country," Tribes may recommend that the EPA designate areas of Indian country separately from the adjacent state areas.[10] This guidance provides for a nationally consistent approach for evaluating such designations recommendations from Tribes. The policy was designed to recognize Tribal sovereignty in air quality management matters affecting Indian country. In addition to nearby areas with emissions sources contributing to nonattainment, $PM_{2.5}$ concentrations in an area with a violating monitor may be affected by long-range or regional transport of $PM_{2.5}$ and its precursors.[11] Where this is the case, the CAA does not require that all contributing areas be designated nonattainment, only the contributing areas that are nearby. Attachment 3 addresses in more detail how to determine the area of analysis when determining nonattainment area boundaries.

As provided in CAA section 188(a), the EPA will initially classify all $PM_{2.5}$ nonattainment areas as "Moderate" when it promulgates initial area designations for the 2024 revised primary annual $PM_{2.5}$ NAAQS. In accordance with CAA section 188(c), the attainment date for each Moderate area shall be as expeditiously as practicable but no later than the end of the sixth calendar year after the effective date of the designation.

Environmental Justice

By adhering to the CAA's schedule for issuing timely area designations, the EPA helps ensure that public health protections under the 2024 revised primary annual $PM_{2.5}$ NAAQS are realized as soon as possible. The revised annual NAAQS was established to protect public health from fine particles, including the health of at-risk populations, with an adequate margin of safety. The "at-risk" populations identified in the supporting scientific evidence for the 2024 revised primary annual $PM_{2.5}$ NAAQS and documented in the proposed rulemaking includes subpopulations that comprise communities with environmental justice concerns.[12]

The EPA has tools that can help air agencies identify communities with potential environmental justice concerns, and such identification may be informative for purposes of developing designations recommendations. In May 2022, the EPA issued a document titled, "EPA Legal Tools to Advance Environmental Justice," which addresses, at a high level, different ways in which air agencies may consider environmental justice in the context of different CAA actions.[13] More specific to designations, the EPA has updated the $PM_{2.5}$ Designations Mapping Tool (which will be posted to the EPA's website)

[10] Guidance to Regions on the EPA's Policy for Establishing Separate Air Quality Designations for Areas of Indian Country. Memorandum from Stephen D. Page, Director, EPA OAQPS to Regional Administrators, Regions I-X. December 20, 2011. Available at *https://www.epa.gov/sites/default/files/2016-02/documents/indian-country-separate-area.pdf*.

[11] The main precursor gases associated with fine particle formation are sulfur dioxide (SO_2), oxides of nitrogen (NO_x), volatile organic compounds (VOC), and ammonia (NH_3) (*See* 81 FR 58010 at 58014, August 24, 2016). Unless otherwise noted, all references to $PM_{2.5}$ precursors in this memorandum and its attachments refer to at least these four gases.

[12] U.S. EPA, Reconsideration of the National Ambient Air Quality Standards (88 FR 5673, January 27, 2023).

[13] *https://www.epa.gov/system/files/documents/2022-05/EJ%20Legal%20Tools%20May%202022%20FINAL.pdf*.

to include a service layer to assist in identifying disadvantaged communities. Disadvantaged communities are defined as any community that meets at least one of the following characteristics: communities reflected in the Climate and Economic Justice Screening Tool (CEJST); any census block group that is at or above the 90th percentile for any of the Environmental Justice Screening and Mapping Tool's (EJSCREEN's) Supplemental Indexes when compared to the nation or state; and/or any geographic area within Tribal lands as included in EJSCREEN. The EPA encourages air agencies to use information from these tools (or other appropriate tools) to help target outreach efforts and facilitate meaningful involvement with disadvantaged communities as they develop their area recommendations.

Conduct outreach to interested parties

The EPA intends to use the $PM_{2.5}$ Designations Mapping Tool to identify disadvantaged communities in the area of analysis of any potential $PM_{2.5}$ nonattainment area for purposes of informing the EPA's outreach efforts associated with the EPA's designations process. The EPA expects to host at least one national webinar to engage with members of disadvantaged communities and receive feedback on the kinds of community outreach activities that air agencies and the EPA could use to facilitate consideration of potential environmental justice concerns in the designations process. At the regional/local level, the EPA may also host public meeting(s) to communicate information and gather feedback as part of the regulatory process on final designations. The EPA also intends to open a non-regulatory docket for the specific purpose of providing an opportunity for public feedback on the outreach process states might undertake in developing the recommendations they submit to the EPA, as well as outreach that the EPA might undertake associated with issuing final designations. The EPA is still working on the details regarding this outreach, with additional information to follow as the approach is finalized.

Unclassifiable Areas

In certain cases, there may be insufficient information to support a clear designation of nonattainment or attainment for an area. For example, the monitoring data may be incomplete, or the monitors may not be sited and operated in accordance with the regulatory requirements of 40 CFR part 58. In such cases the CAA provides for a designation of "unclassifiable" for any area that cannot be classified on the basis of available information as meeting or not meeting the NAAQS. In recommending boundaries for an unclassifiable area, the EPA recommends that states consider whether nearby areas have the potential to contribute to ambient air quality within the relevant area. As indicated in Attachment 3 of this memorandum, data from non-regulatory monitors and air quality modeling, where available, may help define an appropriate boundary for areas contributing to violations at regulatory monitors. The EPA notes that if sufficient information later becomes available indicating the unclassifiable area is violating the NAAQS and the EPA redesignates the area to nonattainment, the EPA would likely conduct a weight-of-evidence analysis as described in Attachment 3 of this memorandum to determine the appropriate area boundaries.

Attainment/Unclassifiable Areas

Once the EPA has determined the boundaries for nonattainment areas (areas that are violating the NAAQS or contributing to a nearby violation) and any unclassifiable areas, the EPA intends to designate the remainder of the state as "attainment/unclassifiable." The EPA requests that states and Tribes recommend how they would like the boundaries specified for their attainment/unclassifiable areas. During designations for previous $PM_{2.5}$ NAAQS, states have elected to specify boundaries for the

attainment/unclassifiable areas in a variety of ways, including as "rest of state" or "entire state," by Air Quality Control Regions, by county, by previous nonattainment area boundaries, or by a combination of methods. The EPA recommends that the boundaries of attainment/unclassifiable areas generally not be smaller than a county.

