UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

APR 23 2014

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Guidance for 1-Hour SO_2 Nonattainment Area SIP Submissions

FROM: Stephen D. Page
Director

TO: Regional Air Division Directors, Regions 1 – 10

The purpose of this memorandum is to distribute a non-binding guidance titled, "Guidance for 1-Hour SO_2 Nonattainment Area SIP Submissions." The document is intended to provide guidance and recommendations to state, local and tribal governments for the development of state implementation plans (SIPs) and tribal implementation plans (TIPs) under the 2010 1-hour primary National Ambient Air Quality Standard for Sulfur Dioxide (SO_2 NAAQS). The EPA issued draft guidance on SO_2 implementation in September 2011 so that states and other interested parties would have the opportunity to comment on our preliminary recommendations on how to implement the 1-hour SO_2 NAAQS. Based on the comments received on the September 2011 draft guidance, the EPA is providing this guidance on how to make SIP and TIP submittals addressing areas that are designated as nonattainment.

The attached document contains non-binding recommendations on a wide range of issues that are likely to arise as state, local and tribal governments develop nonattainment SIPs for the 1-hour SO_2 NAAQS. Key issues include, but are not limited to, attainment dates, SIP credit for other federal measures, timing of controls, scope of the attainment demonstration, averaging times of emissions limits, a clean data policy, and transition from the prior SO_2 NAAQS. The attached guidance document has been developed to assist in the submittal of approvable SIPs that result in expeditious attainment of the SO_2 NAAQS. For the 29 areas initially designated nonattainment in August 2013 (with an effective date of October 4, 2013), these SIPs are due on April 4, 2015. Note that on April 17, 2014, the EPA issued a proposed rule that seeks data to characterize air quality with respect to the 1-hour SO2 NAAQS, which the EPA intends to use for designation of areas in the future. If additional nonattainment areas are designated in the future, then this guidance would also apply to development of those nonattainment area SIPs.

Please distribute the attached guidance document to state, local and tribal governments located in your region. For questions on this guidance, please contact Krishna Viswanathan at (919) 541-2580, *viswanathan.krishna@epa.gov* or Larry Wallace at (919) 541-0906, *wallace.larry@epa.gov*.

Attachment

EPA

Guidance for 1-Hour SO_2 Nonattainment Area SIP Submissions

April 2014

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Preface

This document provides guidance to state, local and tribal governments for the development of state implementation plans (SIPs) and tribal implementation plans (TIPs) for areas designated as nonattainment for the primary 2010 National Ambient Air Quality Standard (NAAQS) for sulfur dioxide (SO_2) (75 FR 35520, June 22, 2010) codified at 40 CFR 50.17. In the preamble for the final 2010 SO_2 NAAQS rule, the U.S. Environmental Protection Agency provided general guidance concerning the Clean Air Act (CAA) provisions that states, tribes and SO_2 emissions sources needed to address when implementing the NAAQS. Additionally, the EPA stated that we intended to develop and seek public comment on additional guidance for modeling, designations, and for the development of nonattainment area SIPs (NAA SIPs) for the 2010 SO_2 NAAQS.

To this end, the EPA issued designations guidance in March 2011, and draft SO_2 NAA SIP guidance in September 2011. These drafts were distributed widely for states and other interested parties to comment on our preliminary recommendations. Based on the comments received on these drafts, the EPA is providing additional guidance through this document to assist states and tribes in preparing SO_2 NAA SIP submittals. Additionally, on April 17, 2014, the EPA issued a proposed rule that seeks data to characterize air quality with respect to the 2010 SO_2 NAAQS. The EPA intends to use such data for designation of areas in the future. To the extent that areas are designated as nonattainment in the future, this guidance would assist states and tribes in preparing NAA SIP submittals for those areas as well.

This guidance document imposes no binding or enforceable requirements or obligations on any person, and is not final agency action. It is intended to provide recommendations for others to consider as they develop information that will be used in future separate final actions, which may involve SIPs or TIPs. While this document provides general guidance for development of SIPs for SO_2 NAA's, the EPA notes that each NAA may pose unique case-specific questions relating to factors such as the characteristics of the contributing sources, meteorology, jurisdictional factors, etc. Therefore, we recommend that air agencies consult with regional offices early in the development of their SIPs for each area, to enable the regional office to work closely with the state to identify and resolve relevant technical or policy issues, to facilitate the submittal of SIPs that successfully demonstrate attainment of the NAAQS as expeditiously as possible. The guidance is subject to change without further notice, and does not represent the culmination of any agency proceeding or a final interpretation by the EPA of any pre-existing statutory or regulatory requirements.

I. Purpose

This guidance document discusses the CAA statutory requirements that air agencies[1] need to address when implementing the 2010 SO_2 NAAQS in areas designated as nonattainment for the standard. It provides recommendations for air agencies to consider as they develop SIPs and TIPs to satisfy the requirements of sections 172, 175A, 191 and 192 of the CAA to show future attainment and maintenance of the 2010 SO_2 NAAQS.

A SIP is a compilation of regulations and programs that an air agency uses to carry out its responsibilities under the CAA, including the attainment, maintenance and enforcement of the NAAQS. Air agencies use the SIP process to identify the emissions sources that contribute to problems in areas designated as nonattainment, and to select the emissions reduction measures that the air agency judges to be most appropriate to implement in order for the affected area to attain the 2010 SO_2 NAAQS based on a variety of local factors such as population exposure, enforceability, and economic impact. To be approved by the EPA, NAA SIPs need to ensure that areas designated as nonattainment reach attainment as expeditiously as practicable. Pertinent sources may be implementing, or planning to implement, necessary control measures to meet national control programs such as the Clean Air Interstate Rule (CAIR) or Maximum Achievable Control Technology (MACT) requirements including the mercury and air toxics standards (MATS) for electric generating units (EGUs). This guidance clarifies how to make these measures enforceable and creditable for SIP purposes.

II. Background

[1] In this document, we use the term "air agency" as shorthand for any non-federal governmental entity that might have the legal authority to develop and submit an implementation plan, including states, tribes, territories and local governments.

In June 2010, the EPA promulgated a new 1-hour primary SO_2 NAAQS of 75 parts per billion (ppb), which is met at an ambient air quality monitoring site when the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations does not exceed 75 ppb, as determined in accordance with Appendix T of 40 CFR part 50. *See* 40 CFR 50.17(a)-(b). On August 5, 2013, the EPA designated 29 areas of the country as nonattainment for the 2010 SO_2 NAAQS. 77 FR 47191, codified at 40 CFR part 81, subpart C. These initial area designations have an effective date of October 4, 2013. The EPA anticipates designating additional areas as information becomes available to determine the air quality of areas concerning the 2010 SO_2 NAAQS.

In addition to the general nonattainment area planning requirements of CAA section 172, Subpart 5 of Part D of Title I of the CAA (sections 191 and 192) describes the specific statutory requirements that apply to areas designated as nonattainment for the SO_2 NAAQS. A substantial set of longstanding guidance reflects the EPA's recommendations regarding these requirements for SO_2, most notably in the General Preamble published in the *Federal Register* on April 16, 1992 (*see, e.g.,* 57 FR 13498, at 13545) and the SO_2 Guideline Document, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, EPA-452/R-94-008, February 1994. This guidance supplements that prior guidance which remains applicable unless specifically altered here. Since the guidance is specifically intended to address the requirements for SIPs for nonattainment areas, the guidance does not contain requirements to address Prevention of Significant Deterioration (PSD).

The EPA received comments on the September 2011 draft SO_2 guidance from commenters who voiced concerns related to the use of section 110(a)(1) of the CAA as the vehicle for the submittal of substantive attainment demonstration SIPs for areas designated as "unclassifiable," which had been discussed in the preamble to the final 2010 SO_2 NAAQS rule and in the September 2011 draft. After reviewing these comments, the EPA revisited its suggested approach on this issue and has changed it. In April 2012, the EPA sent a letter to state environmental commissioners and tribal air quality agencies explaining that we would no longer expect states to submit SIPs by the June 2013 deadline for section 110(a) "infrastructure" SIPs to provide attainment plans for areas designated as "unclassifiable" or that had not yet been designated at all.

The EPA also received comments for and against revising its prior policy recommendations regarding averaging times for emission limits. Based on a reexamination of this issue, the EPA now believes that emission limits based on averaging times longer than 1 hour, up to 30 days, may in some cases provide adequate assurance that the 1-hour SO_2 standard will be attained, so long as the limit reflects comparable stringency to the 1-hour average emission limit that modeling shows to provide for attainment and a source's hourly emissions can be effectively measured. This is discussed in greater detail in section V.D.2 of this guidance.

In addition, to address comments received on the September 2011 draft guidance, the current guidance includes revisions reflected in the following sections: (1) Section V.C., discussing attainment demonstrations, which clarifies that the entire nonattainment area should be addressed in the modeling for the attainment demonstration, and that in some cases, the air agency should also address sources located outside the nonattainment area which may affect attainment in the area; (2) Section V.D.1, discussing control strategies (including reasonably available control measures/reasonably available control technology (RACM/RACT)); (3) Section V.D.2, discussing the criteria necessary for setting SO_2 emission limits (including, among other topics, criteria for averaging times); (4) Section VII., discussing the requirements for being redesignated to attainment, including the criteria for obtaining a "clean data" determination; (5) Appendix A, providing clarifications to the modeling guidance for nonattainment area SIPs; (6) Appendix B, providing an assessment of the comparable stringency of longer-term averages in emissions limits developed under this guidance; (7) Appendix C, providing an example determination of how such an emission limit might be established; and (8) Appendix D, concerning a review of the relationships between SO_2 emissions data with various averaging times.

A. Roles of the EPA and Air Agencies

Under the CAA, air agencies are directed to develop and submit, for the EPA approval, SIPs that provide for the implementation, attainment, maintenance and enforcement of the 2010 SO_2 NAAQS through control programs directed at sources of SO_2 emissions. CAA sections 110(a), 172, and 191-192. If an air agency does not adopt and implement approved SIPs, the EPA must adopt a federal implementation plan (FIP) to ensure that areas attain the NAAQS in an expeditious manner. Federal rules such as those described in section V.D., supplement air agency emissions control measures and provide for nationwide or regional reductions in emissions of SO_2 and other air pollutants that will facilitate attainment of the SO_2 NAAQS. The EPA will review each submitted implementation plan to determine whether it meets applicable CAA requirements, and issue a proposed action in the *Federal Register* to approve or disapprove the plan. There will be an opportunity for public comment on each proposed action. The EPA will consider any public comments received and then issue a final *Federal Register* notice approving or disapproving the plan.

B. How this Guidance Applies to Tribes

Section 301(d) of the CAA authorizes the EPA to treat eligible Indian tribes in the same manner as states under the CAA and requires the EPA to promulgate regulations specifying the provisions of the statute for which such treatment is appropriate. The EPA has promulgated these regulations – known as the Tribal Authority Rule or TAR – at 40 CFR part 49. 63 FR 7254 (February 12, 1998). The TAR establishes the process for Indian tribes to seek treatment-as-a-state eligibility and sets forth the CAA functions for which such treatment will be available. Under the TAR, eligible tribes may seek approval for all CAA and regulatory purposes other than a small number of functions enumerated at section 49.4. Implementation plans under section 110 are included within the scope of CAA functions for which eligible tribes may obtain approval. Section 110(o) describes the EPA's review standards and the geographic scope of TIPs. Eligible Indian tribes may thus submit TIPs covering their reservations and other areas under their jurisdiction. However, tribes are not required to submit TIPs. The TAR provides flexibility and allows tribes to submit partial program elements, so long as such elements are reasonably severable – *i.e.*, "not integrally related to program elements that are not included in the plan submittal, and are consistent with applicable statutory and regulatory requirements." 40 CFR section 49.7. Tribes who elect to submit TIPs are also not bound by the time periods for making plan submissions that are required for SIPs.

If a tribe is unable to develop a TIP for the 2010 SO_2 NAAQS, the Administrator, pursuant to sections 301(a) and 301(d)(4) of the CAA, has the authority to promulgate a FIP to protect air quality. In addition, upon request from a tribe that has undertaken the responsibility for developing a TIP to implement the 2010 SO_2 NAAQS, the EPA will provide assistance as necessary to develop the plan.

III. SIP Submittals and Attainment Dates

The CAA directs states containing an area designated as nonattainment for the 2010 SO_2 NAAQS to develop and submit a NAA SIP to the EPA meeting the requirements of subparts 1 and 5, of part D, of Title I of the CAA, providing for attainment of the NAAQS by the applicable statutory attainment date. *See* sections 172 and 191-192 of the CAA. All components of the SO_2 NAA SIP are to be submitted to the EPA within 18 months of the effective date of an area's designation as nonattainment. To be approved by the EPA under section 192(a), these NAA SIPs need to provide for future attainment of the NAAQS as expeditiously as practicable, but no later than 5 years from the effective date of designation as nonattainment. For areas designated nonattainment in August 2013, with designation effective dates of October 4, 2013, SIPs are due by April 4, 2015, and must contain demonstrations that the areas will attain as expeditiously as practicable, but no later than October 4, 2018.

IV. Section 110(a)(2) NAAQS Infrastructure Elements

In addition to the CAA provisions specific to nonattainment areas, section 110(a)(2) of the CAA directs air agencies to develop and maintain a comprehensive air quality management infrastructure program applicable to each newly promulgated NAAQS, including: an ambient air quality monitoring program, an enforcement program, air quality modeling capability, a stationary source permitting program, adequate personnel, resources and legal authority and, as appropriate, enforceable emission limitations. The EPA has recently issued guidance on such "infrastructure SIPs" that addresses the SIP submittals for the 2010 SO_2 NAAQS.[2]

[2] *See* "Guidance on Infrastructure State Implementation Plan (SIP) Elements Under Clean Air Act Sections 110(a)(1) and 110(a)(2), September 13, 2013," available on the Internet at: *http://www.epa.gov/airquality/urbanair/sipstatus/infrastructure.html.*

V. SO_2 Nonattainment Area Planning Elements

A. Overview of Plan Elements

As mentioned in Section III of this document, all components of the SO_2 part D SIP are to be submitted within 18 months of the effective date of an area's designation as nonattainment. Section 172 of the CAA addresses the general requirements for areas designated as nonattainment for any NAAQS pollutant. Section 172(c) directs states with nonattainment areas to submit a SIP that contains an attainment demonstration showing that the affected area will attain the relevant standard as expeditiously as practicable, but no later than the applicable statutory attainment date. Specific statutory requirements that are highlighted in this guidance document are the requirements that SIPs provide for an accurate emissions inventory of current emissions for all sources of SO_2 (i.e., point, area and mobile sources) within the nonattainment area; a New Source Review (NSR) permit program; and an attainment demonstration using an EPA approved air quality dispersion model. The SIP submittal would also need to provide for: Reasonable Further Progress (RFP); implementation of RACM including RACT, as well as adequate contingency measures for the affected area. These elements are briefly described below.

B. Emissions Information

Emissions inventory and source emission rate data serve as the foundation for modeling and other analyses that enable air agencies to: 1) estimate the degree to which different sources within a nonattainment area contribute to violations within the affected area; and 2) assess the expected improvement in air quality within the nonattainment area due to the adoption and implementation of control measures. The air agency should develop a comprehensive, accurate and current inventory of actual emissions from all sources of SO_2 emissions in each nonattainment area, as well as any sources located outside the nonattainment area which may affect attainment in the area. *See* CAA section 172(c)(3). This inventory should be consistent with the EPA's most recent emissions inventory data requirements as codified at 40 CFR part 51, Subpart A.

For SO_2 nonattainment area SIP submittals, air agencies should submit the nonattainment area emission inventory to the EPA as part of their NAA SIP submittal demonstrating attainment for the affected area. If the inventory is found to be appropriate, the EPA will approve the emissions inventory as a part of the SIP submittal for the affected area. For the formal review of the SIP submittal, the EPA expects that these inventories should contain thorough documentation of how the emissions estimates were prepared.

As part of the NAA SIP submittal, the air agency should also submit a projected attainment year inventory that includes estimated emissions for all emission sources of SO_2 which are determined to have an impact on the affected nonattainment area for the year in which the area is expected to attain the standard, consistent with the attainment demonstration for the affected area. This inventory should reflect projected emissions for the attainment year for all SO_2 sources in the nonattainment area, taking into account emission changes that are expected after the base year. Such emissions changes would include any expected emission reductions from existing control measures, from any new measures that may be adopted as part of the local area attainment plan, or from expected source shutdowns, so long as the existing and new control measures and source shutdowns are enforceable; and would include any expected emission increases due to new sources or growth by existing sources. *See* CAA section 172(c)(4).

The air agency submittal should also include the best available information on current enforceable SO_2 emission rates for the SO_2 sources located in the nonattainment area. These data, also referred to as "allowable" or "permitted" emission rate information, are essential for the air quality modeling required as part of the attainment demonstration. The air agency should also provide information describing any projected reduced emission rates that will become enforceable and lead to emission reductions in the nonattainment area prior to the attainment date. The modeling guidance contained in Appendix A to this document provides a more thorough discussion of the emission rate information recommended for the SO_2 modeling analysis. Finally, to the extent that an air agency is adopting longer term emissions limits for variable emissions sources under the approach laid out later in this guidance, the air agency should submit the information necessary to characterize the variability in these sources' emissions over time.

C. Attainment Demonstration

Section 172(c) of the CAA directs states with nonattainment areas to submit an attainment demonstration as a part of the NAA SIP. An approvable attainment demonstration would be an air quality modeling analysis that demonstrates that the emission limits in the plan will suffice to provide for timely attainment of the affected standard. In cases where the necessary emission limits have not previously been made a part of the SIP, or have not otherwise become federally enforceable, the plan needs to include the necessary enforceable limits in adopted form suitable for incorporation into the SIP in order for it to be approved by the EPA.

The attainment demonstration should include analyses supporting the air agency's determination that sufficient emission reductions will occur in the affected area in order for the area to attain the 2010 SO_2 NAAQS as expeditiously as practicable, but no later than 5 years from the effective date of designation for the area. The attainment plan for the affected area should also demonstrate, through the use of air quality dispersion modeling, using allowable emissions and supplemental analyses as appropriate, that the area will attain the standard by its attainment date. The attainment demonstration should also ensure that the area will attain the 2010 SO_2 NAAQS with a 3 year design value of no greater than 75 ppb throughout the entire nonattainment area by the statutory attainment date, through the adoption and implementation, at a minimum, of emission control measures representing RACM/RACT.

The air agency, through the use of air quality dispersion modeling, should adopt and implement control measures that are necessary to ensure expeditious attainment in the affected nonattainment area. In some cases, where the adoption of control measures on sources located inside the nonattainment area is not sufficient to attain the standard, it may be necessary for the air agency to adopt control measures on SO_2 sources that are located outside the nonattainment area which may affect attainment in the area. In such cases, the modeling for the attainment demonstration should include explicit modeling of these sources in the modeling domain for analysis.

An important feature of attainment plans is the date by which sources must comply with limits sufficient to provide for attainment. In general, the EPA expects the approvable compliance dates for control measures in the attainment demonstration to be as expeditious as practicable. Consistent with its approach for other pollutants, the EPA expects attainment plans to require sources to comply with the requirements of the attainment strategy at least 1 calendar year before the attainment date. Thus, for areas that were designated with an effective date of October 2013, with an attainment deadline that is as expeditiously as practicable, but no later than October 2018, the EPA would expect states to require sources to begin complying with the attainment strategy in the SIP no later than January 1, 2017. By this means, the plans would be able to provide at least 1 calendar year of air quality monitoring data (and at least 1 calendar year of compliance information which, when modeled, would show attainment) before the applicable attainment deadline, indicating that the plan is in fact providing for attainment.[3]

While the EPA may exercise judgment concerning the approval of SIPs with varying compliance dates for source emissions reductions, affected air agencies should be aware that the EPA would not be able to later make a determination of attainment for areas with monitors if the data from such monitors do not yield a design value that meets the NAAQS prior to the applicable attainment date. (This may be the case if the most expeditious practicable compliance date for the SIP's emissions limits is less than 3 years prior to the statutory attainment date.) Such areas may be subject to a determination that the area has failed to attain, and the required plan revisions that flow from that determination under section 179(d). The EPA believes that, where a control strategy has recently taken effect and the state can determine based on recent monitoring data and other relevant information that the control strategy will result in attainment once 3 years of data that reflect those controls are available, the required plan revisions can be accomplished in a very streamlined manner. The EPA expects that the submittal to the EPA could simply provide a demonstration that: (1) all monitors in the affected area have at least 1 calendar year of clean air quality data, (2) the approved SIP has been fully implemented for the area, and (3) emission sources have complied with their SIP requirements. Based on a review of such information, the EPA expects in most cases to be able to propose to approve a revised plan that affirms the previously-approved control strategy but establishes a new attainment date under section 179(d)(3) that reflects three full years of its implementation.