Summary

This memorandum provides the EPA's preliminary views on the process for determining initial area designations and boundaries for the 2024 revised primary annual $PM_{2.5}$ NAAQS. Recommendations contained herein are not binding on states, Tribes, the public, or the EPA. The EPA will make the designations determinations and nonattainment area boundary decisions for the 2024 revised primary annual $PM_{2.5}$ standards in a final regulatory action published in the *Federal Register*. When the EPA issues the final area designations, those decisions will be binding on states, Tribes, the public, and the EPA as a matter of law.

Four attachments to this memorandum provide additional information relevant to the initial area designations process. Attachment 1 is an anticipated timeline of important milestones in the initial area designations process for the 2024 revised primary annual $PM_{2.5}$ NAAQS. Attachment 2 identifies the schedule for exceptional events activities as prescribed in the Exceptional Events Rule (Table 2 of §50.14) for initial data flagging and submission of exceptional events demonstrations. Attachment 3 identifies the five general factors that the EPA intends to consider in evaluating and making decisions on nonattainment area boundaries and provides guidance regarding analyses relevant to support each of these factors. Attachment 4 provides information on preparing and running a Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) modeling analysis for evaluating nonattainment area boundaries for the 2024 revised primary annual $PM_{2.5}$ NAAQS designations.

Attachments

Attachment 1: Anticipated Timeline For 2024 Revised Primary Annual $PM_{2.5}$ NAAQS Designations Process

Attachment 2: Schedule for Exceptional Events Flagging and Documentation Submission for Data to be Used in Initial Designation

Attachment 3: Factors the EPA Plans to Consider in Determining Nonattainment Area Boundaries in Designations for the 2024 Revised Primary Annual $PM_{2.5}$ NAAQS, and Guidance on Analyses to Support these Factors

Attachment 4: Preparing and Running a HYSPLIT Modeling Analysis for Evaluating Nonattainment Area Boundaries for the 2024 Revised Primary Annual $PM_{2.5}$ NAAQS Designations

ATTACHMENT 1

Anticipated Timeline for 2024 Revised Primary Annual $PM_{2.5}$ NAAQS Initial Area Designations Process*

Milestone	Date
The EPA promulgates 2024 Revised Primary Annual $PM_{2.5}$ NAAQS final rule	February 7, 2024
2023 Design Values Available	June 2024
States and Tribes submit recommendations for $PM_{2.5}$ designations to the EPA	No later than February 7, 2025
2024 Design Values Available	June 2025
The EPA notifies states and Tribes concerning any intended modifications to their recommendations (120-day Letters)	No later than October 9, 2025 (120 days prior to final $PM_{2.5}$ area designations)
The EPA publishes public notice of availability of state recommendations and the EPA's intended modifications, if any, and initiates 30-day public comment period	Mid-October 2025
End of 30-day public comment period	Mid-November 2025
States and Tribes submit additional information, if any, to respond to the EPA's modification of recommended designations	Mid-December 2025 (60 days following the publication of the notice of availability of state recommendations and the EPA's intended modifications)
The EPA promulgates final 2024 $PM_{2.5}$ NAAQS area designations	February 6, 2026

*This attachment reflects the EPA's anticipated designations timeline. Some dates may shift as the process moves forward. For specific questions about timing, please reach out to the appropriate EPA Regional office for assistance.

ATTACHMENT 2

Schedule for Exceptional Events Flagging and Documentation Submission for Data to be Used in Initial Area Designations*

Action	Anticipated Deadline	Applicable Data Years
Initial notifications for intent to submit exceptional events demonstrations for the purpose of initial area designations recommendations	No later than January 1, 2025	2021, 2022, 2023* *States and Tribes are not required to submit initial notifications or demonstrations for data years that will not be relied upon for final area designations (data year 2021).[14]
Exceptional Events demonstration submittal	No later than February 7, 2025	2021, 2022, 2023
State and Tribal initial area designations recommendations	No later than February 7, 2025	2021, 2022, 2023
Initial notification and exceptional events demonstration submittal	No later than September 30, 2025	2024
The EPA sends out 120-day Letters for initial area designations	October 9, 2025	2022, 2023, 2024
The EPA promulgates final 2024 $PM_{2.5}$ NAAQS area designations	February 6, 2026	2022, 2023, 2024

*Submittal of exceptional events demonstrations is discretionary. This schedule is applicable to air agencies that intend to submit exceptional events demonstrations for events that have regulatory significance for the 2024 revised primary annual $PM_{2.5}$ NAAQS initial area designations. This schedule is based on a 2-year initial area designations schedule. If the Administrator has insufficient information to make initial designations decisions in the 2-year time frame, the EPA may take up to 1 additional year to make initial area designations decisions (i.e., no later than 3 years after promulgation of the standard). The Schedule for Exceptional Events for Use in Initial Area Designations is found in full at 40 CFR 50.14(c)(2)(vi) Table 2. For area-specific questions, please reach out to the appropriate EPA Regional office.

[14] At this time, the EPA does not anticipate that exceptional events associated with data year 2021 will have regulatory significance for the designations addressed in this memorandum. Unforeseeable circumstances could arise that might change this scenario; however, at this time, the EPA is working under the expectation that exceptional events demonstrations affecting designations would not be relevant for data year 2021.

ATTACHMENT 3:

Factors the EPA Plans to Consider in Determining Nonattainment Area Boundaries in Designations for the 2024 Revised Primary Annual $PM_{2.5}$ NAAQS, and Guidance on Analyses to Support these Factors

This attachment provides descriptions for five "factors" and relevant information informing these factors that the EPA intends to evaluate in making final nonattainment area designations decisions. The EPA notes that the five factors are comparable to the factors that states, Tribes, and the EPA used successfully for analytical purposes in prior designations for the 1997, 2006, and 2012 $PM_{2.5}$ NAAQS. The factors are intended to inform the EPA's analysis of the statutory definition of a nonattainment area, which is to include "any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet)" the $PM_{2.5}$ NAAQS. The EPA recommends that states and Tribes also consider these factors in making their recommendations for area designations and nonattainment area boundaries. The five factors[1] are:

1. Air quality data
2. Emissions and emissions-related data
3. Meteorology
4. Geography/topography
5. Jurisdictional boundaries

The EPA intends to evaluate these factors in its review of state and Tribal nonattainment area boundary recommendations. The EPA's recommendation of these factors is not intended to indicate that other relevant information should not be considered in the initial area designations process, as appropriate. The EPA will also evaluate any other relevant area-specific information in addition to the five factor analysis in cases where that information is provided by states or Tribes in supporting their designations recommendations. This document offers examples and recommendations about techniques and approaches. It does not contain requirements that must be strictly followed and should not be read as prescriptive with respect to the specific techniques recommended.