As stated previously, for attainment demonstrations for the 2010 SO_2 NAAQS, the air agency should demonstrate future attainment and maintenance of the NAAQS in the entire area

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[3] *See EDF v. EPA*, 369 F.3d 193 (2d Cir.2004); *Sierra Club v. EPA*, 356 F3d 296 (D.C. Cir. 2004) amended 2004 WL 877850 (D.C. Cir.2004);

designated as nonattainment *(i.e.,* not just at the violating monitor) by using air quality dispersion modeling (*see* Appendix W to 40 CFR part 51) to show that the mix of sources and enforceable emission rates in an identified area will not lead to a violation of the SO_2 NAAQS. For a short-term (*i.e.,* 1-hour) standard, the EPA believes that dispersion modeling, using allowable emissions and addressing stationary sources in the affected area (and in some cases those sources located outside the nonattainment area which may affect attainment in the area) is technically appropriate, efficient and effective in demonstrating attainment in nonattainment areas because it takes into consideration combinations of meteorological and emission source operating conditions that can contribute to peak ground-level concentrations of SO_2.

The area designated as nonattainment includes the nearby sources identified as likely causing or contributing to the violations of the NAAQS in the area.[4] The modeling for the attainment demonstration should include results for a suitable network of receptors representing the entire nonattainment area, and should exhibit modeling showing attainment of the NAAQS for the entire area by the statutory attainment date. Selection of the modeling domain for the attainment demonstration is based on an evaluation of the number of sources to be modeled, and their geographic distribution. The modeling domain is also dependent on the kind of receptor network needed to show attainment for the nonattainment area. The modeling domain should encompass the entire nonattainment area as designated, and in some cases should incorporate areas with sources located outside the nonattainment area which may affect attainment in the area but are not otherwise accounted for in the modeling analysis (i.e., through use of

[4] *See* Appendix A, pages A-6 and A-7 for more detail on steps that should be taken in developing the modeling domain for the attainment demonstration of the SIP.

background concentrations, or explicit modeling).[5] The modeling domain should also identify sufficient receptors throughout the modeling domain in order to appropriately characterize changing gradients of air quality concentrations. For the attainment demonstration for the NAA SIP, the EPA recommends that air agencies follow the EPA's *Guideline on Air Quality Models*, Appendix W to 40 CFR part 51, which provides recommendations on modeling techniques and guidance for estimating pollutant concentrations in order to assess control strategies and determine emission limits.[6]

Appendix A of this document contains modeling guidance supplemental to that provided in the preamble to the final rulemaking promulgating the 2010 SO_2 NAAQS and in 40 CFR part 51, Appendix W. Appendix A of this document has also been updated to respond to issues raised during the comment period related to the September 2011 draft SO_2 Guidance Document. This guidance clarifies the EPA's recommendations on how to conduct refined dispersion modeling under Appendix W to support the implementation of the 2010 SO_2 NAAQS. Although the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) is identified as the preferred model under Appendix W for a wide range of applications and would be appropriate for most modeling applications to support the 2010 SO_2

[5] The modeling for the attainment demonstration should include results for a suitable network of receptors representing the entire nonattainment area, and should exhibit modeling showing attainment of the NAAQS for the entire nonattainment area by the statutory attainment date. Where it is necessary for the nonattainment area to attain the NAAQS, the state should address the impacts of sources located outside the nonattainment area which may affect attainment in the area. In all other cases, sources located outside the nonattainment area should be accounted for as part of the background concentrations in the modeling for the attainment demonstration for the area. *See* Appendix A below, "Modeling Guidance for Nonattainment Areas".

[6] When considering other sources to include in the modeling (other than those that are driving the nonattainment), Appendix W states in section 8.2.3.b that all sources expected to cause a significant concentration gradient in the vicinity of the source of interest should be explicitly modeled and that the number of such sources is expected to be small except in unusual cases. Other sources in the area, i.e. those not causing significant concentration gradients in the vicinity of the source of interest, should be included in the modeling via monitored background concentrations as described later in Section 8 of this guidance. The number of sources to explicitly model should generally be small. *See* Appendix A, section 5.1 of this guidance.

NAAQS, Appendix W allows flexibility to consider the use of alternative models on a case-by-case basis when an adequate demonstration can be made that the alternative model performs better than, or is more appropriate than, the preferred model for a particular application. Appendix A also discusses the option of conducting supplemental analyses to provide additional information regarding the adequacy of the plan in providing for attainment.

D. Control Strategy (Including RACM/RACT)

1. Accounting for national/regional measures.

The NAA SIP should provide for attainment of the standard based on SO_2 emission reductions from control measures that are permanent and enforceable.[7] Air agencies should consider all RACM/RACT[8] that can be implemented in light of the attainment needs for the affected area(s). The EPA has also promulgated other regulatory requirements that it expects will yield substantial reductions in SO_2 emissions that will significantly contribute to timely attainment of the 2010 SO_2 NAAQS. Thus, the EPA anticipates that the implementation of national and regional control programs will ease the process of planning for attainment of the 2010 SO_2 NAAQS. The subsections below describe some of these programs and the steps needed in many cases for the reductions at specific plants to become enforceable and creditable for attainment planning purposes.

As noted above, the CAA directs attainment of areas designated as nonattainment to be as expeditiously as practicable, but no later than 5 years from the effective date of designation as nonattainment. To the extent that the EPA has promulgated national and regional rules that will

[7] *See* section 110(a)(2)(A) of the CAA.

[8] Section 172 (c) (1) of the CAA provides that "Such plan shall provide for the implementation of all reasonably available control measures as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of reasonably available control technology) and shall provide for attainment of the national primary ambient air quality standards."

require significant SO_2 emission reductions in the period after areas are designated as nonattainment, "expeditious attainment" may in many cases mean that attainment will be possible earlier than 5 years from the date of designation as nonattainment.

a. National and regional measures.

Stationary source emissions of SO_2 are limited by new source performance standards (NSPS) under sections 111 and 129 of the CAA; and the national emission standards for hazardous air pollutants (NESHAP) under section 112 of the CAA. These latter reductions result from control of hazardous air pollutants (HAP) such as hydrogen chloride (HCl) under those rules. In addition, significant reductions in SO_2 emissions from fossil-fuel fired power plants have occurred and will continue to occur as a result of trading programs including Title IV of the CAA, sections 402-416, and from CAIR. Significant reductions of mobile source emissions of SO_2 have also occurred or will be coming before some attainment dates as a result of requirements to reduce the sulfur content of various motor fuels.

Several recent EPA air quality regulations on EGUs and other large sources (such as various types of boilers and incinerators) have the potential to significantly reduce SO_2 emissions further in the United States. Pursuant to CAA section 112, MACT regulations for coal-and oil-fired EGUs, known as the Mercury and Air Toxics Standards, or MATS, were promulgated on February 16, 2012, at 77 FR 9304. These regulations were targeted at reducing EGU emissions of HAPs (e.g., mercury, HCl, hydrogen fluoride (HF), dioxin, and various metals) and are not targeted at reducing emissions of SO_2 (which is a criteria pollutant, not a HAP listed under CAA section 112). Nevertheless, the EPA recognizes that some control measures for reducing emissions of HCl, such as scrubbers, concurrently reduce emissions of SO_2. Indeed, under MATS, EGUs meeting specific criteria may choose to demonstrate compliance with alternative

SO_2 emission limits in lieu of demonstrating compliance with HCl emission limits. Following promulgation of MATS, the EPA reconsidered the limits on new EGUs, and promulgated revised limits on April 24, 2013, at 78 FR 24073. Further information on these rules is available at *http://www.epa.gov/mats*.

The EPA also promulgated rules requiring MACT for major source and area source industrial, commercial and institutional boilers; for commercial and industrial solid waste incinerators; and for sewage sludge incinerators. *See* 76 FR 15608, 76 FR 15554, 76 FR 15704 and 76 FR 15372, respectively. These rules promulgated limits on emissions of mercury, particulate matter (as a surrogate for non-mercury metallic HAP), HCl and carbon monoxide as a surrogate for organic HAP. While some of these rules do not establish limits on emissions of SO_2, the EPA expects that compliance with the mercury and HCl limits in these rules would in many cases necessitate the installation and operation of control equipment that would significantly reduce SO_2 emissions. On January 31, 2013, the EPA published notices of final rulemaking reconsidering and amending limits for major source boilers, area source boilers and commercial and industrial solid waste incinerators, respectively[9]. The EPA denied petitions for reconsidering the rules for sewage sludge incinerators. The D.C. Circuit Court remanded the standards for sewage sludge incinerators to the EPA on August 20, 2013, but left the standards in place to allow the EPA time to address the issues related to the remand. Further information on the status of these rules is available at *http://www.epa.gov/airquality/combustion/*.

Regulations to reduce the interstate transport of air pollution are also leading to reductions in SO_2 emissions that may help certain areas attain the 2010 SO_2 NAAQS,

[9] *See* at 78 FR 7138; on February 1, 2013, at 78 FR 7488; and on February 7, 2013, at 78 FR 9111.

particularly in the eastern United States. The CAIR[10], which the EPA published on May 12, 2005, implemented an SO_2 cap and trade program across 23 states and the District of Columbia. *See* 70 FR 25162. CAIR was projected to reduce SO_2 emissions in 2015 by 5.4 million tons, or 57 percent, from 2003 levels in these states. In 2008, however, the Court of Appeals for the District of Columbia Circuit (Court) remanded CAIR back to the EPA. *North Carolina v. EPA*, 550 F.3d 1176. The Court remanded the rule to the EPA without vacating it because it found that "allowing CAIR to remain in effect until it is replaced by a rule consistent with [the court's] opinion would at least temporarily preserve the environmental values covered by CAIR." *North Carolina v. EPA*, 550 F.3d at 1178. CAIR compliance with nitrogen oxide (NOx) and SO_2 programs began in 2009 and 2010 respectively. Although the EPA promulgated a replacement for CAIR on August 8, 2011, known as the Cross-State Air Pollution Rule (CSAPR), the D.C. Circuit Court vacated CSAPR in August 2012. In vacating CSAPR, the Court ordered that CAIR would remain in effect pending development of a valid replacement rule. The Supreme Court has agreed to review the decision of the D.C. Circuit Court. For further information on the status of CAIR and CSAPR, *see http://www.epa.gov/airtransport/*.

The CAIR program established a region-wide cap on emissions which is the sum of individual state emission budgets for the 23 eastern states and the District of Columbia in the CAIR SO_2 program. Authorizations to emit SO_2, known as allowances, are allocated to affected sources in the CAIR region. The SO_2 allowance market enables sources to trade (buy and sell) allowances throughout the year. The rule does not specify plant-specific emission limits and sources can choose among several options to reduce SO_2 emissions. At the end of the year,

[10] CAIR is a cap and trade program designed to reduce the interstate transport emissions from power plants that contribute significantly to nonattainment of, or interfere with maintenance of, the 1997 $PM_{2.5}$ and ozone NAAQS in downwind states. Because SO_2 is an important $PM_{2.5}$ precursor, CAIR requires substantial SO_2 reductions.

however, each source must hold sufficient allowances to cover its emissions (where each allowance represents 1 ton of SO_2 emissions). Significant SO_2 emissions control measures have been installed on EGUs in the eastern United States to meet the requirements of CAIR, resulting in significant decreases in SO_2 emissions relative to pre-CAIR levels.

b. SO_2 reductions from national rules.

The SO_2 reductions that result when a source achieves compliance with MACT standards and transport SIPs/FIPs are significantly influenced by source-specific factors. When a facility opts to comply with CAIR by installing SO_2 control equipment, the company may choose among various levels of SO_2 control efficiency, taking into account the number of SO_2 allowances that it holds or plans to hold. Flue gas desulfurization systems that have been installed under the Acid Rain program and CAIR have commonly achieved between 90 and 98 percent control efficiency. Similarly, controls for HAPs may achieve varying degrees of efficiency. For example, facilities that install flue gas scrubbing equipment to comply with HCl emission limits in a MACT regulation may have varying fuel chlorine content, leading to varying degrees of control needed to meet HCl emission limits, and may use varying degrees of reagent effecting varying degrees of SO_2 removal. Controlled SO_2 emissions are also a function of the fuel sulfur content and various other factors. Dry sorbent injection is another control option, achieving SO_2 control efficiencies from 30 to 60 percent or higher. Thus, the actual post-control SO_2 emission level that can be achieved at a particular facility is a function of several site-specific factors. The SIP establishing SO_2 emission limits for specific facilities would need to reflect source-specific factors influencing control efficiency as well as the attainment needs of the area.

c. SO_2 limits for sources complying with MACT and interstate transport rules.

For facilities subject to the previously listed MACT and regional interstate transport rules, additional control measures may not be necessary to demonstrate compliance with the 2010 SO_2 NAAQS. An air agency may only need to work with the affected facilities to establish suitable SO_2 emission limits that provide for attainment of the 2010 SO_2 NAAQS consistent with the facilities' plans for compliance with the relevant national and regional rules. The control measures and associated SO_2 emissions limits for a specific facility would need to be permanent and enforceable under the SIP, even if they might not be required to be so under the federal rule(s) that drives the reductions. That enforceability would most commonly be achieved by a source specific permit setting emission limits.

Regional transport regulations (*e.g.* CAIR) require emission reductions from among a set of sources but do not require controls at particular sources. SO_2 concentrations are generally sensitive to emissions from individual nearby plants and less sensitive to regional emission reductions. Therefore, to demonstrate attainment, it will likely be necessary to establish plant-specific SO_2 emission limits to make creditable any emission reductions that the facility may be implementing to address trading program requirements. The air agency has the option to negotiate with its sources to pursue a distribution of controls under the applicable regional transport regulation that also optimizes the achievement and attainment of the SO_2 standard. For such demonstrations the allowable emissions should reflect the specific limits given in an enforceable document (*e.g.*, a rule or permit).

Unlike the transport rules, the MACT rules impose specific requirements, including HAP emission limitations, for facilities in the subject source categories. While MACT standards generally do not specify the type of control measure or technology a source must use to meet an emission standard, they are based upon the HAP emissions reduction performance that is achieved by an average of the best performing sources in the subject source category, which is usually driven by an identified add-on control technology and/or pollution prevention measure employed by such sources. Each facility that is subject to these rules would be subject to HAP emission limits that in many cases will necessitate installation of control equipment or the use of other control measures to substantially reduce regulated HAP emissions, which are prone to result in ancillary reductions of SO_2 emissions.

However, because SO_2 is not a HAP, in most cases the MACT do not require a specific SO_2 emission level. In such cases, further state action, typically by permit or by rule, would be necessary to establish an enforceable SO_2 emission limit for SIP purposes. An exceptional case is incinerators subject to CAA section 129, for which the MACT rules establish a specific numeric SO_2 emissions limit under section 129(a)(4). For industrial boilers and other analogous combustion sources, the MACT rules do not mandate achievement of specific SO_2 emissions levels. Therefore, the SO_2 emission reductions resulting from these rules (except section 129 rules) could be creditable for SIP purposes if the state establishes a specific, enforceable SO_2 emission limit for the source.

For many EGUs, the MATS rule allows the source to choose either to demonstrate compliance with a limit on HCl emissions or to demonstrate compliance with a limit on SO_2 emissions as a surrogate for HCl. This option is available to EGUs that burn coal, operate flue gas desulfurization equipment, and operate a continuous emissions monitoring system (CEMS) for SO_2. As a general matter, a requirement where a source has the option to meet either an HCl limit or an SO_2 limit could not be considered an enforceable restriction on SO_2 emissions for SIP purposes. On the other hand, the EPA believes that these particular circumstances allow a streamlined approach using Title V permits to make the SO_2 limit creditable for SIP purposes.

The Title V permits that the source is required to have under the CAA and the EPA regulations must include emission limitations and standards, including those operational requirements and limitations that assure compliance with all applicable requirements. In addition, the EPA's rules under Title V require compliance and monitoring requirements sufficient to assure compliance with the permit terms and conditions. *See* 40 CFR 70.6(c)(1) and (c)(5)(iii)(B). The EPA expects many sources to choose to demonstrate compliance with the SO_2 emission limit rather than the HCl limit. The EPA expects that these sources' Title V permits would specify that the source must meet the SO_2 limit in the MATS rule.

In these circumstances, the EPA believes that states have multiple options for assuring that the SO_2 limit in the MATS rule is permanent and enforceable and therefore creditable under the SIP's attainment demonstration. The state may opt to establish the limit as an independent permanent and enforceable limit, for example by rule or administrative order, and incorporate it into the SIP submission. However, the EPA believes that an additional option is warranted in these special circumstances, wherein the state uses a combination of Title V permitting and SIP development processes to establish the SO_2 limit of the MATS as a permanent and enforceable and creditable limit. In this latter option, the state would revise the source's Title V permit to identify the MATS rule as imposing a set of applicable requirements for the source. The permit revision in particular would establish (pursuant to 40 CFR 70.6(c)(1) and (c)(5)(iii)(B)) that compliance with MATS requires compliance with the MATS SO_2 emission limit, and the permit would also identify the associated monitoring, recordkeeping, and reporting requirements. The state would then submit these provisions of the Title V permit as part of its SO_2 SIP submittal, certifying that the state considers the source to have permanently selected the MATS SO_2 limit as its chosen means of demonstrating compliance with the MATS acid gas control requirements.

After SIP approval, the SO_2 limit itself would be an applicable requirement for the source, and any subsequently renewed Title V permit for the source would need to identify the SO_2 limit as such. Title V permit renewals or revisions that did not continue to reflect the MATS SO_2 limit, in the absence of an EPA SIP approval of such a change, would not be considered to reflect the applicable requirements of the approved SIP and would be subject to the EPA veto. The EPA believes that this streamlined approach is a suitable means of assuring that the underlying, permanent MATS requirement for acid gas control may be treated as a requirement to meet the particular SO_2 emission limit in MATS and for that limit to qualify as a permanent and enforceable and creditable limit for SIP purposes.[11]

2. Averaging times for SO_2 emission limits.

a. Policy regarding averaging times for SO_2 emission limits.

Past EPA guidance has recommended that averaging times in SIP emissions limits should not exceed the averaging time of the applicable NAAQS that the limit is intended to help attain.[12] For example, under that guidance, the averaging time for an emission limit for complying with the 3-hour secondary SO_2 standard would not exceed 3 hours. Following this approach would suggest that emission limits for attaining the 1-hour SO_2 standard should limit emissions for each hour, without any provision for limiting emissions as averaged across multiple hours. Such an approach would assure that during no hour would emissions in compliance with such a limit have the possibility of exceeding the level associated with attainment of the NAAQS. This

[11] After the EPA approves such a SIP revision, sources would still have the option to request to show compliance with the MATS acid gas requirements by meeting the MATS HCl limit, but such a request would involve a SIP revision and a Title V permit revision, and presumably would involve establishing a suitable replacement SO_2 emission limit, if needed, for the area to continue to show attainment of the NAAQS.

[12] *See* SO_2 Guideline Document, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. 27711, EPA-452/R-94-008, February 1994. (*See http://www.epa.gov/ttn/oarpg/t1pgm.html*).

guidance uses the term "critical emission value" to refer to the hourly emission rate that the model predicts would result in the 5-year average of the annual 99th percentile of daily maximum hourly SO_2 concentrations at the level of the 1-hour NAAQS, given representative meteorological data for the area. Establishing 1-hour limits at the critical emission value is a conservative approach to developing a control strategy that ensures that NAAQS violations do not occur, and is an approach that the EPA recommended in the September 2011 draft guidance and considers acceptable.

After discussing this approach in the September 2011 draft guidance, the EPA received numerous comments. Industry commenters expressed concern that this approach is overly conservative because short term periods of emissions above the critical emission value have an extremely low likelihood of causing a NAAQS exceedance. This conservatism, they argued, is particularly problematic for sources that have highly variable hourly emissions due to such factors as variable sulfur content in fuel, variable operating load, etc. These commenters suggested that designing a control strategy to ensure that emissions for any given hour never exceed the critical emission value might require limits that are extremely difficult to achieve in practice where there is such variability. These commenters suggested that the EPA should accommodate this variability by allowing longer-term average emission limits. Environmental group commenters expressed concern that any provision for longer-term averages would allow short periods of emissions above the critical emission value that would create the potential for violations. In other words, they suggested that the only way to ensure attainment is to establish hourly emission limits at the critical emission value, such that, if met, the source could not cause the number and level of exceedances that would constitute a NAAQS violation.

After considering these comments, and analyzing the impact of emissions variability on air quality, the EPA expects that it may be possible in specific cases for states to develop control strategies that account for variability in 1-hour emissions rates through emission limits with averaging times that are longer than 1 hour, using averaging times as long as 30-days, but still provide for attainment of the 2010 SO_2 NAAQS. The EPA would need to consider specific submitted candidate emission limits along with other elements of a submitted SIP attainment demonstration in order to conclude whether such a limit would be approvable. This view is based on the EPA's general expectation that, if periods of hourly emissions above the critical emission value are a rare occurrence at a source, particularly if the magnitude of the emissions is not substantially higher than the critical emissions value, these periods would be unlikely to have a significant impact on air quality, insofar as they would be very unlikely to occur repeatedly at the times when the meteorology is conducive for high ambient concentrations of SO_2. The EPA believes that making this option available to states could reflect an appropriate balance between providing a strong assurance that the NAAQS will be attained and maintained, while still acknowledging the necessary variability in source operations and the impairment to source operations that would occur under what could be in some cases an unnecessarily restrictive approach to constraining that variability.

Nevertheless, in order to provide adequate assurance that the NAAQS will be met, the EPA believes that any emissions limits based on averaging periods longer than 1 hour should be designed to have comparable stringency to a 1-hour average limit at the critical emission value. A limit based on the 30-day average of emissions, for example, at a particular level is likely to be a less stringent limit than a 1-hour limit at the same level, since the control level needed to meet a 1-hour limit every hour is likely to be greater than the control level needed to achieve the same limit on a 30-day average basis. Therefore, as a general matter, the EPA would expect that any emission limit with an averaging time longer than 1 hour would need to reflect a downward adjustment to compensate for the loss of stringency inherent in applying a longer term average limit.[13]

Appendix B documents analyses that the EPA has conducted to evaluate the extent to which longer term average limits that have been adjusted to have comparable stringency to 1-hour limits at the critical emission value provide for attainment. In brief, while a longer term average limit as contemplated here would allow occasions when emissions exceed the critical emission value, the use of a lower limit compensates by requiring most values to be lower than they are required to be with a 1-hour limit at the critical emission value. The EPA expects that a common net result will be that the comparably stringent limit will provide a sufficient constraint on the frequency and magnitude of occurrences of elevated emissions (especially if supplemented with more direct limits on these occurrences) that a control strategy based on such limits would reasonably provide for attainment.

To assist with the application of the recommended adjustment approach, the EPA is providing example calculations reflecting a recommended method for determining a suitable longer term average limit (in this example, a 30-day average) in Appendix C. This approach would be conducted for each unit that is to be subject to a longer term limit. This approach would involve calculating an appropriate longer term average limit as a percentage of the 1-hour limit that would otherwise be applied. Thus, the first step of these calculations is to conduct dispersion modeling to determine critical emission values, i.e. to determine the limits that would

[13] Stack tests generally involve three runs of approximately 1 hour each. Although stack tests therefore implicitly provide approximately 3-hour average results, the EPA does not expect any adjustments for limits for which compliance is determined by stack test.

be established if the state were applying 1-hour average limits. This modeling will help determine the control strategy that the source will need to apply, which as discussed below influences emissions variability and thus influences the relationship between the critical emission value and the comparably stringent longer term limit. For each emission unit that is to be subject to a longer term average limit, the next four steps of these example calculations are to determine a percentage adjustment based on information appropriate for that unit and its anticipated control strategy. This percentage adjustment is applied to the critical emission value in the final step, to determine a longer term average limit for the unit, at a level that the EPA would expect to be comparably stringent as a 1-hour average limit at the critical emission value. Under this approach, the state would not conduct dispersion modeling using the adjusted level of the longer term limit; instead, the state would submit modeling demonstrating that a hypothetical 1-hour average limit at the critical emission value would provide for attainment, supplemented by a case-specific demonstration that the actually adopted longer term limit reflects a comparable degree of stringency as the hypothetical 1-hour limit at the critical emission value.

The EPA is not precluding states from using other approaches to determine appropriate longer term average limits. However, the EPA would recommend in all cases that the analysis begin with determination of the critical emission values. A comparison of the 1-hour limit and the proposed longer term limit, in particular an assessment of whether the longer term average limit may be considered to be of comparable stringency to a 1-hour limit at the critical emission value, would be a critical element of a demonstration that any longer term average limits in the SIP will help provide adequate assurance that the plan will provide for attainment and maintenance of the 1-hour NAAQS.

Similar principles apply in areas with multiple emission points subject to longer term average limits. The EPA envisions that each such emission point would be subject to an independent analysis of the appropriate adjusted limit (except to the extent that the state justifies applying results of the same analysis to multiple emission points). The statistical principles that make a NAAQS violation highly unlikely with an appropriately set single source longer term average emission limit would also make a NAAQS violation highly unlikely with the combination of appropriately set longer term average emission limits for multiple sources.

The EPA recognizes that the development of longer-term average limits that reflect comparable stringency will necessitate additional effort by air agencies, and by the EPA in reviewing them. We do not expect that the use of longer term averages will be necessary in cases where sources' emissions do not exhibit a high degree of variability. Therefore, the EPA recommends limiting the use of this approach to only those instances where a source's normal emissions variability would result in 1-hour limits being extremely difficult to achieve in practice. In such cases, as previously noted, the EPA believes this approach provides appropriate flexibility while still requiring approximately the same control strategy and while still providing for attainment of the standard.

b. Criteria for establishing emission limits with longer averaging times.

In conjunction with a states' normal obligation to demonstrate that their attainment plans suitably provide for attainment, the EPA believes that air agencies that use longer term average limits should provide additional justification for the application of such limits. The EPA expects to consider the following factors in evaluating the adequacy of plans with limits based on longer averaging times: (1) whether the numerical value of the mass emissions limit averaged over a longer time is comparably stringent to a 1-hour limit at the critical emission value; and (2) whether the longer term average limit, potentially in combination with other limits, can be expected to constrain emissions sufficiently so that any occasions of emissions above the critical emission value will be limited in frequency and magnitude and, if they occur, would not be expected to result in NAAQS violations.

The EPA is issuing this guidance based on consideration of the statistical nature of the NAAQS and based on analyses of selected cases suggesting that comparably stringent longer term average limits can commonly be expected to provide adequate assurance of attainment. For sources to which states wish to apply longer averaging time limits, the EPA expects states to provide information on emissions variability and any related information necessary to enable the EPA to judge whether the frequency and magnitude of occurrence of elevated emissions can be expected to be sufficiently constrained that the plan provides adequate confidence that the area will attain the NAAQS. This information, addressing the factors stated above, would support case-specific SIP rulemaking to address whether the plan provides adequate assurance of attainment.

The first criterion in reviewing SIPs with longer term average limits is whether the stringency of each longer term limit is comparable to the stringency of a 1-hour limit at the critical emission value, i.e. of the 1-hour limit that would otherwise be set to provide for attainment. The EPA expects that meeting the new longer term emission limit would entail application of comparable levels of emission controls as would be required to meet a 1-hour limit that would show attainment of the NAAQS.

In comparison to a source's 1-hour emission rate that the state determines would provide for NAAQS attainment (*i.e.* the critical emission value), the EPA would expect that any emission limit established for that source with an averaging time longer than 1 hour would be set at a level that is sufficiently lower to provide a comparable degree of stringency as the corresponding 1-hour limit that would otherwise be set to provide for attainment. In theory, the adjusted longer term limit would allow occasional emission spikes above the critical emission value, but this adjusted limit would also require emissions to be lower for most of the averaging period than they would be required to be with a 1-hour emission limit. In cases where longer term average limits are appropriate, the EPA envisions that both the short-term and longer-term limits in practice would require similar emission control levels and would commonly result in similar emission patterns.

Appendix C presents example calculations in which the level of the longer term average limit is derived by applying an adjustment factor to the critical emission value, and the adjustment factor is derived from statistical analysis of a set of data that reflect the emissions variability that the controlled source is expected to exhibit. The analysis underlying these example calculations compares the set of emission values averaged over the longer averaging time against the set of 1-hour emission values from which the longer term averages were derived. Insofar as the goal of the analyses is to identify a longer-term average limit that requires a comparable degree of control particularly at times of greatest emissions as would be required by the 1-hour limit that would otherwise be set, the EPA would expect the analyses to compare the corresponding longer-term average and 1-hour values among times of greatest emissions. Indeed, the example calculations in Appendix C reflect a comparison of 99^{th} percentile values of the sets of 30-day averages and 1-hour averages.

Given this focus on the upper end of the distribution of longer term averages and 1-hour averages, focusing on only a fraction of the total data set, states would need to assure that an adequately robust data set is available to support the necessary analysis. The EPA anticipates that data sets reflecting hourly data for at least 3 to 5 years of stable operation (i.e., without changes that significantly alter emissions variability) would be needed to obtain a suitably reliable analysis. Fortunately, such data sets are widely available for EGUs, as required by 40 CFR part 75 and reported to the EPA. Similar emissions monitoring is required for a few additional source types under 40 CFR part 51, Appendix P, though these hourly data are not commonly made publicly available.

Emissions variability is influenced by many factors, and these factors need to be considered in order to assure that an appropriate analysis of emission variability is conducted. For example, if the new emission limit requires more stringent emission control than is currently in place at a source, the analyses should be designed, to the extent practicable, to reflect the hourly emissions variability that can be expected once the emission limit is in place. Since the variability of emissions is in part a function of emission control technique, and might be expected to differ for example with use of low sulfur coal as opposed to the use of flue gas desulfurization, the analyses to the extent practicable should reflect the degree of variability that is expected once the expected emission control is in place.

Appendix D describes a broad analysis of typical percentages, differentiated by the type of control equipment if any, that would be multiplied times the appropriate 1-hour limits to estimate comparably stringent 24-hour average limits and 30-day average limits. As would be expected, these results suggest that emissions variability is generally greater for sources with emission control equipment.

In compiling the results summarized in Appendix D, the EPA identified selected cases in which the approach described in Appendix C leads to calculation of ratios well outside the normal range summarized in Appendix D. These cases appear commonly to be the result of occasions of elevated emissions due to non-operation of emission control equipment that disproportionately influences the 99th percentile of the 30-day averages but not the 99th percentile of the 1-hour values, or vice versa. In such cases, the approach described in Appendix C may not appropriately estimate the relationship between comparably stringent longer term average and 1-hour limits, and the typical ratios in Appendix D may provide a better estimate of comparably stringent limits. In all cases, the EPA advises that in setting longer term limits, states should examine the relationship between the distributions of hourly and longer term averages to identify such atypical features in the distributions that need to be accounted for before determining the appropriate downward adjustment.

The EPA expects that the necessary control strategy for each source will generally be evident once the state has completed sufficient modeling to identify critical emission values. The EPA generally envisions that the control strategy needed to meet a comparably stringent longer term limit would be essentially the same as the control strategy needed to meet a 1-hour limit at the critical emission value. In cases where multiple control options may suffice to achieve the necessary emission control, the state may need to explore the effect of different choices of control options, and the SIP that may be met by various control strategies would need to apply a limit that provides adequate assurance of attainment regardless of the source's choice among those control strategies.

The variability of emissions is influenced by source-specific variations in operating rates and fuel sulfur content. These factors should be weighed to assure that the analysis of variability provides the best projection of variability in emissions that can be expected once the limit takes effect. Time series of emissions from the source itself are generally the best source of data for determining expected emissions variability, except to the extent that implementation of a control strategy might change the source's expected emissions variability. Nevertheless, data from other sources of comparable source type, size, operation, fuel, and control type may be useful for these comparisons. The justification for the limits derived from this analysis would need to support a conclusion that the emissions variability in the data used reflect the full degree of prospective variability that the source can be expected to exhibit once it implements the attainment plan. If the EPA approves an attainment plan but subsequently learns that emissions variability at a source is exceeding the expected variability, such that the plan proves not to provide the expected confidence that the NAAQS is being attained, the EPA will use its available authority to pursue any necessary corrections of the plan.

States should carefully consider the data handling provisions associated with any longer term average limit. A good prototype is the set of data handling provisions for the SO_2 limit in the MATS. Compliance with this limit is determined according to emissions averaged across 30 consecutive operating days, with a new 30-operating-day average computed each operating day.[14] Compliance with this limit (expressed in pounds of SO_2 emissions per megawatt-hour, since the rule is designed to achieve a control level rather than a particular air quality level) is determined by dividing total mass over the 30 operating days by the total electrical output during that period. Particularly for limits on emission factors (e.g., limits on pounds of emissions per megawatt-hour), this procedure effectively weighs each hour's data point according to the hour's emissions, and thus better indicates the average rate of emissions than for example computing an average of hourly average emission rates. The MATS procedure also effectively provides that hours with no operation have no effect on the calculated average emission rate, which is a desirable feature in order to focus on how well controls are operating during operating hours.

[14] As in MATS, "operating day" should generally be defined to be a day with any operation.

The selection of data handling procedures influences the longer term averages that are computed and thus influences the relationship between a 1-hour limit and a comparably stringent longer term average limit. Therefore, early in its process, the state should determine the intended data handling procedures it intends to require, and all analyses for determining comparably stringent longer term average limits should then apply those data handling procedures.

SO_2 emission limits are often expressed either in terms of emission rates (*e.g.*, pounds per hour) or in terms of emission factors (*e.g.*, lbs/mmBTU heat input), with the latter type of limit reflecting the emission factor that at the source's maximum operating rate would result in emissions at the rate found to provide for attainment. The variability of values for these two parameters will likely be different. Therefore, analyses of a longer term average limit that is comparably stringent to a 1-hour limit at the critical emission value would need to be designed to assess variability for the parameter for which an emission limit is being set.

In a few cases, states may conclude that a suitable attainment plan includes existing limits with previously established averaging times longer than 1 hour, or relies on other federal rules (e.g., MATS) with limits that have averaging times longer than 1 hour. The same principle described above also applies here, namely that a source subject to a limit based on a longer term average would be modeled as if it emitted at the rate that would represent a comparably stringent 1-hour average emission limit, which would generally be a higher emission level than the level of the longer term average limit.

The second important factor in assessing whether a long term average limit provides appropriate protection against NAAQS violations is whether the source can be expected to comply with a long term average limit in a manner that minimizes the frequency of occasions with elevated emissions and magnitude of emissions on those occasions. Use of long term average limits is most defensible if the frequency and magnitude of such occasions of elevated emissions will be minimal. Consequently, supplemental limits on the frequency and/or magnitude of occasions of elevated emissions can be a valuable element of a plan that protects against NAAQS violations. Limits against excessive frequency (*e.g.*, limitations on the number of times the hourly emissions exceed the critical emission value) and/or magnitude of elevated emissions (*e.g.*, an hourly emissions limit, supplementing the longer term limit, which sets a cap on the magnitude of the peak hourly emissions rate) could further strengthen the justification for the use of longer term average limits.

States have several additional options for restricting the frequency and magnitude of occurrences of elevated emissions. First, states may apply shorter averaging times, such as 24 hours, which provide less allowance of emission spikes than would longer averaging times, such as 30 days. Second, for sources that are or will be operating emission control equipment, states may establish requirements for the operation of this control equipment. For such sources, a substantial component of the variability in emissions often arises from variations in the operation of the control equipment, perhaps including operating the source when the control equipment is not operating. States have multiple options for requiring less variability in control equipment operation. One option would be a direct work practice requirement for operation of the control equipment, perhaps specifying some minimum level of control efficiency and associated monitoring, recordkeeping and reporting requirements. Another option would be to establish a peak 1-hour emission limit in conjunction with the longer term average limit. This supplementary 1-hour limit would presumably be higher than the critical emission value but sufficiently low enough to prohibit emission spikes that would otherwise occur on occasions with uncontrolled emissions. A further option is to limit the frequency of elevated emissions. For example, a limit could be set on the number of times in a 30-day period that emissions exceed the critical emission value, perhaps limiting this frequency of elevated emissions to the frequency of elevated emissions found in the historical emission pattern used to determine the long term limit.

In many cases, a combination of emission limits is the most appropriate means of limiting emissions from affected facilities. For example, in addressing the Portland Generating Station in Pennsylvania, the EPA promulgated a 1-hour emission limit on mass emissions (in pounds per hour) in combination with a supplemental 30-day average limit on emissions per MMBTU of heat input at the facility (*See* 76 FR 69052).

The frequency and magnitude of occurrences of elevated emissions can have an important influence on the likelihood of violations. Sources with emission control equipment may be especially prone to periodic occurrences of high emissions, arising on occasions when the control equipment is not operating or operating at reduced efficiency. Therefore, the EPA finds it advisable that longer term average limits for sources that meet these limits through the use of emission control equipment be subject to supplemental limits that serve to constrain the frequency and/or magnitude of occasions of elevated emissions. Establishment of such supplemental limits as part of a longer-term averaging approach is especially important in cases with significant potential for frequent and/or high magnitude occasions of elevated emissions, including, but not limited to, sources using emissions control equipment. While most important for such sources, the EPA generally encourages consideration of such limits for all sources being considered for longer term average emission limits in ensuring that SIPs provide an adequate assurance of attainment.

States that wish to set emission limits with averaging times longer than 1 hour are advised to consult with their respective EPA Regional Office to assure that the adjustments to the emission limits are appropriately justified and the frequency and magnitude of allowable occurrences of elevated emissions are sufficiently constrained before formally submitting NAA SIPs. The justification for use of the longer term average limits and the justification for the established limit will then provide the formal basis for the EPA's case-by-case review of whether the plan adequately provides for attainment of the standard.

c. Sources without CEMS.

The EPA's approach for using 1-hour emissions rates to develop comparably stringent longer term average emission limits is primarily appropriate for sources equipped with CEMS. However, longer term average limits may also be appropriate for selected additional sources that are not CEMS-equipped. The absence of CEMS data in such cases poses two particular challenges: (1) establishing the appropriate emission limit, and (2) establishing the appropriate compliance determination method. This section addresses analysis of appropriate emission limits for such sources. The following section addresses compliance determination methods.

As noted above, the EPA envisions that establishing an appropriate longer-term average limit will involve assessing an adjustment in the level of the limit that would provide for comparable stringency. This assessment should generally be conducted using data obtained by CEMS, in order to have sufficient data to obtain a robust and reliable assessment of the anticipated relationship between longer-term average emissions and 1-hour emission values, which is necessary in turn to have a suitable assessment of the warranted degree of adjustment of the longer-term average limit in order to provide comparable stringency to the 1-hour emission rate that is determined to provide for attainment.

The EPA acknowledges the possibility that a source without a CEMS, but with exhaustive fuel quality data and exhaustive operating rate information, might have sufficient information to support an adequate assessment of emissions variability. However, states wishing to apply longer term average emission limits to such sources would need to demonstrate that such limits are based on adequate data representing hourly emissions variability, generally similar to the 3 to 5 years of CEMS data recommended above. As noted above, particular caution is warranted if the SIP will require additional emission control equipment, since existing emissions data from a source without control equipment would not reflect the emissions variability that would be expected with control equipment operation.

Since sources without CEMS would generally lack sufficiently robust data for determining an appropriate emission limit adjustment, the use of a longer-term average at such a source would generally entail inferring the appropriate adjustment of data from another comparable source. Therefore, use of a longer-term average for a source without a CEMS would generally be appropriate only if an adjustment can be inferred from data for another source that can be demonstrated to have comparable (or greater) emissions variability. This demonstration should be based on available data and should also consider the range of factors that influence emissions variability such as fuel type, fuel origins, source type and operational characteristics. To the extent that emissions variability is influenced by variability in operating rate, the analysis of whether the adjustment can be inferred from data for another source should include a comparison of the operation rate variability of the two sources. Given the uncertainties in extrapolating emissions characteristics from data for another source, the EPA advises states to assure that a conservative use of the other source's data is applied in determining the appropriate emission limit adjustment.

d. Compliance determination methods.

Section 172(c)(6) of the CAA requires that nonattainment area SIPs "include enforceable emission limitations, and such other control measures means or techniques ..... as well as schedules and timetables for compliance, as may be necessary or appropriate to provide for attainment of such standard in such area by the applicable attainment date specified in this subpart." Therefore, the limitations that air agencies establish to provide for timely attainment would need to meet various criteria for enforceability.

For emission limitations to be enforceable, each SIP would need to identify methods for determining compliance with the limitations. The most common set of reference methods for evaluating compliance with SO_2 emission limits is known collectively as Method 6, including Methods 6, 6A, 6B and 6C in 40 CFR 60 Appendix A. However, many of the sources that we expect will be subject to emission limits in SO_2 nonattainment plans are required to operate CEMS under other regulatory requirements. *See* 40 CFR 51.214 and 40 CFR 51 Appendix P as well as 40 CFR part 75. In accordance with the credible evidence rule [40 CFR 51.212(c)] and CAA section 113(a)(1), reliable data obtained by a CEMS will represent credible evidence as to whether a source is complying with its SO_2 emission limit.