For initial area designations for the 2024 revised primary annual $PM_{2.5}$ NAAQS, the EPA will rely on monitoring data to identify areas to be designated nonattainment due to monitored violations of the standard. Consistent with the CAA and with previous area designations processes, the EPA will then determine the appropriate nearby areas to include within the nonattainment area boundary for the violating area based on emissions that contribute to these violations. For each monitor or group of monitors indicating a violation, the EPA intends to assess information related to five factors for the purpose of establishing the appropriate geographic boundaries for designated $PM_{2.5}$ nonattainment areas. The EPA will evaluate relevant information from the entire urbanized area (i.e., CBSA/CSA) containing the violating monitor(s) and any adjacent counties that have the potential to contribute to the violation, using a weight-of-evidence approach to draw conclusions.

[1] These factors are derived, in part, from the CAA's ozone pollution provisions identifying factors the Administrator is to consider in determining portions of metropolitan areas that may be excluded from an ozone nonattainment area. (CAA section 107(d)(4)(A)(v)). These factors include population density, traffic congestion, commercial development, industrial development, meteorological conditions, and pollution transport. The EPA finds these factors, and other information as indicated in this memorandum, relevant to evaluating areas potentially contributing to NAAQS violations more generally, including in the context of $PM_{2.5}$ pollution.

For those portions of the urbanized area where an evaluation of the available information clearly establishes that emissions sources in that portion of the area do not contribute to exceedances at the violating monitor(s), it may be appropriate to exclude that portion of the area from the nonattainment area. This weight-of-evidence approach to determining area boundaries could result in nonattainment areas consisting of the entire urbanized area, the urban area plus adjacent counties or partial adjacent counties, single counties, or, in cases supported by relevant evidence, partial counties, including partial counties within larger urban areas. While technical assessments can help to define the magnitude and relative magnitude of contribution from nearby areas, the EPA is not setting a threshold contribution level or bright line test for determining whether an area should be included within the boundaries of a given nonattainment area. Section 107(d) of the CAA does not require the EPA to set a threshold contribution and the EPA does not believe that such a threshold is helpful as it could result in boundaries that are either over- or under inclusive. For these reasons, and as was done in prior designations for the NAAQS, the contribution determination will be made through a case-by-case evaluation of the relevant facts and circumstances in each nonattainment area.

The EPA recognizes that some of the recommended assessments are data intensive. The EPA intends, wherever possible, to make the relevant data available to states and Tribes to facilitate their analyses. Table 3-1 below outlines the datasets that the EPA expects to make available to the public on the $PM_{2.5}$ designations website at *http://www.epa.gov/pmdesignations/* and the expected date of availability. The EPA may update this website during the initial area designations process as other relevant datasets are identified.

Table 3-1. Datasets the EPA will provide via the EPA Air Quality Designations for Particle Pollution Website

Dataset	Expected Availability Date
Current annual $PM_{2.5}$ design values with all applicable updates	June 2024
Chemical Speciation Network (CSN) data (same years as design values)	July 2024
Interagency Monitoring of Protected Visual Environments (IMPROVE) speciation data (same years as design values)	November 2024
2022 Emissions Modeling Platform (EMP) data	Draft Estimates: April 2024 Final Estimates: July/August 2024
Urban Increments	November 2024
Wind speed/direction data	TBD
HYSPLIT trajectory data	TBD

This attachment also offers recommendations concerning how states and Tribes can describe the basis for their initial designations recommendations. The EPA recommends that states and Tribes provide an explanation for those recommendations in a narrative format. Thus, this attachment provides some direction regarding the content and sequence of the narrative describing the nonattainment problem in an area with monitored violations of the NAAQS. The EPA recommends that a comprehensive

narrative articulate a conceptual model of $PM_{2.5}$ nonattainment that explains the nature and causes of the $PM_{2.5}$ air quality problem in the specific area, identifies the scope and scale of the air quality problem in that area, and describes all nearby emissions sources that contribute to the problem and those that do not. The EPA encourages states to work collaboratively with adjacent states to develop a comprehensive narrative for multi-state nonattainment areas. Similarly, the EPA encourages states and Tribes to work collaboratively to develop a comprehensive narrative for areas consisting of both state and Tribal lands.[2] The underlying analytical framework of the recommended narrative can be summarized as follows:

- Determine violating monitoring sites and gather data that enables an assessment of the CBSA or CSA, and potential nearby contributing areas, and the emissions sources in those areas.

- Assess and characterize air quality patterns at, and in proximity to, the violating monitoring site. Identify the conditions that are most associated with high average concentration levels of $PM_{2.5}$ in the area by quarter of the year. Further, identify the spatial extent of the high $PM_{2.5}$ concentrations. This analysis will provide a basic construct from which to evaluate potential contributing sources.

- Assess and characterize the spatial and temporal differences in $PM_{2.5}$ concentrations within an area using regulatory monitor data as well as any available relevant non-regulatory $PM_{2.5}$ data.

- Assess and characterize all relevant $PM_{2.5}$ chemical species over the analysis area. All parts of the year are important in determining contributions to the annual average concentration. However, a quarterly-average analysis in combination with other information may provide additional insight as to which emissions sources may play a greater role in contributing to a violation. This analysis can be an important first step in linking specific nearby sources of emissions to the violation.

- Assess and characterize the difference in quarterly and annual average $PM_{2.5}$ speciation values observed near the violating monitoring site(s) relative to monitoring sites outside the area under evaluation that reflect regional background concentrations. This “urban increment” analysis will help to differentiate the influence of more distant emissions sources from the influence of closer emissions sources, and thus to identify the relative magnitude of contributions from nearby emissions sources.

- Once the air quality factor analyses identified in the previous bullets are compiled, they can be evaluated in conjunction with emissions data and emissions-related data (e.g., vehicle miles traveled, population) to determine which source categories and source regions are most likely to contribute to the monitored violations.

[2] In these circumstances, each state and/or tribal entity would not be expected to describe the scope and scale of the air quality problem throughout the entire area, but rather would develop a conceptual model that describes only the contribution from their respective jurisdictions to the larger nonattainment area.

- Once the emissions and air quality assessments have been evaluated, it is valuable to then assess the meteorological characteristics of air quality throughout the year in the violating area. In many locations, the weather patterns will have a large impact on the eventual determination of which source categories and source regions in the area are most likely to contribute. This analysis will further help to identify the relative magnitude of contributions from emissions sources in nearby areas.