Limits expressed as longer-term averages would need to be accompanied by compliance methods that provide for ongoing assessment of compliance. In general, at a source with variable emissions, a stack test would not be a suitable method for judging compliance with a limit based on a 24-hour average of hourly values, for example, because a source with an elevated stack test result could generally argue that noncompliance is not proven without information on hourly emissions during the remainder of the 24-hour period.

In most cases, the EPA expects states to establish the use of CEMS as the compliance method for longer-term average limits. In particular for the majority of relevant sources that are required for other reasons to operate CEMS, the use of CEMS provides the most appropriate means of obtaining routine information, calculable on a rolling average basis, on the source's compliance status.

The EPA also anticipates that a small number of sources without CEMS may be suitably regulated with longer-term average emission limits. In selected cases, for example, routine fuel sulfur content measurements (of sufficient frequency to characterize expected emissions), averaged as a rolling average over the appropriate period and established as an enforceable indicator of average emissions, may suffice to assess compliance with a longer-term average limit. The premise of this approach would be that SO_2 emissions are directly proportional to the quantity of sulfur in the fuel that is burned, a premise that can be assumed to apply in cases without flue gas desulfurization, i.e. in cases where all sulfur in the fuel is assumed to be emitted as SO_2. (Conversely, a source that installs SO_2 emission control equipment to achieve its limit could not use fuel sampling as a compliance method without supplemental methods to assure that the control equipment is continuously achieving the control efficiency necessary to meet the applicable limit.) The EPA expects that compliance for the largest and most important sources will be assessed using CEMS, but the EPA believes that fuel sampling may be a suitable method with which to assess compliance for smaller sources that may have less air quality impact. Use of fuel sampling as a compliance method or as a requirement to provide credible evidence as to compliance may also be more justifiable for sources subject to emission rate limits (*e.g.*, limits on emissions per unit heat input), except to the extent that additional or different compliance methods are needed to evaluate the effectiveness of emission control equipment. The air agency that establishes a longer term average limit for an emission unit without CEMS would need to demonstrate that the compliance determination method for this source makes the limit suitably enforceable.

E. *RFP*

Section 171(1) of the CAA defines RFP as "such annual incremental reductions in emissions of the relevant air pollutant as are required by this part (part D) or may reasonably be required by the EPA for the purpose of ensuring attainment of the applicable NAAQS by the applicable attainment date." As the EPA has previously explained, this definition is most appropriate for pollutants that are emitted by numerous and diverse sources, where the relationship between any individual source and the overall air quality is not explicitly quantified, and where the emission reductions necessary to attain the NAAQS are inventory-wide. We have also previously explained that the definition is generally less pertinent to pollutants like SO_2 that usually have a limited number of sources affecting areas of air quality which are relatively well defined, and emissions control measures for such sources result in swift and dramatic improvement in air quality.[15] That is, for SO_2, there is usually a single "step" between pre-control nonattainment and post-control attainment. Therefore, for SO_2, with its discernible relationship between emissions and air quality, and significant and immediate air quality improvements, we explained in the General Preamble that RFP is best construed as "adherence to an ambitious compliance schedule." *See* 74 FR 13547, April 16, 1992. This means that the air agency needs to ensure that affected sources implement appropriate control measures as expeditiously as practicable in order to ensure attainment of the standard by the applicable

[15] *See* SO_2 Guideline Document, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. 27711, EPA-452/R-94-008, February 1994. (*See http://www.epa.gov/ttn/oarpg/t1pgm.html*).

attainment date. We believe that this guidance continues to be appropriate for the implementation of the 2010 SO_2 NAAQS.

F. Contingency Measures

Section 172(c)(9) of the CAA defines contingency measures as such measures in a SIP that are to be implemented in the event that an area fails to make RFP, or fails to attain the NAAQS, by the applicable attainment date. Contingency measures are to become effective without further action by the state or the EPA, where the area has failed to (1) achieve RFP or, (2) attain the NAAQS by the statutory attainment date for the affected area. These control measures are to consist of other available control measures that are not included in the control strategy for the NAA SIP for the affected area.

However, the EPA has also explained that SO_2 presents special considerations.[16] First, for some of the other criteria pollutants, the analytical tools for quantifying the relationship between reductions in precursor emissions and resulting air quality improvements remains subject to significant uncertainties, in contrast with procedures for directly-emitted pollutants such as SO_2. Second, emission estimates and attainment analyses for other criteria pollutants can be strongly influenced by overly optimistic assumptions about control efficiency and rates of compliance for many small sources. In contrast, the control efficiencies for SO_2 control measures are well understood and are far less prone to uncertainty. Since SO_2 control measures are by definition based on what is directly and quantifiably necessary to attain the SO_2 NAAQS, it would be unlikely for an area to implement the necessary emission controls yet fail to attain the NAAQS. Therefore, for SO_2 programs, the EPA has explained that "contingency measures" can

[16] *See* SO_2 Guideline Document, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. 27711, EPA-452/R-94-008, February 1994. (*See http://www. epa.gov/ttn/oarpg/t1pgm.html*).

mean that the air agency has a comprehensive program to identify sources of violations of the SO_2 NAAQS and to undertake an "aggressive" follow-up for compliance and enforcement, including expedited procedures for establishing enforcement consent agreements pending the adoption of the revised SIP.[17] The EPA believes that this approach continues to be a valid approach for the implementation of contingency measures to address the 2010 SO_2 NAAQS.

This approach to contingency measures for SO_2 would not preclude an air agency from requiring additional contingency measures that are enforceable and appropriate for a particular source category. The source might adopt a contingency measure such as switching to low sulfur coal or reducing load until more permanent measures can be put into place to correct the problem. In either case, in order for the EPA to be able to approve the SIP, the contingency measures would need to be a fully adopted provision in the SIP that becomes effective where the area has failed to meet RFP, or fails to attain the standard by the statutory attainment date.

G. NSR

Part D of title I of the CAA prescribes the procedures and conditions under which a new major stationary source or major modification may obtain a preconstruction permit in an area designated nonattainment for any criteria pollutant. The nonattainment NSR (nonattainment NSR) permitting requirements in section 172(c)(5) and 173 of the CAA are among "the requirements of this part" to be submitted to the EPA as part of a revised SIP for a nonattainment area within 18 months of the effective date of a designation or redesignation to nonattainment. Air agencies that already have a nonattainment NSR permitting program applicable to areas previously designated nonattainment on the basis of the previous SO_2 NAAQS (annual, 24-hour or 3-hour averaging periods) may be able to use that existing program to authorize the

[17] Id.

construction and modification of major stationary sources of SO_2 that would locate in a new 2010 SO_2 nonattainment area[18]. However, because there are very few nonattainment areas designated under the previous SO_2 NAAQS, a few air agencies may not have nonattainment NSR rules that apply when new nonattainment areas for SO_2 are designated. In such cases, within 18 months of designation, such agencies would need to either revise their existing nonattainment NSR programs or develop new ones to enable the permitting of any major stationary source of SO_2 locating in a nonattainment area under the 2010 SO_2 NAAQS.

Beginning on the effective date of any new nonattainment designation for the 2010 SO_2 NAAQS, proposed major stationary sources and major modifications of SO_2 will be required under section 173 of the CAA to obtain a NSR permit. Until such time that the EPA approves an air agency's revised SIP containing a nonattainment NSR program for SO_2, on and after the effective date of a nonattainment designation for the 2010 SO_2 NAAQS, states are authorized under 40 CFR 52.24(k) to use the Emission Offset Interpretative Ruling at 40 CFR part 51, Appendix S to govern permits to construct and operate new major stationary sources and major modifications in the newly designated SO_2 nonattainment areas.

In general, the nonattainment NSR program should ensure that the construction and modification of major stationary sources of SO_2 will not interfere with reasonable further progress toward the attainment of the 2010 SO_2 NAAQS. More specifically, the applicable statutory requirements include but are not limited to:

- The installation of Lowest Achievable Emissions Rate (LAER) control technology;

[18] The annual and 24-hour primary SO_2 NAAQS generally will remain in effect for 1 year following the effective date of the initial area designations for the new 1-hour SO_2 NAAQS, however, the annual and/or 24-hour SO_2 NAAQS will remain in place for a longer period of time for any current nonattainment area for the annual or 24-hour SO_2 NAAQS, and any area for which a state has not fulfilled the requirements for a SIP call.

- The acquisition of emissions reductions to offset new emissions of nonattainment pollutant(s);
- Certification that all major sources owned and operated in the state by the same owner are in compliance with all applicable requirements under the CAA;
- A demonstration via an analysis of alternative sites, sizes, production process, and environmental control techniques shows that the benefits of a proposed source significantly outweigh the environmental and social costs imposed as a result of its location, construction, or modification; and
- An opportunity for a public hearing and written comment on the proposed permit.

The nonattainment NSR requirements apply on a pollutant-specific basis with respect to each nonattainment pollutant for which a source has the potential to emit in amounts greater than the applicable major source threshold for the pollutant, i.e., in major amounts. 40 CFR 51.165(a)(1)(iv). For new sources, in areas that are designated nonattainment for the 2010 SO_2 NAAQS, 100 tpy or more of SO_2 represents a major amount. Similarly, nonattainment NSR requirements for SO_2 also apply to any existing major stationary source of SO_2 that proposes a major modification, i.e., a physical change or change in the method of operation that results in a significant net emissions increase (40 tpy or more) of SO_2. [40 CFR 51.165(a)(1)(x)(A)].

H. Conformity

General conformity is required by CAA section 176(c). This section of the CAA requires that actions by federal agencies do not cause new air quality violations, worsen existing violations, or delay timely attainment of the relevant NAAQS or interim reductions and milestones. General conformity applies to any federal action (*e.g.*, funding, licensing, permitting or approving), other than certain highway and transportation projects,[19] if the action takes place in a nonattainment or maintenance area (i.e., an area which submitted a maintenance plan that meets the requirements of section 175A of the CAA and has been redesignated to attainment) for ozone, PM, NO_2, carbon monoxide, lead or SO_2. As directed by CAA section 176(c)(6), general conformity for the revised SO_2 NAAQS will not apply until 1 year after the effective date of a nonattainment designation for that 2010 NAAQS. The EPA's General Conformity Rule (40 CFR 93.150 to 93.165) establishes the criteria and procedures for determining if a federal action conforms to the SIP. With respect to the 2010 SO_2 NAAQS, federal agencies are expected to continue to estimate emissions for conformity analyses in the same manner as they estimated emissions for conformity analyses under the previous NAAQS for SO_2. The EPA's General Conformity Rule includes the basic requirement that a federal agency's general conformity analysis be based on the latest and most accurate emission estimation techniques available 40 CFR 93.159(b). When updated and improved emissions estimation techniques become available, the EPA expects the federal agency to use these techniques.

Transportation conformity is required under CAA section 176(c) to ensure that federally supported highway and transit project activities are consistent with ("conform to") the purpose of the SIP. Transportation conformity applies to areas that are designated nonattainment, and those areas redesignated to attainment after 1990 ("maintenance areas" with plans developed under CAA section 175A) for transportation-related criteria pollutants. Due to the relatively small, and decreasing, amounts of sulfur in gasoline and on-road diesel fuel, the EPA's transportation

[19] Projects that are Federal Highway Administration (FHWA)/Federal Transit Administration (FTA) projects as defined in 40 CFR 93.101, are generally not subject to general conformity requirements and are instead subject to transportation conformity, as described below. However, per 40 CFR 93.101, general conformity requirements do apply to a federal highway and transit project that does not involve Title 23 or 49 funding but requires FHWA or FTA approval, such as is required for a connection to an Interstate highway or for a deviation from applicable design standards.

conformity rules provide that they do not apply to SO_2 unless either the EPA Regional Administrator or the director of the state air agency has found that transportation-related emissions of SO_2 as a precursor are a significant contributor to a $PM_{2.5}$ nonattainment problem, or if the SIP has established an approved or adequate budget for such emissions as part of the RFP, attainment or maintenance strategy. 40 CFR 93.102(b)(1), (2)(v).

VI. Transition from the Previous SO_2 NAAQS to the Revised SO_2 NAAQS

As air agencies transition from implementing the prior SO_2 NAAQS to implementing the 2010 SO_2 NAAQS, they will need to ensure that the health protection provided under the previous SO_2 NAAQS continues to be achieved as well as maintained. This means that air agencies will need to continue implementing attainment and maintenance SIPs (where such SIPs have been approved by the EPA) associated with the prior 24-hour and annual primary SO_2 NAAQS until such time as they are subsumed by any new EPA-approved SIPs reflecting planning and control requirements associated with the 2010 SO_2 NAAQS. It also means air agencies will need to continue implementing preconstruction permitting and conformity requirements associated with prior SO_2 NAAQS until those NAAQS are revoked in a given area.

CAA section 110(l) provides that the EPA may not approve a SIP revision if it interferes with any applicable requirement concerning attainment and RFP, or any other applicable requirement under the CAA. In addition, section 193 of the CAA prohibits the modification of a control, or a control requirement, in effect or required to be adopted before November 15, 1990 (i.e., prior to the enactment of the CAA Amendments of 1990), in any nonattainment area unless such a modification insures equivalent or greater emission reductions.

In the 2010 SO_2 NAAQS final rule, the EPA's regulations provided that the prior 24-hour and annual primary SO_2 NAAQS will remain in effect for at least 1 year following the effective date of the initial area designations under section 107(d)(1) for the 2010 SO_2 NAAQS before being revoked 40 CFR 50.4(e). Any existing SIP provisions under CAA sections 110, 172, 175A, 191 and 192 associated with the annual and 24-hour SO_2 NAAQS would need to remain in effect after the 24-hour and annual primary SO_2 NAAQS are no longer in effect, unless their modification is consistent with CAA sections 110(l) and 193.[20] This includes all current implementation and emissions control obligations contained in air agency SIPs and those that have been promulgated by the EPA in FIPs.

The EPA's regulations also provide that the annual and 24-hour NAAQS remain in place for any nonattainment area under the prior NAAQS (as of the effective date of the revised NAAQS on August 23, 2010), or any area for which a state has not fulfilled the requirements of a SIP call under the prior NAAQS.[21] In these areas the prior NAAQS are revoked only after an air agency submits under CAA section 191, and the EPA approves, a SIP for the affected area providing for attainment of the 2010 SO_2 NAAQS. *See* 40 CFR 50.4(e). This SIP would need to meet all part D nonattainment area SIP requirements under the 2010 SO_2 NAAQS, as described above.

Also, the annual and 24-hour SO_2 increments contained in CAA section 163 and PSD regulations will remain in effect even after the time that the annual and 24-hour SO_2 NAAQS are no longer in effect.[22] Thus, the owner or operator of a new or modified source would need to

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[20] Once the 24-hr and annual standards have been officially revoked, all statutory requirements related to future state submissions regarding these standards under CAA sections 110, 172, 175A, 191 and 192 would no longer apply. This includes any remaining requirements for the submittal of second 10 year maintenance plans required under section 175A.

[21] The areas that were designated as nonattainment for the previous SO_2 primary NAAQS as of August 23, 2010 (the effective date of the new NAAQS) are Hayden, AZ; Armstrong, PA; Laurel, MT; Piti, GU; and Tanguisson, GU. The areas that are designated nonattainment for both the primary and the secondary pre-existing standards are East Helena, MT, Salt Lake Co, MT, Toole Co, UT and Warren Co, NJ. (*See http://www.epa.gov/oar/oaqps/greenbk/lnc.html*). The Billings/Laurel, MT area is the only area not meeting the requirements of a SIP call under the prior NAAQS.

[22] The retention of the statutory annual and 24-hour SO_2 increments subsequent to the revocation of the annual and 24-hour SO_2 NAAQS has been previously discussed in various EPA documents. *See,* e.g., 75 FR 35520 (June 22,

demonstrate compliance with the statutory annual and 24-hour SO_2 increments, even when the corresponding SO_2 NAAQS no longer apply. The EPA has previously explained that it does not believe that the CAA allows it to eliminate the annual and 24-hour SO_2 increments without appropriate legislative changes to the statutory SO_2 increments.

VII. Determinations of Attainment for SO_2 Nonattainment Areas

The EPA can make a determination of attainment for an SO_2 nonattainment area when relevant air quality information indicates that the 1-hr SO_2 NAAQS has been attained. There are several circumstances under which the EPA may need to make determinations of attainment. Under CAA section 179, the EPA must determine whether a nonattainment area has attained a NAAQS by the relevant statutory deadline. Under CAA sections 107(d) and 175A, a request for redesignation to attainment may only be approved if, among other criteria, the area is determined to be in attainment. Also, under the EPA's clean data policy described in this section, an attainment determination may suspend certain nonattainment area SIP planning submission requirements for so long as the area remains in attainment. These attainment determinations are discussed in more detail in the sections that follow.

A. Determining Attainment by the Applicable Deadline

Section 192 of the CAA requires attainment of the 1-hr primary SO_2 NAAQS for areas designated as nonattainment within 5 years of the effective date of designation for the affected area. Under section 179(c)(1) of the CAA, the EPA has up to 6 months following the attainment date for an area to make a determination as to whether the area has attained the standard by its

2010) at page 35578; the EPA memorandum titled "Guidance Concerning Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration," signed by Stephen D. Page on August 23, 2010.

attainment date. If the EPA determines that the standard was not attained for the area by the attainment date, the EPA will publish a *Federal Register* notice making the determination.[23]

If the EPA finds that an area did not attain the NAAQS by the applicable deadline, the responsible air agency has up to 12 months from the effective date of the determination to submit a revised SIP for the area demonstrating attainment and containing any additional measures that the EPA may reasonably prescribe that can be feasibly implemented in the area in light of technological achievability, costs, and any non-air quality and other air quality-related health and environmental impacts as required under CAA section 179(d)(2). This revised SIP is to achieve attainment of the 1-hr SO_2 NAAQS as expeditiously as practicable, but no later than 5 years from the effective date of the area's failure to attain. CAA section 179(d)(3). As further discussed below, if the EPA determines that an area has attained the SO_2 NAAQS by the applicable deadline, the area will remain designated nonattainment until (1) the air agency has met the planning requirements for redesignation and has requested redesignation to attainment under CAA section 107(d)(3), and (2) the EPA has approved the state's request and maintenance plan, pursuant to section 175A of the CAA, for the area.

B. Information Necessary to Determine Attainment for SO_2 Nonattainment Areas

The EPA will determine whether or not an SO_2 nonattainment area has attained the NAAQS based on air quality monitoring data (when available) and air quality dispersion modeling information for the affected area, and/or a demonstration that the control strategy in the SIP has been fully implemented (compliance records demonstrating that the control measures

[23] These determinations are often called "attainment findings" or "findings of failure to attain" and typically made by the EPA Regional Offices in coordination with the EPA's Office of Air Quality Planning and Standards. *See* Memorandum from Sally L. Shaver, "Attainment Determination Policy for Sulfur Dioxide Nonattainment Areas", January 26, 1996.

have been implemented will normally be sufficient to make this demonstration).[24] An additional SIP submittal from the air agency is not required by the CAA, and if the air agency has previously submitted a modeled attainment demonstration, no further modeling would be needed as long as source characteristics (*e.g.* factors affecting plume height) are still reasonably represented. In that case, demonstration that the control strategy in the SIP has been fully implemented would suffice as evidence that modeling of emissions would show attainment. For the EPA to use air quality monitoring data in the attainment determination, the data would need to be complete, quality assured, and certified and would need to have been entered into the EPA's Air Quality System (AQS) database. If the EPA determines that the air quality monitors located in the affected area are located in the area of maximum concentration, the EPA may be able to use the data from these monitors to make the determination of attainment without the use of air quality modeling data.

The EPA will begin processing and analyzing data related to the attainment of the SO_2 NAAQS following the applicable attainment date for the affected area. In 40 CFR part 58, the EPA requires air quality data to be submitted into the AQS database no later than 90 days after the end of each quarter. Air agencies should identify any issues concerning the validity of the data, or discrepancies related to the data during this time period. The EPA will address these issues on a case-by-case basis, in accordance with 40 CFR part 50.

In any attainment determination for SO_2 nonattainment areas when adequate air quality monitoring data is not available, modeling will generally be necessary to (1) develop a comprehensive evaluation of source impact in a given area, and (2) to determine areas of expected high concentrations based on current conditions. Generally, the EPA expects that areas

[24] *See* Memorandum from Sally L. Shaver, "Attainment Determination Policy for Sulfur Dioxide Nonattainment Areas", January 26, 1996.

designated nonattainment based on modeling would not be able to be redesignated to attainment unless dispersion modeling indicates attainment has been achieved in the affected area. As noted above, so long as the emission release characteristics of the relevant source or sources have not changed significantly, evidence of compliance with limits shown in previously EPA-approved modeling (e.g., the allowable-based modeling that was used in the approved attainment demonstration) should be a suitable surrogate for updated modeling using current emissions.

Section 179(c)(2) of the CAA states that the EPA may, at any time, revise or supplement the attainment determination for an area if more complete information, or analyses, concerning the area's air quality, as of the attainment date, are obtained. This could include cases where there are discrepancies concerning the validity of data, or discrepancies revealed subsequent to an attainment determination for an area.

C. Achieving "Clean Data"

Below we discuss an incentive for attaining the SO_2 NAAQS prior to the statutory deadline for submitting an attainment demonstration under CAA section 191(a). Nonattainment areas with design values over the level of the NAAQS may be able to achieve emission reductions in the area, or in nearby areas such that, when their effect is considered in combination with reductions achieved under national or regional programs, they may be sufficient to attain the SO_2 NAAQS before SIPs are due under section 191(a).

For other NAAQS, the EPA has issued "Clean Data" policy memoranda describing possible reduced regulatory requirements for nonattainment areas that attain the NAAQS, but have not yet been redesignated as attainment. *See* Memorandum of December 14, 2004, from Stephen Page, Director, Office of Air Quality Planning and Standards to the EPA Air Division Directors, "Clean Data Policy for the Fine Particle National Ambient Air Quality Standards" (available at: *http://www.epa.gov/pmdesignations/guidance.htm*). These memoranda have been followed up by national rulemakings that codified the policy. *See* "Final Rule to Implement the 8-hour Ozone National Ambient Air Quality Standard—Phase 2," 70 FR 71612, 71644-46 (November 29, 2005) (promulgating 40 CFR 51.918), and 72 FR 20585, 20603-05 (April. 25, 2007) promulgating 40 CFR 51.1004)(c). While these memoranda and rules address specific NAAQS other than SO_2, the EPA has previously observed that the legal bases set forth in detail in those documents are equally pertinent to all NAAQS.[25] *See* "The Clean Data Policy and Regulations," available at *http://epa.gov/airquality/urbanair/sipstatus/policydetails.html* (Last updated August 17, 2012).

Under our prior clean data guidance and rulemakings, we have explained our view that it is reasonable to interpret the CAA section 172 statutory provisions regarding "reasonable further progress" and attainment demonstrations, along with certain other related attainment planning provisions, as not requiring further submissions to achieve attainment for so long as the area is in fact attaining the NAAQS. *See* 72 FR at 20604. Under those policies, the EPA does not grant an exemption from any applicable requirement of CAA title I, part D, rather, the EPA has interpreted these requirements as not applying for "so long as" the area remains in attainment with the NAAQS. This is not a waiver of requirements that by their terms apply; it is a determination that certain requirements are written so as to be operative only if the area is not attaining the NAAQS. The EPA has stressed that should areas attain the NAAQS under the clean data policies, the obligation to submit an attainment demonstration and associated planning requirements is not waived but is only suspended. If the EPA determines that the area later has

[25] *See* court cases upholding legal basis for the EPA's "Clean Data Determination Policies", *NRDC v. EPA*, 571 F.3d at 1258-61 (D.C. Cir. 2009); Sierra Club v. EPA, 99 F.3d 1551 (10th Cir. 1996); *Latino Issues Forum v. EPA*, 315 Fed. App. 651, 652 (9th Cir. 2009),

air quality concentrations that violate the NAAQS, the area's obligation to submit an attainment demonstration would again be back in effect. Moreover, determinations of attainment under the policies do not purport to be redesignations, and thus the requirements for redesignation under CAA section 107(d) are not applicable. All of those requirements remain in effect and would need to be satisfied for an area to be redesignated. The area thus also remains subject to the requirement to demonstrate maintenance of the NAAQS pursuant to section 175A of the CAA in order to be redesignated. *Id.* at 20605.

The EPA intends to apply a similar clean data policy for SO_2 areas designated as nonattainment. Specifically, under this policy, following a clean data determination by the EPA, further submittals by the state to achieve attainment would be suspended for so long as the area continues to attain the NAAQS. The EPA has previously explained that the SIP submittal requirements that would be suspended under this policy address RFP, attainment demonstrations, and contingency measures. Our prior guidance and rulemakings explain that the general provisions of the CAA part D, subpart 1 (sections 171 and 172) do not require a nonattainment area to include these provisions in its SIP submittal if that area already meets the NAAQS and does not subsequently exceed the NAAQS. The following discussion describes the rationale for suspending these submittal requirements, as provided in those prior guidance and rulemaking explanations.

1. Reasonable further progress.

CAA section 172(c)(2) provides that SIP provisions in nonattainment areas must require RFP. Section 171(1) of the CAA states that, for the purposes of part D, RFP means: "such annual incremental reductions in emissions of the relevant air pollutant as are required by this part, or may reasonably be required by the Administrator, for the purpose of ensuring attainment of the applicable NAAQS by the applicable date." Thus, by definition, the RFP provision requires only such reductions in emissions as are necessary to attain the NAAQS. If an area has attained the NAAQS, then the purpose of the RFP requirement will have been fulfilled, and since the area has already attained, showing that the area will make RFP toward attainment will have no meaning at that point. We took this view with respect to the general RFP requirement under CAA section 172(c)(2) in the "General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990" (General Preamble) (*see* 57 FR 13498, 13564, April 16, 1992). *See* 72 FR at 20604.

2. Attainment demonstrations.

CAA section 172(c)(1), the requirement for an attainment demonstration, provides in relevant part that SIPs "shall provide for attainment of the [NAAQS]." The EPA has interpreted this requirement as not applying to areas that have reached attainment. If an area has attained the NAAQS, there is no need to submit a plan demonstrating how the area will reach attainment. In the General Preamble, the EPA stated that no other measures to provide for attainment would be needed by areas seeking redesignation to attainment since *"attainment will have been reached"* (*see* 57 FR 13564; also *see* John Calcagni memorandum, September 4, 1992, at page 6; *see* also 72 FR at 20604).

3. Contingency measures.

CAA section 172(c)(9) provides that SIPs in nonattainment areas "shall provide for the implementation of specific measures to be undertaken if the area fails to make reasonable further progress, or to attain the [NAAQS] by the attainment date applicable under this part." Such measures shall be included in the plan revision as contingency measures to take effect in any such case without further action by the state or [the EPA]." The contingency measure requirement is inextricably tied to the RFP and the attainment demonstration requirements. Contingency measures are implemented if RFP targets are not achieved, or if attainment is not realized by the attainment date. Where an area has already achieved attainment by the attainment date, it has no need to rely on contingency measures to come into attainment or to make further progress to attainment. As the EPA stated in the General Preamble, *"[t]he section 172(c)(9) requirements for contingency measures are directed at ensuring RFP and attainment by the applicable date"* (*see* 57 FR 13564). Thus, these requirements no longer apply when an area has attained the NAAQS. *See* 72 FR at 20604.

The EPA has consistently stated that the suspension of each of these submission requirements applies only for as long as a nonattainment area continues to attain the standard. If such an area should violate the SO_2 NAAQS prior to being redesignated to attainment, then the affected area would again be required to submit the pertinent SIP submittal sections. If the EPA ultimately redesignates the area to attainment, the area will be entirely relieved of these requirements (to the extent that they are not the basis for the area's section 175A maintenance plan). *See* 72 FR at 20604-05.

4. Consequences for redesignation to attainment, sanctions and conformity.

a. Redesignations

A determination that an area has met the 2010 SO_2 NAAQS for purposes of a Clean Air Determination is not equivalent to a redesignation to attainment. Attainment of the standard is only one of the criteria that an area must satisfy in order to be redesignated to attainment CAA section 107(d)(3)(E). As stated previously, if an air agency wishes for an area to be redesignated to attainment, then the air agency must also submit, and receive full approval of a request that satisfies all of the criteria for redesignation to attainment, including the requirements to:

- demonstrate that the improvement in the area's air quality is due to permanent and enforceable reductions,
- have a fully approved SIP that meets all of the applicable requirements under section 110 and part D and
- have a fully approved maintenance plan.

The EPA has explained that SIP submissions for RFP, attainment demonstration, and contingency measures would not be required in order for an area's redesignation request to be approved, provided that the area is still attaining the 2010 SO_2 NAAQS.[26] However, if an area violates the standard before the EPA takes final action on the area's redesignation request, the EPA will not be able to grant redesignation for the area to attainment, and all the suspended SIP requirements would once again apply to the area.

b. Sanctions

The EPA has previously explained that if the EPA determines that an area is attaining the 2010 SO_2 NAAQS, the SIP submission requirements discussed above would then be suspended, and any sanction clock related to those SIP submission requirements would be stopped, since the area will no longer be obligated to submit those plans and thus can be considered to have corrected the deficiency that had started that sanctions clock so long as the area remains in attainment.[27]

c. Conformity

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[26] *See* memorandum from Calcagni, John, Director, Air Quality Management Division, OAQPS, U.S. EPA, Research Triangle Park, N.C., "Procedures for Processing Requests to Redesignate Areas to Attainment." September 4, 1992.

[27] *See* memorandum from Calcagni, John, Director, Air Quality Management Division, OAQPS, U.S. EPA, Research Triangle Park, N.C., "Procedures for Processing Requests to Redesignate Areas to Attainment." September 4, 1992.

An area determined to be attaining the standard under this policy will continue to be required to meet the *general conformity* requirements. As stated in section V.H. of this document, due to the relatively small, and decreasing, amounts of sulfur in gasoline and on-road diesel fuel, the EPA's *transportation conformity* rules provide that they do not apply to SO_2 unless either the EPA Regional Administrator or the director of the state air agency has found that transportation-related emissions of SO_2 as a precursor are a significant contributor to a $PM_{2.5}$ nonattainment problem, or if the SIP has established an approved or adequate budget for such emissions as part of the RFP, attainment or maintenance strategy. 40 CFR 93.102(b)(1), (2)(v).

5. NSR.

An attainment determination for an SO_2 nonattainment area pursuant to the clean data policy would not relieve an area of its responsibility to meet the requirements of the EPA's NSR regulations. All NSR requirements would continue to apply to any area designated as nonattainment.

6. Process of determining attainment.

a. Regional Office determinations

The EPA Regional Offices would conduct individual notice and comment rulemakings related to each area seeking an attainment determination under the clean data policy. Once an area has demonstrated that it is meeting the 2010 SO_2 NAAQS, the EPA Regional Office would issue a binding determination after responding to submitted comments that the area has attained the standard and need not make the SIP submittals discussed previously.

b. 3 years of clean monitoring data and/or modeling

In general, to demonstrate that it is meeting the standard, a nonattainment area which was designated based on air quality monitoring data would first need to have 3 consecutive calendar years of air quality monitoring data which show that the area is meeting the standard. The data would need to be complete and quality-assured, consistent with 40 CFR part 58 requirements, and other relevant EPA guidance, and properly submitted to the AQS database of the EPA's Aerometric Information Retrieval System (AIRS). In addition, under the clean data policy for SO_2, in the case of areas initially designated nonattainment based on monitoring data alone, and especially for any future nonattainment areas designated based on modeling in the absence of violating monitoring data, additional information would be necessary to make the determination of attainment either by (1) providing modeling of the most recent 3 years of actual emissions for the area or (2) providing a demonstration that the affected monitor (s) is or are located in the area of maximum concentration, in which case the EPA believes that it may be appropriate, if relevant facts support it, to determine for purposes of the clean data policy that the nonattainment area is attaining the standard based on monitoring information alone.[28] As we have previously explained, the absence of a violating monitor may not be sufficient to show that an area is attaining the SO_2 NAAQS or is not contributing to a violation. Partly for this reason, we have not yet issued an attainment designation under the 2010 SO_2 NAAQS for any area based on the absence of violating monitor data. When air agencies provide modeling and/or monitoring to support clean data determinations, we recommend that the supporting monitoring and/or modeling follow our recent draft Technical Assistance Documents (TADs) discussing suggested monitoring and modeling approaches for future SO_2 designations.[29,30] Upon completion of the supporting analysis, the air agency should notify the appropriate EPA Regional Office that it

[28] Note: This should not at this time be construed as suggesting that the EPA will issue initial designations or redesignations based on "clean data" at existing SO_2 monitors.
[29] The SO_2 NAAQS Designations Source-Oriented Monitoring Draft Technical Assistance Document, Office of Air Quality Planning and Standards, Air Quality Assessment Division, May 2013, can be found at *http://www. epa.gov/airquality/sulfurdioxide/pdfs/SO₂MonitoringTAD.pdf.*
[30] SO_2 NAAQS Designations Draft Modeling Technical Assistance Document, Office of Air Quality Planning and Standards, Air Quality Assessment Division, May 2013.

believes a nonattainment area is attaining the 2010 SO_2 NAAQS and request a clean data determination under this policy.

c. Entire multi-state nonattainment areas should have clean air quality data to be eligible

Multi-state nonattainment areas should show that the entire nonattainment area is meeting the standard in order for the EPA to suspend any of the SIP requirements covered by this policy. The EPA would not propose to suspend any requirements based on a determination that only part of a nonattainment area is monitoring and/or modeling attainment. If the multi-state nonattainment area involves more than one EPA Regional Office, the appropriate EPA Regional Offices will coordinate these efforts in making any attainment determinations.

In addition, areas that are determined to be in attainment of the 2010 SO_2 NAAQS would need to continue to monitor and/or model clean air quality to verify continued attainment. The air agency would be expected to continue to operate an appropriate air quality monitoring network in the affected area, in accordance with the EPA regulations, to verify the attainment status of the area (*see* 40 CFR part 58). If an air agency uses modeling that is based on actual emissions in its showing of early attainment, and does not thereafter employ monitoring for the area that would meet the monitoring TAD's recommendations, we would expect the air agency to periodically conduct follow-up modeling to track any changes in SO_2 concentrations. The extent and frequency of such continued modeling would be established on a case-by-case basis in the rulemaking determining that the area attained the NAAQS.

As stated previously, if the EPA makes a subsequent determination that an area has violated the SO_2 NAAQS, the air agency would again be required to submit the pertinent planning requirements under the SIP for the area. Through notice and comment rulemaking, the

EPA would notify the air agency of that determination and would also provide notice to the public in the *Federal Register*. Areas subject to such a determination would receive a reasonable amount of time to address the applicable SIP requirements and submit revisions to the affected SIP. The EPA would establish this SIP submittal due date on a case-by-case basis, taking into account the individual circumstances surrounding the particular SIP provisions at issue.

Attainment determinations under this policy would not shield an area from other required actions, such as provisions to address pollution transport, which could require emission reductions at sources or other types of emission activities contributing significantly to nonattainment in other areas or states, or interfering with maintenance in those areas. The EPA has the authority to require emissions reductions as necessary and appropriate to deal with transported air pollution situations *See* CAA §§110(a)(2)(D), 110(a)(2)(A), and 126.

VIII. Redesignation to Attainment of SO_2 Nonattainment Areas

The latest date by which an area designated as nonattainment is required to attain the SO_2 NAAQS is based on the effective date of the nonattainment designation for the affected area. Once designations for the SO_2 NAAQS are effective, states with nonattainment areas are required by CAA section 191(a) to submit SIPs for the affected areas no later than 18 months following that date. Approvable SIPs need to provide for attainment of the NAAQS as expeditiously as practicable, but no later than 5 years from the effective date of the nonattainment designation for the area. *See* CAA section 192(a). The EPA expects to determine, under CAA section 179(c), whether an area has attained the SO_2 NAAQS by its attainment date, within 6 months by evaluating air quality modeling (and current emissions) data and monitoring data (where available) consistent with 40 CFR part 50, Appendix T and 40 CFR part 51, Appendix W.

CAA section 107(d)(3)(D) provides that state governors may request redesignation of areas to attainment.[31] Within 18 months of receipt of a complete redesignation request submittal, the EPA shall approve or deny such redesignation request.[32] A request for redesignation, however, does not affect the effectiveness or enforceability of the SIP for an area. Section 107(d)(3)(E) of the CAA provides that an area may be redesignated to attainment only if each of the following conditions are met:

- The EPA has determined that the relevant NAAQS has been attained in the area;
- The applicable implementation plan has been fully approved by the EPA under section 110(k);
- The EPA has determined that improvement in air quality is due to permanent and enforceable reductions in emissions resulting from the SIP, federal regulations and other permanent and enforceable reductions;
- The state has met all applicable requirements for the area under section 110 and part D; and
- The EPA has fully approved a maintenance plan, including a contingency plan, for the area under section 175A of the CAA for the area.

The following is an expanded discussion of the criteria the EPA would consider in determining whether to redesignate an area from nonattainment to attainment. It is suggested that the reader also refer to the memorandum dated September 4, 1992, from John Calcagni to the Regional Air Division Directors titled, "Procedures for Processing Requests to Redesignate

[31] Note that section 107 does not permit the EPA to redesignate any area from nonattainment to unclassifiable.
[32] The EPA recognizes the states' desire that nonattainment areas be redesignated to attainment as soon as the necessary steps to improve air quality are achieved and the NAAQS are attained. As such, the EPA encourages states to work closely with their respective Regional Offices, including early consultation, to ensure that complete and approvable redesignation packages are submitted. This will assist the EPA in being able to expedite rulemaking action.

Areas to Attainment" for a more detailed discussion of these criteria. These conditions are also discussed in the 1994 SO_2 Guideline Document. (*See http://www.epa.gov/ttn/oarpg/t1pgm.html*).

A. Attainment of the NAAQS

The air agency would need to show that the affected nonattainment area is attaining the 2010 SO_2 NAAQS. As discussed in the previous section on attainment determinations, for SO_2, there are generally two components needed to support an attainment determination, which should be considered interdependently. The first component relies on air quality monitoring data. For SO_2, any available monitoring data would need to indicate that all monitors in the affected area are meeting the standard as stated in 40 CFR 50.17 using data analysis procedures specified in 40 CFR part 50, Appendix T. The air agency should also provide analyses indicating whether any of the monitors located in the nonattainment area are located in the area of maximum concentration. In cases where air quality monitors for the affected area are located in the area of maximum concentration, the EPA may be able to use the data from the monitors alone to make the attainment determination for the affected area without need for additional air quality modeling beyond what the previously approved attainment demonstration has provided.

The second component relies on air quality modeling data. If there are no air quality monitors located in the affected area, or there are air quality monitors located in the area, but analyses show that none of the monitors is located in the area of maximum concentration, then air quality dispersion modeling will generally be needed to estimate SO_2 concentrations in the area. Such dispersion modeling should be conducted to estimate SO_2 concentrations throughout the nonattainment area using actual emissions and meteorological information for the most recent 3 calendar years. This is because, as the EPA has previously explained, the absence of violating monitors, in the context of SO_2, may not in all cases be sufficient to show that areas are not violating, or are not contributing to violations, of the 2010 SO_2 NAAQS.

Air quality modeling, using actual emissions, may also be necessary to determine the representativeness of the monitoring data, and/or to provide needed information where there is nonexistent or inadequate monitoring data for the affected area. For SO_2, air quality dispersion modeling would generally be necessary to comprehensively evaluate a source's impacts on the affected area and to determine the areas of expected high concentrations based upon current conditions. Particularly in cases where previous modeling is available, the EPA Regional Offices should consult with OAQPS for further guidance on addressing the need for modeling in specific circumstances.[33]

As stated in section VII.B above, the EPA may also make determinations of attainment based on the modeling from the attainment demonstration for the applicable SIP for the affected area, eliminating the need for separate actuals-based modeling to support a redesignation request. A demonstration that the control strategy in the SIP has been fully implemented (compliance records demonstrating that the control measures have been implemented as required by the approved SIP) would also be relevant for making this determination.[34] An additional SIP submittal from the air agency would not be required by the CAA, and if the air agency has previously submitted a modeled attainment demonstration, using allowable emissions, no further modeling would be needed as long as the source characteristics (*e.g.* factors affecting plume height) are still reasonably represented.

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[33] *See* memorandum from Calcagni, John, Director, Air Quality Management Division, OAQPS, U.S. EPA, Research Triangle Park, N.C., "Procedures for Processing Requests to Redesignate Areas to Attainment." September 4, 1992.
[34] *See* Memorandum from Sally L. Shaver, "Attainment Determination Policy for Sulfur Dioxide Nonattainment Areas", January 26, 1996.