- It may be useful to assess any geographic/topographic or jurisdictional considerations that are relevant in the identification of the nonattainment area boundary.

- Finally, all of the previously described assessments are aggregated or synthesized into a cogent narrative that describes the relationship between emissions sources in the analysis area and the measured violation. This synthesis will represent a collective "weight-of-evidence" regarding the most appropriate boundaries for the nonattainment area.

While the general five factor framework should be comprehensive and provide the foundation for each assessment of nonattainment area boundary determinations, the extent of the analyses may vary on an area-by-area basis based on the nature, cause, and extent of the $PM_{2.5}$ air quality problem in the area. This attachment suggests analyses of certain data sets that can be useful to assess which nearby areas contribute to nonattainment at a monitor or monitors in a given area. In cases where more highly-resolved or newer data sets are available that are not explicitly mentioned here, the EPA recommends that states and Tribes consider their use, as appropriate. If these data are used, the EPA recommends that the states or Tribes fully describe the data and their derivation in supporting documentation for their designations recommendations.

The following sections provide more detail on the specific factor analyses and the approaches for synthesizing the five factors that the EPA plans to consider when evaluating state recommendations and determining nonattainment area boundaries for the annual $PM_{2.5}$ NAAQS.

1. Air Quality Data

The initial area designations process for $PM_{2.5}$ begins with an evaluation of available ambient air quality measurements from regulatory monitors to determine the location and magnitude of violations of the standard. In addition to data from violating monitors, the air quality data from other monitors can add to the weight-of-evidence in assessing the contribution of sources in areas outside the county with a violating monitor(s). Examples include the use of chemical speciation data to help characterize contributing emissions sources and the determination of nearby contributions through analyses that differentiate local and regional source contributions.

1.1 Current $PM_{2.5}$ Design Values

The first step in identifying an area that must be designated "nonattainment" and determining an appropriate nonattainment area boundary is to identify all monitored violations of the revised primary annual $PM_{2.5}$ NAAQS using the most recently available air quality data. The EPA determines NAAQS compliance by considering the "design value" for each air quality monitoring site. The design values for the 2024 revised primary annual $PM_{2.5}$ NAAQS are calculated using the 3-year

average (e.g., 2021 to 2023) of the annual mean concentrations, in which the annual mean concentrations are calculated using the mean of daily averages of each quarter in the given year.[3] The EPA calculates annual $PM_{2.5}$ design values based on ambient air quality data from the most recent three calendar year period from all regulatory monitors that are sited and operated in accordance with 40 CFR part 58, also known as Federal Reference Monitors (FRMs) and Federal Equivalent Monitors (FEMs). The EPA will designate as nonattainment all areas with one or more regulatory ambient $PM_{2.5}$ air quality monitors with a design value greater than the annual standard of 9.0 $\mu g/m^3$.

Because of the form of the annual $PM_{2.5}$ NAAQS, monitored ambient $PM_{2.5}$ levels throughout the entire 3-year period, including daily monitored levels below the numerical level of the NAAQS, are integral to the calculation of the design value at the monitor, and hence integral to determining whether there is a violation of the NAAQS. The amount by which monitored levels exceed the NAAQS level throughout the period can be an important consideration in determining appropriate boundaries for the nonattainment area because the monitored level indicates the magnitude of emissions contributions that result in such exceedance levels and whether there is a likelihood of influences from surrounding areas. Accordingly, contributions to monitored ambient $PM_{2.5}$ concentrations at a violating monitor throughout the entire 3-year period are relevant to determining the appropriate boundaries for a nonattainment area.

Individual measurements influenced by exceptional events for which the EPA concurs are excluded in accordance with the Exceptional Events Rule (EER), are not included in these calculations. State, local, and Tribal monitoring agencies are required to certify ambient air quality data submitted to AQS on an annual basis, by May 1st of the subsequent year. The EPA typically extracts ambient data from AQS and calculates official design values for regulatory purposes shortly after that certification due date (e.g., typically by June 1st) and then posts NAAQS design values for each regulatory monitor on a public website.

In addition to looking at the violating monitor site, an *intra*-urban analysis may be useful to understand emerging "within urban" gradients near violating monitor sites. This analysis can help further differentiate and isolate nearby contributing influences to the violating monitor site(s), particularly those that may be more evident at a refined scale such as localized plumes or suburban influences. This refined characterization of contributing emissions influences within the immediate urban area may in turn help to further identify the relative importance of surrounding areas in terms of their contribution to the violating monitor. In combination, analyzing the three spatial layers (urban, sub-urban, and rural) of $PM_{2.5}$ design values can provide a more complete understanding of the contributing urban and near monitor emissions, separate from the regional contributions. The ability to conduct an intra-urban analysis, however, is predicated on having data from multiple monitors within the urban study area, which may not be feasible for some areas being evaluated.

[3] Procedures for using the air quality data to determine whether a NAAQS violation has occurred are given in 40 CFR Part 50 Appendix N.

There are many possible drivers for intra-urban variability in $PM_{2.5}$ design values, including the following influences: local sources of primary PM emissions; transient emissions events; topographic barriers that isolate sub-regions of the urban area; meteorological phenomena that vary on spatial scales within the urban area; differences in behavior of semi-volatile components; and measurement error. The larger the contribution of regional sources, the more uniform is the intra-urban $PM_{2.5}$.

1.2 $PM_{2.5}$ Design Value Trends

In addition to identifying monitor sites where the most recent design values violate the 2024 revised primary annual $PM_{2.5}$ NAAQS, examining spatial and temporal trends in $PM_{2.5}$ air quality values (e.g., design values for the past 10 years) can improve one's understanding of the nature of the $PM_{2.5}$ ambient air quality problem in a violating area and thereby inform decisions regarding the sufficient size and shape of the nonattainment area boundary. Analyzing design value trends, particularly across multiple monitors in an area being evaluated, can show how $PM_{2.5}$ concentrations have changed and whether the most recent design value is consistent with that trend. Additionally, these trends analyses can show how frequently the design value at the 'defining' site (*i.e.*, the monitoring site with the highest design value for the area) has occurred at other monitoring locations in the area under consideration, and whether the design value trend across the evaluation area is homogeneous. This information can help to identify spatial and temporal patterns in the design values and, when combined with other information from the five factor analysis, can help identify nearby areas with emissions sources contributing to an area with a monitored violation.