B. Approve Section 110(k) SIP for the Area

The SIP for the affected area would need to be fully approved under section 110(k) of the CAA and satisfy all applicable requirements for the area.[35] "An area cannot be redesignated to attainment if a required element of its plan is the subject of a disapproval; a finding of failure to submit, or failure to implement the SIP; or a partial, conditional, or limited approval. However, this does not mean that earlier issues with regard to the SIP will be reopened."[36]

C. Permanent and Enforceable Improvement in Air Quality

The air agency must be able to reasonably attribute the improvement in air quality to emission reductions which are permanent and enforceable. Permanent and enforceable emission reductions should be a result of emission limitations in the SIP for sources in the nonattainment area or at outside sources contributing to violations in the nonattainment area. In making this showing, the air agency should provide sufficient quantitative information about emission reductions achieved by relevant measures to demonstrate that the improvement in air quality is attributed to permanent and enforceable measures.[37]

D. Section 110 and Part D Requirements

For the purpose of redesignation, an air agency would need to meet all requirements of section 110 and part D of title I of the CAA that were applicable prior to submittal of the complete redesignation request. Section 110(a)(2) contains general requirements for

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[35] Note: This should not be construed as suggesting that the EPA will issue initial designations or redesignations based on "clean data" at existing SO_2 monitors.

[36] The SIP for the affected area must be fully approved under section 110(k), and must satisfy all requirements that apply to the area. It should be noted that approval action on both SIP elements and the redesignation request may occur simultaneously.

[37] *See* memorandum from Calcagni, John, Director, Air Quality Management Division, OAQPS, U.S. EPA, Research Triangle Park, N.C., "Procedures for Processing Requests to Redesignate Areas to Attainment." September 4, 1992.

nonattainment plans. Part D of title I consists of general requirements applicable to all areas designated nonattainment and specific requirements applicable to certain NAAQS.[38]

E. Fully Approved Maintenance Plan

Before an area can be redesignated to attainment, the EPA must approve a maintenance plan which meets the requirements of section 175A of the CAA. An air agency may submit both the redesignation request and the maintenance plan at the same time and rulemaking on both may proceed on a parallel track. Maintenance plans may, of course, be submitted and approved by the EPA before a redesignation is requested. However, according to section 175A(c), "pending approval of the maintenance plan and redesignation request, all applicable nonattainment area requirements shall remain in place."[39]

The maintenance plan will constitute a SIP revision and under section 175A needs to provide for maintenance of the 2010 SO_2 NAAQS in the area for at least 10 years after redesignation. Because the CAA requires a demonstration of maintenance for 10 years after an area is redesignated to attainment, the air agency should plan for some lead time to allow the EPA to take action on the submittal and the redesignation request. In determining the amount of lead time that should be provided, air agencies should consider that section 107(d)(3)(D) grants the Administrator a time period up to 18 months from receipt of a complete submittal in order to process a redesignation request.[40] (Even though the state should factor in this lead time for purposes of its maintenance demonstration, the EPA will attempt to redesignate areas to

[38] *See* memorandum from Calcagni, John, Director, Air Quality Management Division, OAQPS, U.S. EPA, Research Triangle Park, N.C., "Procedures for Processing Requests to Redesignate Areas to Attainment." September 4, 1992.

[39] *See* SO_2 Guideline Document, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. 27711, EPA-452/R-94-008, February 1994. (*See http://www.epa.gov/ttn/oarpg/t1pgm.html*).

[40] *See* memorandum from Calcagni, John, Director, Air Quality Management Division, OAQPS, U.S. EPA, Research Triangle Park, N.C., "Procedures for Processing Requests to Redesignate Areas to Attainment." September 4, 1992.

attainment as soon as the necessary steps to improve air quality are taken and the NAAQS are attained.) In addition, under section 175A the maintenance plan is to contain a contingency plan with measures to ensure prompt correction of any violation of the SO_2 NAAQS. These measures should include a requirement that the air agency will implement all measures contained in the nonattainment area SIP for the area prior to the EPA's approval of the redesignation.[41]

Where the state has submitted an attainment plan for SO_2, this plan in many cases can also serve as the basis for the maintenance demonstration for the area. Insofar as attainment plans generally rely on maximum allowable emissions, these plans can generally be considered to demonstrate that the standard will be maintained without regard to any changes in operation rate of the pertinent sources. Such plans may be assumed to provide maintenance for the requisite 10 years and beyond. The EPA would expect the state to verify continued attainment by tracking the compliance status of the pertinent sources. Below is a list of supporting elements for section 175A maintenance plans.

1. Attainment inventory.

To demonstrate continued maintenance, the air agency should develop an attainment inventory to identify the level of emissions in the affected area which is sufficient to attain and maintain the SO_2 NAAQS. This inventory should be consistent with the EPA's most recent guidance on emission inventories for nonattainment areas available at the time and should include the emissions during the time period associated with the monitoring or modeling data showing attainment.

2. Maintenance demonstration.

[41] *Id.*

An air agency may generally demonstrate maintenance of the NAAQS by either showing that future emissions of SO_2 will not exceed the level of the attainment inventory, or by modeling to show that the future mix of sources and emission rates will not cause a violation of the NAAQS.[42] As a part of the maintenance demonstration, the air agency should provide a listing of SO_2 control measures being implemented in the affected area by general source sector (e.g., point, area, and mobile). The air agency should also project emissions for at least the 10 year period following redesignation of the area to attainment under CAA section 175A(a). Where the state has submitted an attainment plan, this plan in many cases can also serve as a maintenance plan for the area. Insofar as an attainment plan generally relies on air quality dispersion modeling using maximum allowable emissions, the plan can generally be expected to demonstrate that the standard will be maintained for the requisite 10 years and beyond without regard to any changes in operation rate of the pertinent sources that do not involve increases in maximum allowable emissions.

3. Monitoring network.

Once an area has been redesignated to attainment, where air quality monitors exist in an area, the air agency should continue to operate an appropriate air quality monitoring network as provided under 40 CFR part 58 to verify the attainment status of the affected area.[43]

4. Verification of continued attainment.

Each air agency should ensure that it has the legal authority to implement and enforce all measures necessary to attain and maintain the 2010 SO_2 NAAQS. The air agency's submittal

[42] *Id*

[43] State, or where appropriate, local agency requests for the discontinuation of monitors in a network, would need to meet the criteria as stated in 40 CFR part 58.14(c) related to network monitoring system modifications.

should indicate how it will track the progress of the maintenance plan for the area either through air quality monitoring or modeling.[44]

5. Contingency plan.

CAA section 175A (d) provides that the maintenance plan must contain contingency provisions that will promptly correct any violation of the SO_2 NAAQS that occurs after the area is redesignated to attainment. Unlike CAA section 172(c)(9), section 175A of the CAA does not explicitly require that contingency measures must take effect without further action by the air agency in order for the maintenance plan to be approved. However, the maintenance plan's contingency plan would become an enforceable part of the SIP and should ensure that contingency measures are adopted and implemented as expeditiously as practicable once they are triggered. The plan should clearly identify the measures to be adopted, provide a schedule and associated procedures for adoption and implementation, and provide a specific time limit for action by the air agency. The EPA will review what constitutes an adequate contingency plan on a case-by-case basis. At a minimum, CAA section 175A(d) requires that the air agency continue to implement all measures contained in the part D nonattainment area plan that was in place prior to redesignation of the affected area to attainment. An air agency may submit a SIP revision at the time of its redesignation request to remove or reduce the stringency of control measures. The EPA can approve such a revision subject to the limitations of CAA sections 110(l) and 193, as applicable.[45]

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[44] For guidance on the verification of continued attainment, *See* memorandum from Calcagni, John, Director, Air Quality Management Division, OAQPS, U.S. EPA, Research Triangle Park, N.C., "Procedures for Processing Requests to Redesignate Areas to Attainment." September 4, 1992.

[45] *See* both the memorandum from Calcagni, John, Director, Air Quality Management Division, OAQPS, U.S.EPA, Research Triangle Park, N.C., "Procedures for Processing Requests to Redesignate Areas to Attainment." September 4, 1992; and the SO_2 Guideline Document, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. 27711, EPA-452/R-94-008, February 1994.(*See http://www.epa.gov/ttn/oarpg/t1pgm.html*).

In the "General Preamble for the Implementation of Title I of the Clean Air Act Amendments of 1990," published on April 16, 1992, at 57 FR 13498, the EPA provides further discussion of contingency measures for SO_2. This guidance states that in many cases, attainment revolves around compliance of a single source or a small set of sources with emission limits shown to provide for attainment. This guidance concludes that in such cases, "the EPA interprets 'contingency measures' to mean that the state agency has a comprehensive program to identify sources of violations of the SO_2 NAAQS and to undertake an aggressive follow-up for compliance and enforcement, including expedited procedures for establishing enforceable consent agreements pending the adoption of revised SIP's." *See* 57 FR 13547. Although this guidance applies to contingency measures for nonattainment plans under section 172(c)(9), the EPA envisions applying a similar policy with respect to the contingency measures required in maintenance plans under section 175A(d), to the extent consistent with section 175A(d)'s requirement that all NAA SIP or FIP requirements be implemented.

Appendix A
Modeling Guidance for Nonattainment Areas

1. Purpose

On June 2, 2010, then-Administrator Jackson signed a final rulemaking notice that revised the primary SO_2 NAAQS (75 FR 35520, published on June 22, 2010) after review of the existing two primary SO_2 standards, promulgated on April 30, 1971 (36 FR 8187).[46] The new primary SO_2 NAAQS is codified at 40 CFR 50.17, while the prior primary SO_2 NAAQS are set forth at 40 CFR 50.4. The EPA established the revised primary SO_2 standard at 75 parts per billion (ppb), which is met at an ambient air quality monitoring site when the 3-year average of the annual 99^{th} percentile of 1-hour daily maximum concentrations does not exceed 75 ppb, as determined in accordance with Appendix T of 40 CFR part 50. *See* 40 CFR 50.17(a)-(b). In the final rule preamble, the EPA outlined a possible analytic approach to determining compliance with the new NAAQS that would include the use of both modeling and monitoring. The EPA explained that this analytic approach to determining compliance with the 2010 SO_2 NAAQS could be a technically appropriate and accurate means of assessing peak 1-hr SO_2 concentrations, and would be consistent with historic (past and more recent) implementation practice of using models to determine compliance with the SO_2 NAAQS. This guidance explains the expected application of dispersion models to support the SIP process regarding the use of modeling in the development of CAA sections 191-192 SIPs for nonattainment areas.

While this guidance explains the expected general application of dispersion models, there will be applications of dispersion models unique to specific areas where it is necessary to model unique specific sources or types of sources. In such cases, there should be consultation between the state or appropriate air agency and the appropriate EPA Regional Office modeling contact to discuss how best to model a particular source.

This guidance reflects changes made since the September 2011 release of the SO_2 draft guidance. Changes made to this guidance include:

- Removal of references to the maintenance SIPs
- Modification of section 5.1 (Determining sources to model)
- Changes to section 7.2.1 (National Weather Service data) to reflect the March 2013 release of the clarification memo "Use of ASOS meteorological data in AERMOD dispersion modeling"

2. Guidance on Air Quality Models

This guidance is based on and is consistent with the EPA's *Guideline on Air Quality Models*, also published as Appendix W of 40 CFR Part 51. Appendix W is the primary source of information on the regulatory application of air quality models for SIP revisions for existing sources and for New Source Review (NSR) and Prevention of Significant Deterioration (PSD) programs. Air quality modeling in this SIP process would need to employ air quality dispersion

[46] The EPA publicly disseminated a copy of the signed notice on June 3, 2010, and therefore treats June 3, 2010, as the date of the rule's promulgation, for purposes of the deadlines in CAA section 107(d) and 110(a)(1).

models that properly address the source-oriented nature of SO_2 and, thus, should rely upon the principles and techniques in Appendix W.

Appendix W was originally published in April 1978 and was incorporated by reference in the regulations for the Prevention of Significant Deterioration of Air Quality, Title 40, Code of Federal Regulations (CFR) sections 51.166 and 52.21 in June 1978 (43 FR 26382-26388). The purpose of Appendix W is to promote consistency in the use of air quality modeling within the air quality management process. Appendix W is periodically revised to ensure that new model developments or expanded regulatory requirements are incorporated. The most recent revision to Appendix W was published on November 9, 2005 (70 FR 68218), wherein the EPA adopted the American Meteorological Society (AMS) and the EPA Regulatory Model (AERMOD) as the preferred dispersion model for a wide range of regulatory applications in all types of terrain. To support the promulgation of AERMOD as the preferred model, the EPA evaluated the performance of the model across a total of 17 field study data bases (Perry, et al., 2005; U.S. EPA, 2003), including several field studies based on model-to-monitor comparisons of SO_2 concentrations from operating power plants. AERMOD is a steady-state plume dispersion model that employs hourly sequential preprocessed meteorological data to simulate transport and dispersion from multiple point, area or volume sources for averaging times from 1 hour to multiple years, based on an advanced characterization of the atmospheric boundary layer. AERMOD also accounts for building wake effects (i.e., downwash) on plume dispersion.

Clarifications and interpretations of modeling procedures become official EPA guidance through several courses of action: 1) the procedures are published as regulations or guidelines; 2) the procedures are formally transmitted as guidance to Regional Office managers; 3) the procedures are formally transmitted as guidance to Regional Modeling Contacts as a result of a Regional consensus on technical issues; or 4) the procedures are a result of decisions by the EPA's Model Clearinghouse that effectively establish national precedent. Formally located in the Air Quality Modeling Group (AQMG) of the EPA's Office of Air Quality Planning and Standards (OAQPS), the Model Clearinghouse is the single EPA focal point for the review of criteria pollutant modeling techniques for specific regulatory applications. Model Clearinghouse and related clarification memoranda involving decisions with respect to interpretation of modeling guidance are available at the Support Center for Regulatory Atmospheric Modeling (SCRAM) website.[47]

Recently issued EPA guidance and technical assistance documents of relevance for consideration in modeling for attainment demonstrations include:

- "Applicability of Appendix W Modeling Guidance for the 1-hr SO_2 NAAQS" August 23, 2010—confirming that Appendix W guidance is applicable for NSR/PSD permit modeling for the new SO_2 NAAQS (U.S EPA, 2010a).
- "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hr NO_2 National Ambient Air Quality Standard" March 1, 2011– provides additional guidance regarding NO_2 permit modeling and also relevant to SO_2 (U. S. EPA, 2011a).

[47] The Support Center for Regulatory Atmospheric Modeling (SCRAM) website is available at: *http://www.epa.gov/ttn/scram/*.

- "SO_2 National Ambient Air Quality Standards Designations Modeling Technical Assistance Document" 2013 – provides modeling recommendations for designating areas for the purpose of implementing the 2010 revised primary SO_2 NAAQS (U. S. EPA, 2013a).

This guidance should not be confused with the December 2013 SO_2 NAAQS Designations Modeling Technical Assistance Document (U.S. EPA, 2013a) which offers recommendations of modeling SO_2 sources with actual emissions for the purposes of designations only. The guidance discussed in this implementation guidance is for modeling to demonstrate future attainment of the SO_2 NAAQS in designated nonattainment areas.

The guidance listed above, in addition to other relevant support documents can be found on the SCRAM website at *http://www.epa.gov/ttn/scram/so2_modeling_guidance.htm*. This website will be made publicly available at the time of release of this SO_2 implementation guidance document.

The following sections will refer to the relevant sections of Appendix W and other existing guidance with summaries as necessary. Please refer to those original guidance documents for full discussion and consult with the appropriate EPA Regional Modeling Contact if questions arise about interpretation on modeling techniques and procedures[48].

3. Model selection

Preferred air quality models for use in regulatory applications are addressed in Appendix A of the EPA's *Guideline on Air Quality Models* (Appendix W). If a model is to be used for a particular application, the user should follow the guidance on the preferred model for that application. These models may be used without an area specific formal demonstration of applicability as long as they are used as indicated in each model summary of Appendix A. Further recommendations for the application of these models to specific source problems are found in subsequent sections of Appendix W. In 2005, the EPA promulgated AERMOD as the Agency's preferred near-field dispersion modeling for a wide range of regulatory applications in all types of terrain based on extensive developmental and performance evaluation.

For SIP development under the 2010 primary SO_2 NAAQS, AERMOD or one of the other preferred models in Appendix A should be used for near-field dispersion unless use of an alternative model can be justified (Section 3.2, Appendix W). It is anticipated that AERMOD will be the model of choice for most applications but there may be particular applications where other preferred models, such as BLP would be used. As outlined in the August 23, 2010 clarification memo "Applicability of Appendix W Modeling Guidance for the 2010 SO_2 National Ambient Air Quality Standard", AERMOD is the preferred model for single source modeling to address the 2010 SO_2 NAAQS as part of the NSR/PSD permit programs (U.S. EPA, 2010a). AERMOD is appropriate for the SIP development process because SO_2 concentrations result from direct emissions from combustion sources so that concentrations are highest

[48] List of Regional Modeling Contacts by the EPA Regional Office is available from SCRAM website at: *http://www.epa.gov/ttn/scram/guidance_cont_regions.htm*.

relatively close to sources and are much lower at greater distances due to dispersion, i.e. a strong concentration gradient. Given the source-oriented nature of this pollutant (*see, e.g.*, 75 FR at 35570), dispersion models are the most appropriate air quality modeling tools to predict the near-field concentrations and gradients of this pollutant.[49]

The AERMOD modeling system includes several components. The regulatory components are:

- AERMOD: the dispersion model (U.S. EPA, 2004a; U.S. EPA, 2013b)
- AERMAP: the terrain processor for AERMOD (U.S. EPA, 2004b, U.S. EPA, 2011b)
- AERMET: the meteorological data processor for AERMOD (U.S. EPA, 2004c; U.S. EPA, 2013c)

and non-regulatory components are:

- AERSURFACE: the surface characteristics processor for AERMET (U.S. EPA, 2008)
- AERSCREEN: a recently released screening version of AERMOD (U.S. EPA, 2011c, 2011d)
- BPIPPRIME: the building input processor (U.S. EPA, 2004d)
- AERMINUTE, a preprocessor to AERMET that calculate 1-hourly averaged winds from 1-minute ASOS winds (U.S. EPA, 2011e)

The relationships among the inputs and outputs of the AERMOD modeling system are presented in Figure 1.

Before running AERMOD, the user should become familiar with the user's guides associated with the modeling components listed above and the AERMOD Implementation Guide (AIG) (U.S. EPA, 2009). The AIG lists several recommendations for applications of AERMOD which would be applicable for SIP modeling.

[49] Section 4 of Appendix W offers guidance for the use of traditional stationary source models including AERMOD. Section 5 of Appendix W states that Section 4 guidance is applicable to SO_2 further reinforcing the applicability of AERMOD for SO_2 modeling.

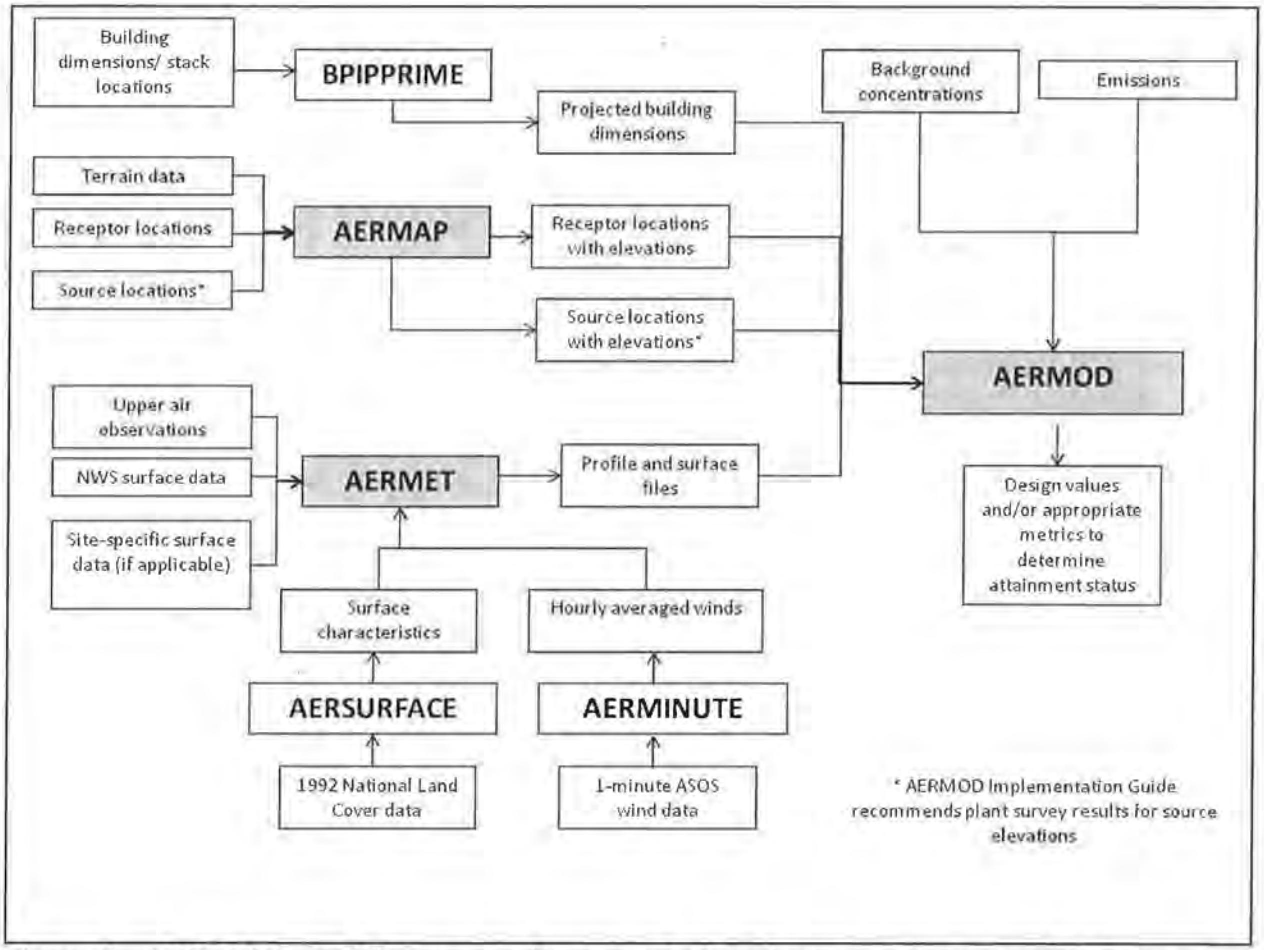


Figure 1. AERMOD modeling system framework. Regulatory components of the system are in gray boxes.