Under normal circumstances, the mere fact that a nearby area has a monitor with a design value below the level of the NAAQS would not answer the question of whether that area was contributing to violations at a monitor in another area. Such an area might contain sources releasing very large amounts of emissions that together with emissions from sources in other nearby areas combine to cause the violation at the monitor. However, there may be circumstances in which the trend in emissions at the non-violating monitor in the potentially contributing area could be relevant to the evaluation of contribution. For example, a monitor on the border of a nearby county may show a downward trend in $PM_{2.5}$ design values below the level of the standard although a neighboring county has a clearly violating monitor for the current design value period. While the county with the violating monitor will be designated as "nonattainment," the downward trend in the monitor on the border of a nearby county may, along with other evidence from the five factor analysis, support a weight-of-evidence conclusion to exclude the nearby county from being included as part of the nonattainment area. Similarly, an upward trending site may be indicative of growth in nearby contributing emissions sources and provide more weight toward inclusion of the nearby area in the nonattainment area.

1.3 $PM_{2.5}$ Compositional Analysis

Measurements of the ambient $PM_{2.5}$ speciation can be used to determine which chemical species constitute $PM_{2.5}$ in the particular area of interest and/or at particular violating monitor(s). Identifying the major chemical species of the $PM_{2.5}$ mass in the area (e.g., sulfate, nitrate, organic carbon, elemental carbon, and crustal material) can provide insight into the types of emissions

sources that are contributing to the monitored $PM_{2.5}$ concentrations at the violating monitor, either from direct $PM_{2.5}$ emissions or from emissions of $PM_{2.5}$ precursor emissions. However, analysis of $PM_{2.5}$ speciation at the violating monitor alone will generally not be able to distinguish between local/nearby source contributions and regional background contributions. This assessment is therefore only one step in establishing a link between nearby emissions sources to violating monitors (i.e., the source types that appear to be important to the violations in the area but not specific facilities). Determining the specific facilities and emissions sources that are contributing to the violations requires the synthesis of results from an "urban increment" analysis, emissions data analysis, and an assessment of meteorological information as explained in subsequent sections.

The $PM_{2.5}$ speciation measurements for some locations are available from the routine urban and rural speciation monitoring networks – the CSN and IMPROVE, respectively. There may not always be a co-located speciation monitor at the exact location of a violating monitor site. In these cases, and where there are other nearby speciation monitors available, measurement data from the nearest monitor can be considered for use in a manner that best represents the conditions at the violating monitor site.

1.4 Urban Increment Analyses

$PM_{2.5}$ mass concentrations are generally higher in urban areas compared to surrounding regions. One conceptional model of this is the idea of an "urban increment" from locally generated and largely directly-emitted $PM_{2.5}$ in addition to regional contributions. Among the major contributors to $PM_{2.5}$ mass, the urban increment model generally predicts that sulfate originates mainly from regional sources; organic carbon and nitrate from a mix of regional and local sources; and black carbon and crustal material from local sources. The goal of the urban increment analysis is to estimate the local contribution to urban $PM_{2.5}$ as measured at violating regulatory monitor sites and thereby provide additional evidence to consider in deciding which nearby areas with sources contributing to the monitored violations in the area to include within the boundary of the designated nonattainment area. The urban increment analysis is a key part of the air quality data factor evaluation because it can suggest spatial and temporal correlations between contributing influences and areas by integrating information from violating monitors and $PM_{2.5}$ compositional data as described in the previous sections.

The basic approach for the urban increment analysis is to calculate the difference between the ambient $PM_{2.5}$ speciation levels at an urban area monitoring site and the ambient $PM_{2.5}$ speciation levels at a nearby rural area monitoring site(s). Local contributions to $PM_{2.5}$ speciation can be estimated by subtracting the rural concentration from the urban concentration. Assuming that the rural concentrations represent the regional background concentration, this difference is defined as the urban increment and calculated as follows:

In the equation above, the 'Urban Concentration' will preferably come from the same site as the violating $PM_{2.5}$ design value monitor or a nearby CSN site consistent with conditions at the violating monitor site in cases where a speciation monitor is not co-located with the violating $PM_{2.5}$ design value monitor. The EPA recommends that the calculation of the 'Regional Background Concentration' be prepared using data from IMPROVE monitors within the same airshed as the

violating design value monitor. For the urban increment dataset provided via the EPA PM Designations Website, the Urban Concentration will use $PM_{2.5}$ speciation data from the closest CSN site and the Regional Background Concentration will be calculated using the average of the $PM_{2.5}$ speciation data from IMPROVE sites within 150 miles or the closest IMPROVE site if none are within 150 miles. For each daily value of the $PM_{2.5}$ speciation used in urban increment calculation, data from both the CSN and IMPROVE site(s) must be available.

Linking the previously-described $PM_{2.5}$ speciation assessment with the urban increment analysis can also help identify the likely contributing emissions source types to the local or 'nearby' concentration increment. This is possible because different measured components of the $PM_{2.5}$ mass can be linked to specific types of emissions sources. For example, large stationary sources such as electric generating units (EGUs) are predominant contributors to the sulfate component of $PM_{2.5}$. High nitrate levels often indicate the presence of localized mobile sources, local or regional fuel-combustion sources, or a combination of these sources. Carbonaceous mass is typically associated with mobile sources, wood or biomass burning, and localized combustion sources. Carbonaceous mass is commonly a substantial component of the urban increment. A high elemental carbon to organic carbon mass ratio can be a signature of diesel combustion source contributions, such as diesel trucks, construction engines and vehicles, ships, and trains. A high organic carbon to elemental carbon ratio on the other hand is often a signature of biomass burning, such as residential wood combustion.

In areas experiencing seasonal fluctuations in $PM_{2.5}$ concentrations, it may be useful to perform a compositional analysis of the urban increments during these specific periods and to compare those results to other periods of the year that experience lower or less variable $PM_{2.5}$ concentrations. While all parts of the year are important to determine contributions to the annual average concentration, a quarterly compositional increment analysis in combination with other factor information may provide additional insight into contributing sources and/or contributing factors (e.g., local meteorology) influencing monitored violations. For example, residential wood combustion has a unique PM signature and can contribute appreciably to the organic fraction of wintertime $PM_{2.5}$. A review of both the urban increment results and the seasonal emissions inventory for the area can be an important synthesis analysis to better understand what specific emissions sources, and therefore which areas, may be contributing to a violating monitor.

2. Emissions and Emissions-Related Data

The sources and levels of emissions of $PM_{2.5}$-related pollutants are important factors in the initial area designations process. As noted previously, ambient $PM_{2.5}$ is formed through complex atmospheric processes with contributions from direct emissions of particles and from secondarily-formed particles that result from multiple $PM_{2.5}$ precursors. Air quality in a nonattainment area is also typically the result of a combination of regional and local emissions. In the designations process, for each metropolitan area with a violating monitor, the EPA evaluates the emissions data from both individual sources and area sources in nearby counties to assess each county's contribution to $PM_{2.5}$ concentrations at the violating monitor or monitors in the area under evaluation. Because $PM_{2.5}$ components such as sulfate and nitrate are formed through atmospheric processes and can be transported many hundreds of miles, sources of emissions outside the counties comprising the metropolitan area (CBSA or CSA) may also influence the regional

contribution measured at a particular site, but may not be considered in the designation determination to be "nearby" sources. Thus, the evaluation of the area is also a means to differentiate between those transported pollutants from more distant sources of emissions and those sources of emissions in nearby areas that should be part of the designated nonattainment area because they are part of the local nonattainment problem.

For initial area designations associated with the 2024 revised primary annual $PM_{2.5}$ NAAQS, the EPA intends to examine emissions of identified sources of direct $PM_{2.5}$, the major components of direct $PM_{2.5}$ (organic carbon, elemental carbon, crustal material and/or individual trace metal compounds), primary nitrate and primary sulfate, and precursor gaseous pollutants. The EPA anticipates that direct $PM_{2.5}$ emissions sources will generally be local in nature and will influence monitored values in a more direct fashion with little long-range transport. With respect to the gaseous precursors, on the other hand, the EPA anticipates that these will generally be more regional in nature (although the EPA also expects some local NO_X and VOC emissions contributions from mobile and stationary sources) and transport from nearby areas can contribute to higher $PM_{2.5}$ levels at the violating monitors. The EPA recommends that analyses include reviewing data from the latest NEI or other relevant sources if available. Further, the EPA also recommends that the analysis also include examining the magnitude of relevant, county-level emissions and the geographic locations of sources of the relevant pollutants.

Analyzing the magnitude and spatial extent of emissions further informs the analysis of the urban/rural ambient relationship discussed earlier. In addition, combining these analyses (e.g., magnitude of emissions and point of release) with meteorological information can inform the evaluation of the degree of contribution from nearby areas. The EPA will also consider any additional information it receives on changes to emissions levels that are not reflected in the most recent emissions inventories. These changes may include emissions reductions due to permanent and enforceable emissions controls that will be in place before final designations are issued, and likewise may include emissions increases from new sources or increases at existing sources.
For the initial area designations for the 2024 revised primary annual $PM_{2.5}$ NAAQS, the EPA believes that it will be appropriate to use the draft 2022 emissions modeling platform (EMP) inventory version 1 ("2022v1 draft") because that will be the most recent and robust emissions inventory information available at the beginning of this designations process. While the 2022 EMP is not an NEI, it will be developed collaboratively, meaning some air agencies will be participating in the inventory development process. Like the NEI, EMPs include emissions inventories, generally, on an annual basis at the county level. Emissions from large stationary sources are available at a point in space; emissions from large fires are available as point sources for each day. More detailed inventories at a finer resolution than county estimates are also available as part of the EMP and could aid in partial area non-attainment boundary determinations. The 2022v1 EMP will include 12km gridded data. For the final area designations process, the EPA expects to have available the official 2022v1 EMP (which would incorporate comments by stakeholders on the draft 2022v1 EMP and appropriate corrections). Gridded emissions for the final 2022v1 EMP will be generated.

Population density and degree of urbanization. The EPA has consolidated the sub-factors of population density, degree of urbanization, and vehicle use characteristics and trends within the "Emissions and Emissions-Related Data" factor as these elements supplement and help to inform the spatial analysis of emissions data. The EPA intends to provide these data as available, although

the EPA expects that states and Tribes may have independently developed datasets to better inform these elements, which are not available to the EPA. The EPA recommends that population density analyses examine the location and, when available, trends in population growth as potential indicators of the probable location and magnitude of emissions sources that may contribute to $PM_{2.5}$ concentrations in a given nonattainment area.

Related to population density is degree of urbanization, which indicates the relative spatial distribution of the total population of a multi-county metropolitan area across the counties contained in the area. Counties with a higher proportion of the areawide population are more likely to contain emissions sources that tend to be correlated with human activity, such as residential and commercial heating and cooking, vehicle emissions, and nonroad engines.

The NEI also contains county-level aggregate estimates of smaller stationary area and mobile sources emissions (gridded emissions as well as sub-annual emissions come from spatially and temporally allocating the NEI emissions). Emissions from these types of sources are often not reported on a fine scale and are estimated using less refined methods than emissions from larger stationary sources. An analysis of population density, degree of urbanization, and vehicle use characteristics and trends may provide insight into the location of emissions-related activity from these source types within the larger county, and thus may serve as a proxy for the spatial distribution of county-level emissions that may contribute to $PM_{2.5}$ formation in a given area. The EPA recommends that population density and degree of urbanization data from the 2020 U.S. Census be used for these analyses.

Traffic and commuting patterns. As with the previous factors discussed above, these factors are also secondary in nature to the actual emissions levels. Traffic and commuting pattern data can help assess the influence of mobile source emissions in a given area. The EPA recommends that analyses examine the location of major transportation arteries and information on traffic volume and commuting in and around the area containing a violating monitor. This would include examining the number of commuters in each nearby county who drive to a county within the area that has a violating monitor, the percent of total commuters in each county who commute to other counties with violating monitors within the metropolitan area, and the total Vehicle Miles Traveled (VMT) for each county. Areas with higher VMT and commuting levels can be an indicator of the location of mobile source emissions that may contribute to $PM_{2.5}$ concentrations at the violating monitor.

The NEI is one source of the county-wide VMT data and facilitates relative comparisons of traffic and commuting patterns between counties in a larger area. However, more detailed assessments provided by states or Tribes could help to highlight the magnitude and location of emissions activity. Along with gridded emissions from the 2022 EMP, the EPA will also provide gridded VMT data; however, as mentioned previously, these estimates may not correspond directly with state-based VMT data to which air agencies may already have access. Table 3.1 details all the datasets that the EPA will provide for use in this process.