4. Modeling Framework

Figure 2 presents a flow chart of the SIP modeling framework from identifying sources and emissions inputs to design value calculations. The methodology presented here for SO_2 differs from SIP guidance developed for ozone and $PM_{2.5}$ (U.S. EPA, 2007). For SO_2 modeling, maximum allowable emissions are the basis of the emissions input to the model in accordance with Section 8 of Appendix W and past SO_2 guidance (U.S. EPA, 1994). For ozone and $PM_{2.5}$, actual emissions for a particular base year are the basis of the emissions input to the model in accordance with U.S. EPA (2007). For SO_2 SIP modeling, the general steps include the following:

1. Gather information about SO_2 sources in the nonattainment areas defined in the designations process including source emissions and locations, as well as other pertinent source characteristics (e.g., building information for modeling building downwash),
2. Identify sources to explicitly model and sources to represent via monitored background. The sources to be explicitly modeled within each area should include the larger sources and others that potentially contribute to the NAAQS violation for the state to have the greatest flexibility in determining controls across sources, as necessary, to attain the

NAAQS; Information about sources just outside the nonattainment area may be gathered if those sources are thought to cause or contribute to violations inside the nonattainment area.

3. Beginning with the maximum allowable emissions or federally enforceable emission limits, apply control strategies that may be employed from nationally enforceable rules[50];
4. Input the initially controlled emissions along with receptors, meteorology, and background concentrations into the dispersion model and calculate design values based on cumulative concentrations (all modeled sources and background). These design values represent a baseline case to determine the extent of possible control strategies;
5. If there are no predicted violation of the NAAQS at all modeled receptors from the initial dispersion modeling results, the area has demonstrated attainment;
6. If there are predicted violations of the NAAQS, additional control strategies would need to be implemented on the initially controlled sources and possible controls on additional sources would need to be assessed, which may necessitate re-running the dispersion model;
7. If additional controls result in no predicted violations of the NAAQS, the area has demonstrated attainment;
8. If there are still predicted violations of the NAAQS, continue to assess additional controls until no predicted violations occur.

Note that in Figure 2, steps 7 and 8 above are repeats of step 4 through 6.

The following sections provide details of the SO_2 modeling framework and each element in the modeling analysis for the SIP development effort. Section 5 describes the modeling domain and receptor grid. Section 6 describes the input emissions and controls, while Section 7 describes meteorological inputs. Section 8 describes the inclusion of background, and Section 9 describes the calculations of the design values.

[50] *See* Section V.D. of the SO_2 SIP guidance document for more information about national rules.

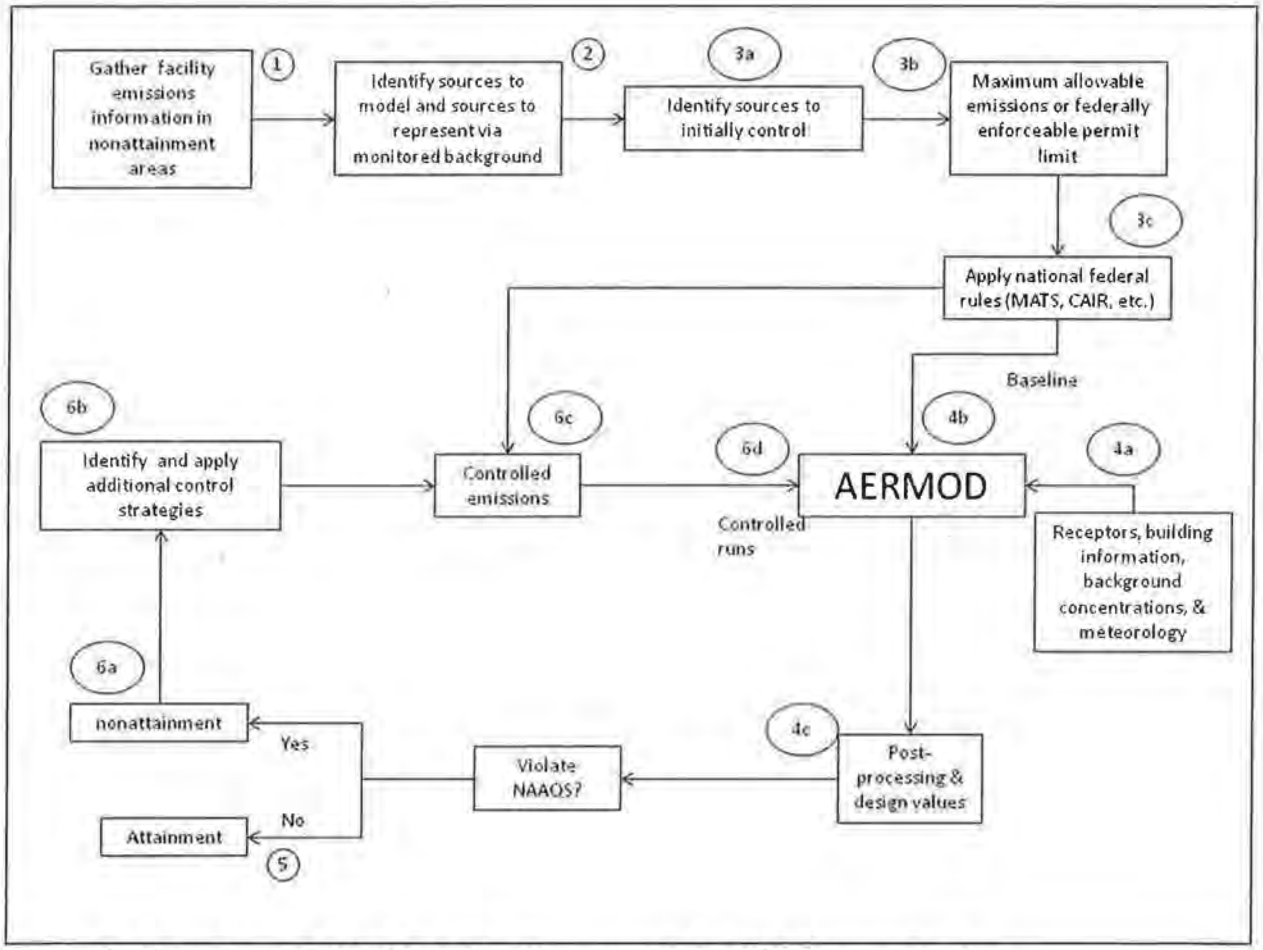


Figure 2. Flowchart of SO_2 Modeling Framework for SIP Demonstration.

5. Modeling domain

Selection of the modeling domain is important in terms of how many sources to explicitly model and what kind of receptor network to create. Two questions may arise in model domain selection:

1. Where to center the modeling domain?
2. How large should the modeling domain be (i.e., in terms of the number of sources to explicitly model and size of the receptor network in order to account for the areas of impact)?

The modeling domain should at a minimum encompass the nonattainment area and include the sources thought most likely to cause or contribute to NAAQS violations in and around the nonattainment area. Note that in the modeling exercise, all modeled receptors should exhibit modeled attainment of the NAAQS. The comparison of all receptor design values to the NAAQS is necessary given the short term nature of the SO_2 NAAQS and the fact that SO_2 emissions are primarily from stationary combustion sources with strong local concentration gradients. Given the variability of meteorology (especially wind speed and direction) and the short term nature of the NAAQS, comparison of modeled design values at only one receptor, such as the location of the monitor, would not yield results that provide for informing the most stringent controls to aid the area to demonstrate attainment. Because monitors represent a single location, modeling with a multitude of receptors allows for determining other possible locations of high concentrations given the meteorological variability. The necessity of all receptors exhibiting modeled attainment is consistent with NSR and PSD guidance (U.S. EPA, 1990).

As stated in section 4 and shown in Figure 2, the first step of the SIP modeling exercise is to determine which sources to explicitly model and those that can be represented by background concentrations from a representative monitor. The determination of sources to explicitly model is a multi-step process. The first basic step would be to consider those sources within the nonattainment area defined in designations or those thought to cause or contribute to violations in the nonattainment area.

5.1. Determining sources to explicitly model

As stated above, the determination of sources to explicitly model for each area is a multi-step process and requires thoughtful consideration of the area in question (terrain influences, meteorology, etc.). If the nonattainment area was defined as a partial county during the designations process, then considering what sources to model may have already been considered. If the nonattainment area was defined as the presumptive county boundary, then it may be necessary to follow the methodology below.

Determining specific sources to explicitly model is a multi-step process. The goal is to determine those sources that could cause or contribute to a NAAQS violation. Sound technical justification, best professional judgment, and consultation with the appropriate EPA Regional Modeling Contact should be used to determine which sources to model and which to represent via background concentrations. When considering other sources to include in the modeling (other than those that are driving the nonattainment), Appendix W states in section 8.2.3.b that all sources expected to cause a significant concentration gradient in the vicinity of the source of interest should be explicitly modeled and that the number of such sources is expected to be small except in unusual cases. Other sources in the area, i.e. those not causing significant concentration gradients in the vicinity of the source of interest, should be included in the modeling via monitored background concentrations as described later in Section 8 of this guidance. The number of sources to explicitly model should generally be small. The March 1, 2011 NO_2 memorandum (U.S. EPA, 2011a) also offers recommendations for determining nearby sources, and those recommendations are relevant for SO_2 as well. The NO_2 memo recommends the following:

1. Analyze contour plots of the source which clearly depict the impact area of the source, preferably overlaid on a map that identifies key geographic features that may influence the dispersion patterns. The concentration contour plot also serves to visually depict the concentration gradients associated with the source's impact.
2. Controlling meteorological conditions for the source's impact should be identified as clearly as possible. Use of the MAXDAILY or MXDYBYYR AERMOD output options can help identify the appropriate time periods to be used to calculate controlling design values.

3. A wind rose of the meteorological station used in the modeling can help to analyze flow patterns.

For SIP modeling purposes "source" refers to those sources that may be drivers of the monitored nonattainment and contour plots should present the modeled design values. Overlaying other sources' locations on the contour plots can aid in determining the possibility of a significant concentration gradient around those sources. U.S. EPA (2011a) also offers guidance on the determination of significant concentration gradients and distance from the source. The memo discusses that concentration gradients associated with a particular source will be generally largest between the source and the distance to the maximum ground level concentrations from the source. Beyond that distance, gradients tend to be smaller and more spatially uniform. The memo also offers a general guideline that the distance between a source and its maximum ground level concentration is generally 10 times the stack height in flat terrain. However, the potential influence of terrain can impact the location and magnitudes of significant concentration gradients. The use of significant concentration gradients can help inform the decision of sources to consider for explicit modeling. For more details on the significant concentration gradient, refer to U.S EPA (2011a).

For those sources that are questionable for inclusion in the modeling, the use of screening modeling via AERSCREEN may aid in the decision process. While AERSCREEN does not output a design value, but a maximum hourly concentration, it can serve as a conservative estimate to compare against the NAAQS and Significant Impact Level (SIL)[51]. If a source exceeds the EPA interim SIL or a state-selected impact criterion, it may need evaluation with refined modeling. If the maximum 1-hour concentration output from AERSCREEN violates the NAAQS, it does not necessarily mean that the screened source is in nonattainment, but that the source may need evaluation using refined dispersion modeling. For small isolated sources, screening may be useful on a source by source basis. However, for a cluster of small sources, their cumulative impact should also be assessed. Individual sources may not be significant by themselves, but together they could cause or significantly contribute to a NAAQS violation.

5.2. Receptor grid

The model receptor grid is unique to the particular situation and depends on the size of the modeling domain, the number of modeled sources, and complexity of the terrain. Receptors should be placed in areas that are considered ambient air (i.e., where the public generally has access) relative to a particular facility and placed throughout the nonattainment area and perhaps outside the boundaries of the nonattainment area if professional judgment indicates the possibility that modeled design values will exceed the NAAQS. Receptor placement should be of sufficient density to provide resolution needed to detect significant gradients in the concentrations with receptors placed closer together near the source to detect local gradients and placed farther apart away from the source. In addition, the user may want to place receptors at key locations such as around facility fence lines (which define the ambient air boundary for a particular source) or monitor locations (for comparison to monitored concentrations for model

[51] The 3 ppb interim SIL for the 2010 SO_2 NAAQS was provided by the EPA for states to consider using for the PSD program in the August 23, 2010 memorandum "Guidance Concerning the Implementation of the 2010 SO_2 NAAQS for the Prevention of Significant Deterioration Program."

evaluation purposes). States may already have existing receptor placement strategies in place for regulatory dispersion modeling under NSR/PSD permit programs. If this strategy is considered adequate for the implementation modeling, states should continue with their respective receptor placement strategies. When designing the receptor network, the emphasis should be on receptor resolution and location, not the total number of receptors.

As noted above, terrain complexity should also be considered when setting up the receptor grid. If complex terrain is included in the model calculations, AERMOD requires that receptor elevations be included in the model inputs. In those cases, the AERMAP terrain processor (U.S. EPA, 2004b; U.S EPA, 2011b) should be used to generate the receptor elevations and hill heights. The latest version of AERMAP (version 09040 or later) can process either Digitized Elevation Model (DEM) or National Elevation Data (NED) data files. The AIG recommends the use of NED data since it is more up to date than DEM data, which is no longer updated (Section 4.3 of the AIG).

6. Source inputs

This section provides guidance on source characterization to develop appropriate inputs for dispersion modeling with the AERMOD modeling system. Section 6.1 provides guidance on use of allowable emission levels as the base emissions, section 6.2 discusses control strategies for emissions, section 6.3 covers guidance on Good Engineering Practice (GEP) stack heights, section 6.4 discusses dispersion techniques, section 6.5 provides details on source configuration and source types, section 6.6 provides details on urban/rural determination of the sources, and section 6.7 provides general guidance on source grouping, which may be important for design value calculations.

6.1. Baseline emissions including Federal rules

Consistent with past SO_2 modeling guidance (Section 4.5.2 of U.S. EPA (1994)) and regulatory modeling for other programs (Appendix W, Section 8.1), dispersion modeling for the purposes of SIP development should be based on the use of maximum allowable emissions or federally enforceable permit limits at 100 percent load and can include federal rules that will be in place by the attainment date (i.e. MATS, Industrial Boiler MACT, etc.), to the extent that the sources are subject to specific enforceable limitations on SO_2 emissions as a result of these rules. Also consistent with past and current guidance, in the absence of allowable emissions or federally enforceable permit limits, potential to emit emissions (i.e., design capacity) should be used. Because of the short-term nature of the new SO_2 NAAQS, the maximum short term or hourly emission rate should be input into AERMOD for each modeled hour. As stated in the August 23, 2010 memo (U. S. EPA, 2010a),

> "Since short-term SO_2 standards ($\leq$ 24 hours) have been in existence for decades, existing SO_2 emission inventories used to support modeling for compliance with the 3-hour and 24-hour SO_2 standards should serve as a useful starting point, and may be adequate in many cases for use in assessing compliance with the 2010 SO_2 standard since issues

identified in Table 8-2 of Appendix W related to short-term vs. long-term emission estimates may have already been addressed.[52]"

The necessary emissions information for attainment demonstration modeling should be available from existing SO_2 inventories used for permitting or SIP demonstrations. For emission limits longer than 1-hour, it may be prudent to assess whether the emission limit is adequate for the 1-hour SO_2 NAAQS. For example, for a 24-hour average limit, there may be hours within the 24-hour period with emissions that exceed the level associated with NAAQS attainment. It may be necessary to calculate an hourly emission rate from the 24-hour limit that would then be modeled for the attainment demonstration. For those situations, it may be useful to review the methodology used to estimate the existing limits to determine if those limits were estimated from a modeled 1-hour emission rate that demonstrated attainment in the past. In those situations, the hourly emission rate that was the basis of the limit may be the initial input emission rate for the SIP modeling to determine control strategies.

However, if short-term emissions are not readily available, they may be calculated using the methodology shown in Table 8-1 of Appendix W, with an important caveat discussed in the following paragraph. For the short term NAAQS standards this is a product of the maximum allowable emission limit or federally enforceable emission limit, the operating level and operating factor. The operating level is defined in Section 8.1 of Appendix W as the actual or design capacity (whichever is greater) or federally enforceable permit condition. Emissions are often calculated using AP-42 factors and an example calculation of short term emissions is shown in Attachment A of the June 28, 2010 memorandum "Applicability of Appendix W Modeling Guidance for the 1-hr NO_2 National Ambient Air Quality Standard" (U. S. EPA, 2010b). Although the example is for NO_2, the calculation methodology would be the same for SO_2. In the example, an emission rate for modeling is based on the design capacity of a natural gas fired boiler and the emission factor of the boiler. Emissions can be estimated for a coal fired boiler for example, using the appropriate AP-42 factor, sulfur content of the coal, and design capacity of the boiler.

An important caveat regarding Table 8-1 of Appendix W is that this guidance is oriented toward short term emission limits (e.g., 1-hour emission limits), as recommended in previous guidance. Current guidance, providing for use of longer term emission limits, provides that after the state determines the 1-hour limit that would be necessary to provide for attainment, any longer term limit should be established at a level that is sufficiently lower to provide comparable stringency. Thus, in cases where a state wishes to apply a longer term average limit, the attainment analysis would be based not on the level of the longer term limit but rather on the level of the corresponding 1-hour emission limit that was shown in the plan to be of comparable stringency.

Appendix W (Section 8.1.2) also recommends modeling at 50 percent and 75 percent of design capacity to determine the load that may cause the highest concentration because changes in stack parameters in loads less than 100 percent of capacity may cause higher ground level

[52] The August 23, 2010 memo refers to modeling for PSD and Table 8-2 refers to PSD applications.

concentrations[53]. Loads that are less than design capacity should be included in the modeling analysis.

Regarding the use of allowable emissions and the modeling of intermittent emissions sources from such sources as emergency generators and startup/shutdown emissions, the inclusion of such emissions for the purpose of modeling for SO_2 attainment demonstrations should follow the recommendations in U. S. EPA, (2011a). As stated in this memo, the EPA suggests the most appropriate data to use for compliance demonstrations for the 1-hour NO_2 NAAQS are those based on emissions scenarios that are continuous enough or frequent enough to contribute significantly to the annual distribution of maximum daily 1-hr concentrations. Although the referenced guidance in this memo is for NO_2 permit modeling, the common 1 hour averaging time and form of both the NO_2 and SO_2 standards makes this modeling guidance relevant to the 2010 SO_2 NAAQS and, thus, useful for SO_2 modeling in support of attainment demonstrations. For more details, refer to the NO_2 memo (U.S. EPA, 2011a). If any questions arise regarding preparation of emissions inputs for dispersions modeling including intermittent emissions from sources, then users should consult the appropriate EPA Regional Modeling Contact.