3. Meteorology

The evaluation of meteorological data helps to determine the effect on the fate and transport of emissions contributing to $PM_{2.5}$ concentrations and to identify areas potentially contributing to the monitored violations. This section of the attachment provides recommendations for summarizing meteorological data and results in support of appropriate nonattainment area boundaries. One basic type of meteorological analysis involves assessing potential source-receptor relationships in the area using summaries of emissions, wind speed, and wind direction data. A more sophisticated assessment involves modeling air parcel trajectories. Even more sophisticated is source apportionment modeling that incorporates extensive meteorological and emissions data into a multi-dimensional photochemical grid model; this approach is discussed in the "Additional Analytical Tools" section of this document.

HYSPLIT Trajectories. Air parcel trajectory models can help understanding of complex transport situations in an area. The HYSPLIT modeling system is useful for illustrating the three-dimensional paths traveled by air parcels over time to a violating monitor. The EPA will provide HYSPLIT trajectories as individual plots as well as part of density maps for the design value period. These depictions will be displayed in the Mapping Tool. Information will be plotted for each violating monitor, for all days within the design value period, as well as for the subset of all days within the design value period that have a 24-hr $PM_{2.5}$ average exceeding the annual standard. HYSPLIT inputs and settings are described in Attachment 4.

4. Geography/topography

Consideration of geography or topography can provide additional information relevant to defining nonattainment area boundaries. The EPA recommends that analyses examine the physical features of the land that might define the airshed and, therefore, affect the formation and distribution of $PM_{2.5}$ concentrations over an area. Mountains or other physical features may influence the fate and transport of emissions and $PM_{2.5}$ concentrations. Additional analyses may consider topographical features that cause local stagnation episodes via inversions. Valley-type features can cause local cold-air drainage patterns and vertical temperature inversions that effectively "trap" air pollution. Under these conditions emissions can accumulate leading to periods of elevated $PM_{2.5}$ concentrations. These air drainage patterns and inversions may be limited in extent and therefore may need to be separated from adjacent regions with more conventional air flow and $PM_{2.5}$ concentration patterns. Similarly, the absence of any such geographic or topographic features may also be a relevant consideration in a given nonattainment area.

5. Jurisdictional boundaries

Once the geographic extent of the area violating the $PM_{2.5}$ standard and the nearby area contributing to violations is determined, the EPA intends to consider existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary and carrying out the CAA's air quality planning and enforcement functions for nonattainment areas. Examples of jurisdictional boundaries include, but are not limited to, counties, air districts, areas of Indian country, metropolitan planning organizations, and existing nonattainment areas. The EPA encourages states to also consider federal land boundaries and provide information and/or explanations for including partial or full federal lands in any recommendations to the EPA. If an

existing jurisdictional boundary is used to help define the nonattainment area, it must encompass the entire area that has been identified as meeting the nonattainment definition. Where existing jurisdictional boundaries are not adequate to describe the nonattainment area, other clearly defined and permanent landmarks or geographic coordinates are recommended to be used.

Synthesizing the Five Factors

In making designations decisions for nonattainment area boundaries encompassing violating areas and contributing areas, the EPA intends to, and recommends that states and Tribes also, evaluate the five factors together and use a weight-of-evidence approach for this analysis. As explained above, the starting point for evaluating the factors is the air quality analysis. Of particular importance is the location(s) of the violating monitor(s) based on 2021-2023 air quality data and the characteristics of those violations (e.g., speciation and urban increment analyses).[4] Once the characteristics of the violations are established, one can begin to assess which nearby emissions sources or source categories and source regions may have contributed to those violations. This contribution evaluation should generally consider the location and magnitude of emissions, and the potential for these emissions to contribute to the ambient conditions at the violating monitors as informed by the meteorological and geographical/topographical analysis factors. The guiding principle for this evaluation is to include within the boundaries of the nonattainment area, any nearby areas with emissions of $PM_{2.5}$ or $PM_{2.5}$ precursors that have the potential to be transported to the violating monitor. The final factor, jurisdictional boundaries, is recommended to refine the nonattainment area boundary to ensure meaningful and effective air quality planning and regulation of emissions sources during the NAAQS implementation phase.

Additional Analytical Tools

While the EPA believes the synthesis evaluation of the five factors in the manner previously discussed is generally comprehensive and sufficient to make weight-of-evidence determinations in establishing nonattainment area boundaries for the 2024 revised primary annual $PM_{2.5}$ NAAQS, in some cases the EPA recognizes that it may also be useful to employ one or more of the additional analytical tools and approaches described below. These approaches involve combining inputs of emissions data, air quality information, and meteorology in an effort to evaluate the contributions from nearby areas to monitor violations. Due to the time and resources necessary to develop the inputs, run the models, and interpret the results, the EPA generally expects these analytical tools and approaches to be beyond what is necessary to inform nonattainment area boundaries. Nonetheless, there may be circumstances where undertaking such an effort could be highly beneficial to identify relative contributions qualitatively or quantitatively from source areas to violating monitors.

This section provides limited information regarding additional quantitative techniques that the EPA has experience with in past designations efforts. They include: (i) the weighted emissions score (WES); (ii) the contributing emissions score (CES); and (iii) source apportionment modeling (SAM). States may find WES and SAM useful, with some modifications, in preparing designations recommendations for the

[4] The EPA also anticipates considering 2024 air quality data in making final designations decisions. The entire year of that air quality data may not be fully available to states and Tribes during the period they are developing their designations recommendations.

2024 revised primary annual $PM_{2.5}$ standard. The CES should not be used to inform the 2024 revised primary annual $PM_{2.5}$ NAAQS initial area designations because it was designed specifically for a 24-hour standard, and therefore will not be further discussed in this document. The EPA does not plan to provide WES or SAM assessments for any areas as part of the area designations process for the 2024 revised primary annual $PM_{2.5}$ NAAQS. Where these additional analytical tools and approaches are used, the results of these approaches should be considered just one part of an overall assessment of the potential nonattainment area boundaries.

States and Tribes may also consider the potential value of additional methods beyond WES and SAM, such as receptor modeling techniques (e.g., Positive Matrix Factorization (PMF) and Chemical Mass Balance (CMB)) and advanced statistical analyses (e.g., non-parametric regression and cluster analyses) to better understand contributing influences to air quality. Because of the EPA's limited experience applying such techniques to the designations factor analysis, the EPA recommends that states and Tribes intending to use such methods consult with their EPA Regional office regarding their usage and intended applications.

Whenever states or Tribes elect to generate or use additional analytical tools or approaches (such as those identified in this section) in developing their nonattainment area recommendations, the EPA expects them to provide all the necessary underlying input data and model specifications, and provide detailed descriptions of the methodological approach and model evaluation so that the EPA can adequately evaluate the technical validity of the approach and results. In considering any of these additional approaches it is important to remember that the EPA's assessment of potential nonattainment area boundaries is based on all of the information available to the Agency for all of the factors identified in the EPA's designations memorandum. The EPA will base its final decisions on attainment and nonattainment areas on a collective assessment of the five factors.

Weighted Emissions Score (WES). The WES analysis takes the urban increment compositional fractions of $PM_{2.5}$ determined through the technique described in Section 1.4 and applies them to each county's fraction of total emissions in the urban area for each PM species. In this manner it attempts to evaluate the level of contribution of a county's emissions to a violating monitor site by weighting each county's emissions by the fractional component observed at the violating monitor. The basic steps are as follows:

Step 1. The counties to be analyzed in relation to each urban area are first identified.
Step 2. For each analysis area, the urban increment compositional fraction of $PM_{2.5}$ mass is calculated according to the methodologies described in Section 1.4 above.
Step 3. The next step involves calculating, for each pollutant, the percentage of analysis area emissions attributable to each county (counties within and adjacent to the CBSA/CSA as applicable).
Step 4. The county's percentage of analysis area emissions for each pollutant is then multiplied by the corresponding $PM_{2.5}$ component percentage of urban increment mass.
Step 5. Sum the results for each $PM_{2.5}$ species within each county to get the county WES.
The EPA recommends that WES be regarded simply as one tool to evaluate the relative importance of multi-pollutant emissions from one county to others in the same nonattainment area. The WES of a county in one nonattainment area is not a suitable point of comparison to the WES of a county in another nonattainment area; the WES is only a meaningful tool to

evaluate the relative contribution of counties within the same nonattainment area. This analysis must be considered in combination with other air quality and emissions-related information, as well as information supporting the meteorology and geography factors, to support more specific conclusions.

***Source Apportionment Modeling*.** Source apportionment modeling (SAM) is another aggregation technique which may be useful to assess contribution to elevated $PM_{2.5}$ levels and thereby to help identify possible areas for inclusion in the nonattainment area because of their contribution to violations in nearby areas with violating monitors. SAM can track the contribution of directly-emitted $PM_{2.5}$ and $PM_{2.5}$ precursors at a receptor from any number of user-defined source regions and source types. Emissions are tracked with source apportionment through $PM_{2.5}$ formation, transport, and deposition processes in the host photochemical model (Yarwood, et al., 2007).[5] SAM combines into a single analysis several of the factors that the EPA believes are important for determining nonattainment area boundaries: emissions, meteorology, and geography/topography.

If a state chooses to conduct SAM, the EPA recommends that at least one entire year be modeled to capture as many source-receptor transport patterns as possible. Further, the EPA recommends that states and Tribes follow the relevant EPA guidance for photochemical modeling attainment demonstrations when establishing their SAM platform. In establishing the parameters of a SAM exercise, the violating monitors establish the receptors in the analysis. The EPA recommends that source regions include any and all nearby contributing areas broken out into appropriate jurisdictional areas (e.g., all CBSA/CSA counties and adjacent counties, or partial counties where appropriate, associated with the violation). When summarizing the outputs from the SAM, it is suggested that the relative contributions from nearby source regions be compared against one another. The primary metric from the SAM is the source region's contribution to the $PM_{2.5}$ annual mean. A threshold quantity indicating substantial influence will vary with local conditions, so that it is not possible to establish a clear-cut, universal threshold contribution level. However, a relative comparison of source regions should ensure capturing the relevant nearby contributing emissions sources within the nonattainment area.

[5] Yarwood, G., Morris, R. E., & Wilson, G. M. (2007). Particulate matter source apportionment technology (PSAT) in the CAMx photochemical grid model. In *Air pollution modeling and its application XVII* (pp. 478-492). Boston, MA: Springer US.

ATTACHMENT 4

Preparing and Running a HYSPLIT Modeling Analysis for Evaluating Nonattainment Area Boundaries for the 2024 Revised Primary Annual $PM_{2.5}$ NAAQS Designations

The Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT)[1] model is frequently used to produce trajectories for assessments associated with determining area boundaries. The trajectory model uses meteorological analysis and forecast fields from regional or global models to compute advection and stability of air parcels.

For these designations, HYSPLIT trajectories are plotted for each violating monitor, for all days within the design value period, as well as for the subset of all days within the design value period that have a 24-hr $PM_{2.5}$ average exceeding the annual standard. Backward trajectories may illustrate potential source regions for the air that affected the monitor on high concentration days. However, HYSPLIT trajectories alone do not conclusively indicate the contribution to a measured high concentration of $PM_{2.5}$, and HYSPLIT should not be used in isolation to determine an area boundary.

A HYSPLIT backward trajectory is usually depicted as a single line extending backward in time from a monitor location starting point. This single line should not be misinterpreted as having finer accuracy than the underlying meteorological model and data. For illustrating several years of backward trajectories, hundreds of lines can be confusing. Heat maps illustrating areas of high frequency of trajectory lines may be used to summarize the many trajectories.

The HYSPLIT trajectories contained in the $PM_{2.5}$ Designations Mapping Tool were prepared using HYSPLIT version 5.2.1. The input meteorology is the North American Mesoscale Forecast System (NAM) 12 km.[2] While HYSPLIT offers the user several options for vertical motion parameters within the model, these trajectories are computed using the vertical motion calculated by the NAM12 meteorology input.

Start times for backward trajectories are chosen to best coincide with times of maximum $PM_{2.5}$ concentrations. The Integrated Science Assessment[3] showed two typical periods of $PM_{2.5}$ concentration maxima, generally 0800 and 2200 local standard time (LST). Backward trajectories were initiated at these times for each day of the 2000-2022 period, with a trajectory length of 24 hours. Trajectories are computed with a starting elevation of 500 meters above ground level.[4] This height provides a good balance between remaining within the mixed layer at most times while avoiding terrain influences at lower elevations.

HYSPLIT output files containing latitude and longitude plot points for each trajectory will be posted on the EPA's Particle Pollution Designations Guidance and Data website.

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[1] *https://www.arl.noaa.gov/hysplit/.*

[2] *ftp.arl.noaa.gov/archives/nam12.*

[3] U.S. EPA. Integrated Science Assessment (ISA) for Particulate Matter (Final Report, Dec 2019). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-19/188, 2019.

[4] Stein et al. (2016) NOAA's HYSPLIT Transport and Atmospheric Dispersion Modeling System, Bulletin of the American Meteorological Society (BAMS), 96(12): 2059-2077.