6.2. Modeling of additional Controls

As stated in Section 4 and shown in Figure 2, the initial baseline emissions input into the modeling for the SIP can include the national rules that will be in place by the attainment date. Therefore, if these initial controls on subject sources in the nonattainment area allow for the area to be in attainment by the attainment date, additional controls may not be necessary. However, if additional controls are necessary to achieve attainment, identifying additional sources within the nonattainment area to control or additional control strategies may be necessary (see Figure 2). Often these sources can be determined by analyzing spatial relationships between the sources and receptors whose concentrations exceed the NAAQS.

In some cases, control of one source may allow an area to be in attainment, while in other cases, controls could be implemented on several sources to share the control responsibility to demonstrate the area to be in attainment. As stated in section V.B. of the SIP guidance document, states should develop an accurate attainment inventory to identify the level of emissions in the area sufficient to attain the 2010 SO_2 NAAQS and be consistent with the EPA's most recent guidance on emissions inventories. These emissions are maximum allowable emissions levels that reflect enforceable national, regional, or local rules that will be in place within the timeframe for demonstrating attainment of the standard. When modeling with emissions from the emissions inventory, the input emissions should be reflective of implemented control strategies that will allow the area to be in attainment of the NAAQS. The controlled emissions should be tested using Table 8-1 of Appendix W. *See* section V.B. of the SIP guidance document for more information about control strategies.

[53] As stated in Table 8-1 of Appendix W, "If an operation does not occur for all hours of the time period of consideration (e.g. 3 or 24 hours) and the source operation is constrained by a federally enforceable permit condition, an appropriate adjustment to the modeled emission rate may be made. (e.g., if operation is only 8 a.m. to 4 p.m. each day, only these hours will be modeled with emissions from the source. Modeled emissions should not be averaged across non-operating time periods."

6.3. Good Engineering Practice (GEP) stack height

Consistent with previous SO_2 modeling guidance (U.S. EPA, 1994) and section 6.2.2 of Appendix W, for stacks with heights that are within the limits of Good Engineering Practice (GEP), actual heights should be used in modeling. Under the EPA's regulations at 40 CFR 51.100, GEP height, H_g, is determined to be the greater of:

- 65 m, measured from the ground-level elevation at the base of the stack;
- For stacks in existence on January 12, 1979, and for which the owner or operator had obtained all applicable permits or approvals required under 40 CFR parts 51 and 52

  $$H_g=2.5H$$

  provided that the owner or operator produces evidence that this equation was actually relied on in designing the stack or establishing an emission limitation to ensure protection against downwash;

  For all other stacks,

  $$H_g=H + 1.5L,$$

  where H is the height of the nearby structure(s) measured from the ground-level elevation at the base of the stack and L is the lesser dimension of height or projected width of nearby structure(s), or

- the height demonstrated by a fluid model or a field study approved by the EPA or the state/local agency which ensures that the emissions from a stack do not result in excessive concentrations of any air pollutant as a result of atmospheric downwash, wakes, eddy effects created by the source itself, nearby structures or nearby terrain features.

For more details about GEP, see the Guideline for Determination of Good Engineering Practice Stack Height Technical Support Document (U.S. EPA, 1985).

If stack heights exceed GEP, then GEP heights should be used with the individual stack's other parameters (temperature, diameter, exit velocity). For stacks modeled with actual heights below GEP, building downwash should be considered as this can impact concentrations near the source (Section 6.2.2b, Appendix W). If building downwash is being considered, the BPIPPRIME program (U.S. EPA, 2004d) should be used to input building parameters for AERMOD. More information about buildings and stacks is in Section 6.5.

6.4. Dispersion techniques

As stated in past SO_2 modeling guidance (U .S. EPA, 1994), the EPA stack regulations generally prohibit stationary sources from taking credit for dispersion techniques in determining allowable emission limitations. As stated in section 5.3 of the 1994 SO_2 modeling guidance prohibited dispersion techniques are:

- Using that portion of a stack in excess of good engineering practice stack height
- Varying the pollutant emission rate according to atmospheric conditions or ambient concentrations of that pollutant (referred to as intermittent or supplemental control systems – ICS or SCS) or,
- Increasing final exhaust gas plume rise by manipulating source process parameters, exhaust gas parameters, stack parameters or combining exhaust gases from several existing stacks into one stack, or other selective handling of exhaust gas streams so as to increase the exhaust gas plume rise.

Exceptions to the prohibitions are:

- Merging of gas streams in original design and construction, or as part of a change that includes installation of controls and a net reduction in allowable emissions affected by the change
- Utilizing techniques which increase final, exhaust gas plume rise, provided facility-wide allowable emissions of SO_2 are less than 5,000 tons per year
- Smoke management techniques involved in agricultural or silvicultural programs
- Episodic restrictions on residential wood burning and open burning and,
- Reheating after a pollution control system

6.5. Source configurations and source types

An accurate characterization of the modeled facilities is critical for refined dispersion modeling, including accurate stack parameters and physical plant layout. Accurate stack parameters should be determined for the emissions being modeled. Since modeling would be done with maximum allowable or potential emissions levels at each stack, the stack's parameters such as exit temperature, diameter, and exit velocity should reflect those emissions levels. Accurate locations (i.e. latitude and longitude or Universal Transverse Mercator (UTM) coordinates and datum)[54] of the modeled emission sources, determination of stack base elevation, and relative location to any nearby building structures are also important, as this can affect the impact of an emission source on receptors. Not only are accurate stack locations needed, but accurate information for any nearby buildings is important. This information would include location and orientation relative to stacks and building size parameters (height, and corner coordinates of tiers) as these parameters are input into BPIPPRIME to calculate building parameters for AERMOD. If stack locations and or building information are not accurate, downwash will not be accurately accounted for in AERMOD.

Emission source type characterization within the modeling environment is also important. As stated in the AERMOD User's Guide (U.S. EPA, 2004a; U.S. EPA, 2013b), emissions sources can be characterized as several different source types: POINT sources, capped stacks (POINTCAP), horizontal stacks (POINTHOR), VOLUME sources, OPENPIT sources, rectangular AREA sources, circular area sources (AREACIRC), and irregularly shaped area

[54] Latitudes and longitudes to four decimal places position a stack within 30 feet of its actual location and five decimal places place a stack within three feet of its actual location. Users should use the greatest precision available.

sources (AREAPOLY). Note that POINTCAP and POINTHOR are not part of the regulatory default option in AERMOD because the user must invoke the BETA option in the model options keyword MODELOPT while not including the "DFAULT" modeling option for these options to work properly. Use of the BETA options for POINTCAP and POINTOR source types would fall under the alternative models scenario under Section 3.2.2 of Appendix W. Users should consult with the appropriate reviewing authority and or Regional Office about using these source types. While most sources can be characterized as POINT sources, some sources, such as fugitive releases or nonpoint sources (emissions from ports/ships, airports, or smaller point sources with no accurate locations) may be best characterized as VOLUME or AREA type sources. Sources such as flares can be modeled in AERMOD using the parameter input methodology described in section 2.1.2 of the AERSCREEN User's Guide (U. S. EPA, 2011c). If questions arise about proper source characterization or typing, users should consult the appropriate EPA Regional Modeling Contact.

6.6. Urban/rural determination

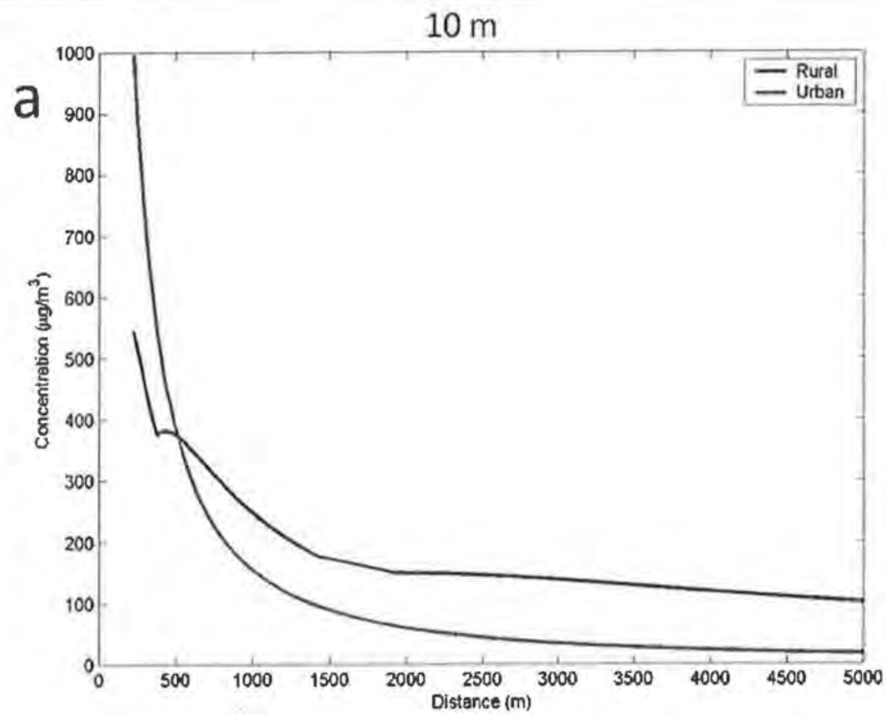
For any dispersion modeling exercise, the urban or rural determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. Figure 3 gives example maximum 1-hour concentration profiles for a 10 meter stack (Figure 3a) and a 100 m stack (Figure 3b) based on urban vs. rural designation. The urban population used for the examples is 100,000. In Figure 3a, the urban concentration is much higher than the rural concentration for distances less than 750 m from the stack but then drops below the rural concentration beyond 750 m. For the taller stack in Figure 3b, the urban concentration is much higher than the rural concentration even as distances increase from the source. These profiles show that the urban or rural designation of a source can be quite important.

In addition, for SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half life[55] for urban SO_2 sources (See Section 7.2.6 of Appendix W) due to SO_2 removal by conversion to H_2SO_4 (catalytic and photochemical) and adsorption onto particulate matter (Turner, 1964). This would only be done for urban sources when the POLLUTID keyword in AERMOD is set to "SO_2" and the MODELOPT keyword includes the DFAULT option. Rural sources within the same AERMOD run would not be affected. If the DFAULT option is not included with the MODELOPT keyword, the 4-hour half life would not be used and the user would specify the 4-hour half life using the HALFLIFE or DCAYCOEF keywords in order to account for the chemical transformation. See section 3.2.6 of the AERMOD User's Guide (U.S. EPA, 2004a) for more details about these keywords. If the user invokes the HALFLIFE or DCAYCOEF option, then any rural sources included in the modeling would need to be run in separate AERMOD runs so that they are not subject to the 4-hour half life. Note that if the DFAULT option is used, the rural sources would not need to be in a separate run from the urban sources. Determining whether a source is urban or rural can be done using the methodology outlined in Section 7.2.3 of Appendix W and recommendations outlined in Sections 5.1 through 5.3 in the AIG (U.S. EPA, 2009). In summary, there are two methods of urban/rural classification described in Section 7.2.3 of Appendix W.

[55] Over a 4-hour period, SO_2 concentrations decrease by half from the initial value.

The first method of urban determination is a land use method (Appendix W, section 7.2.3c). In the land use method, the user analyzes the land use within a 3 km radius of the source using the meteorological land use scheme described by Auer (1978). Using this methodology, a source is considered urban if the land use types I1 (heavy industrial), I2 (light-moderate industrial), C1 (commercial), R2 (common residential), and R3 (compact residential) are 50% or more of the area within the 3 km radius circle. Otherwise, the source is considered a rural source. The second method uses population density and is described in section 7.2.3d of Appendix W. As with the land use method, a circle of 3 km radius is used. If the population density within the circle is greater than 750 people/km^2, then the source is considered urban. Otherwise, the source is modeled as a rural source. Of the two methods, the land use method is considered more definitive (Section 7.2.3e, Appendix W).

Caution should be exercised with either classification method. As stated in section 5.1 of the AIG (U.S. EPA, 2009), when using the land use method, a source may be in an urban area but located close enough to a body of water or other non-urban land use category to result in an erroneous rural classification for the source. The AIG in Section 5.1 cautions users against using the land use scheme on a source by source basis, but advises considering the potential for urban heat island influences across the full modeling domain. When using the population density method, section 7.2.3e of Appendix W states, "Population density should be used with caution and should not be applied to highly industrialized areas where the population density may be low and thus a rural classification would be indicated, but the area is sufficiently built-up so that the urban land use criteria would be satisfied..." With either method, section 7.2.3(f) of Appendix W recommends modeling all sources within an urban complex as urban, even if some sources within the complex would be considered rural using either the land use or population density method.


10 m
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Rural
Urban
Concentration (µg/m³)
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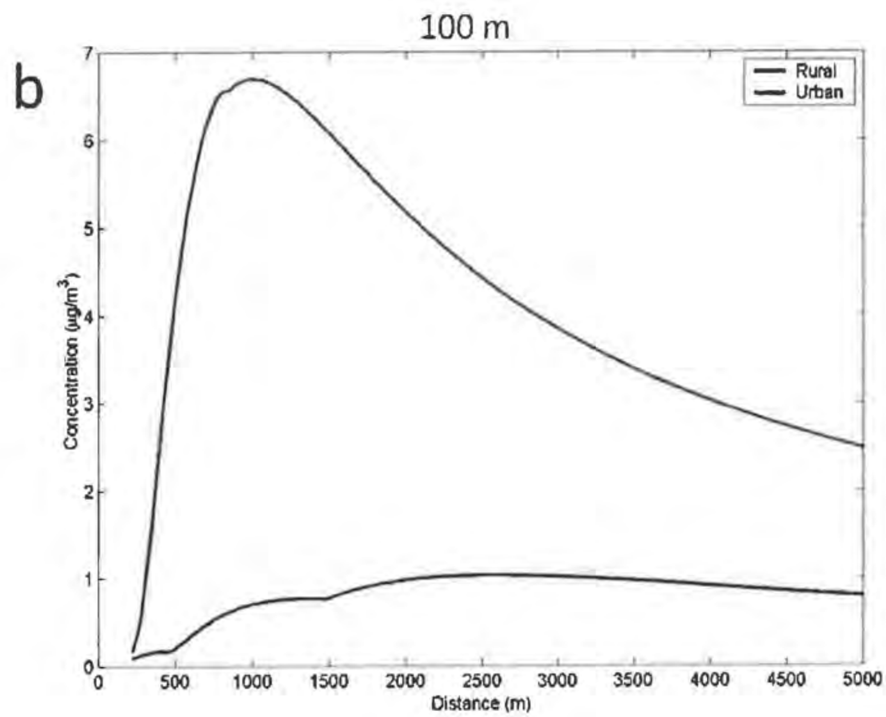
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Another consideration that may need attention by the user and is discussed in section 5.1 of the AIG relates to tall stacks located within or adjacent to small to moderate size urban areas. In such cases, the stack height or effective plume height for very buoyant sources may extend above the urban boundary layer height. The application of the urban option in AERMOD for these types of sources may artificially limit the plume height. The use of the urban option may not be appropriate for these sources, since the actual plume is likely to be transported over the urban boundary layer. Section 5.1 of the AIG gives details on determining if a tall stack should be modeled as urban or rural, based on comparing the stack or effective plume height to the urban boundary layer height. The 100 m stack illustrated in Figure 3b, may be such an example as the urban boundary layer height for this stack would be 189 m (based on a population of 100,000) and equation 104 of the AERMOD formulation document (Cimorelli, et al., 2004). This equation is:

$$z_{iuc} = z_{iuo}\left(\frac{P}{P_o}\right)^{1/4} \qquad (1)$$

where z_{iuo} is a reference height of 400 m corresponding to a reference population P_o of 2,000,000 people and P is the local population for the project area.

Given that the stack is a buoyant release, the plume may extend above the urban boundary layer and may be best characterized as a rural source, even if it were near an urban complex. Exclusion of these elevated sources from application of the urban option would need to be justified on a case-by-case basis in consultation with the appropriate reviewing authority.

AERMOD requires the input of urban population when utilizing the urban option. Population can be entered to one or two significant digits (i.e., an urban population of 1,674,365 can be entered as 1,700,000). Users can enter multiple urban areas and populations using the URBANOPT keyword in the runstream file (U.S. EPA, 2004a; U.S. EPA, 2013b). If multiple urban areas are entered, AERMOD requires that each urban source be associated with a particular urban area or AERMOD model calculations will abort. Urban populations can be determined by using a method described in section 5.2 of the AIG (U.S. EPA, 2009).

6.7. Source groups

In AERMOD, individual emission sources' concentration results can be combined into groups using the SRCGROUP keyword (Section 3.3.11 of the AERMOD User's Guide (U.S, EPA, 2004a). The user can automatically calculate a total concentration (from all sources) using the SRCGROUP ALL keyword. For the purposes of attainment demonstrations and design value calculations, source group ALL should be used, especially if all sources in the modeling domain are modeled in one AERMOD run. Design values should be calculated from the total concentrations (all sources and background). For the purposes of SIP modeling, individual facility contributions outputs to the total concentration may be necessary to determine the effectiveness of control strategies.

7. Meteorological data

Section 7 gives guidance on the selection of meteorological data for input into AERMOD. Much of the guidance from section 8.3 of Appendix W is applicable to SIP modeling and is summarized here. In section 7.2, guidance for the use of National Weather Service (NWS) data and the use of AERMINUTE is discussed. AERMINUTE is an AERMET pre-processor that calculates hourly averaged winds from ASOS (Automated Surface Observing System) 1-minute winds.

7.1. Surface characteristics and representativeness

The selection of meteorological data that are input into a dispersion model should be considered carefully. The selection of data should be based on spatial and climatological (temporal) representativeness (Appendix W, section 8.3). The representativeness of the data is based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data are: NWS stations, site-specific or onsite data, and other sources such as universities, Federal Aviation Administration (FAA), military stations, and others. Appendix W addresses spatial representativeness issues in Sections 8.3.a and 8.3.c. Information regarding spatial representativeness can also be found in Section 3.1. of the *Meteorological Monitoring Guidance for Regulatory Modeling Applications* (U.S. EPA, 2000).

Spatial representativeness of the meteorological data can be adversely affected by large distances between the source and receptors of interest and the complex topographic characteristics of the area (Appendix W, section 8.3.a and 8.3.c). If the modeling domain is large enough such that conditions vary drastically across the domain then the selection of a single station to represent the domain should be carefully considered or the size of the modeling domain should be reconsidered. Also, care should be taken when selecting a station if the area has complex terrain. While a source and meteorological station may be in close proximity, there may be complex terrain between them such that conditions at the meteorological station may not be representative of the source. An example would be a source located on the windward side of a mountain chain with a meteorological station a few kilometers away on the leeward side of the mountain. Spatial representativeness for off-site data should also be assessed by comparing the surface characteristics (albedo, Bowen ratio, and surface roughness) of the meteorological monitoring site and the analysis area. When processing meteorological data in AERMET (U.S. EPA, 2004c; U.S. EPA, 2013c), the surface characteristics of the meteorological site should be used (Section 8.3.c of Appendix Wand the AERSURFACE User's Guide (U.S. EPA 2008)). Spatial representativeness should also be addressed for each meteorological variable separately. For example, temperature data from a meteorological station several kilometers from the analysis area may be considered adequately representative, while it may be necessary to collect wind data near the plume height (Section 8.3.c of Appendix W).

Surface characteristics can be calculated in several ways. For details *see* Section 3.1.2 of the AIG (U.S. EPA, 2009). The EPA has developed a tool, AERSURFACE (U.S. EPA, 2008) to aid in the determination of surface characteristics. The current version of AERSURFACE uses 1992 National Land Cover Data. Note that the use of AERSURFACE is not a regulatory requirement but the methodology outlined in section 3.1.2 of the AIG should be followed unless an alternative method can be justified.

7.2. Meteorological inputs

Appendix W states in section 8.3.1.1 that the user should acquire enough meteorological data to ensure that worst-case conditions are adequately represented in the model results. Appendix W states that 5 years of NWS meteorological data or at least 1 year of site-specific data should be used (section 8.3.1.2, Appendix W) and should be adequately representative of the study area. The most recent 5 years are preferred and if 1 or more years (including partial years) of site-specific data are available, those data are preferred. While the form of the SO_2 NAAQS contemplates obtaining 3 years of monitoring data in order to determine attainment at a monitoring site (*see* 40 CFR 50.17(b)), this does not preempt the use of 5 years of NWS data or at least 1 year of site-specific data in the modeling. The 5-year average based on the use of NWS data, or an average across 1 or more years of available site specific data, serves as an unbiased estimate of the 3-year average for purposes of modeling demonstrations of compliance with the NAAQS (U. S. EPA, 2010a). *See* U.S. EPA (2010a) for more details on the use of 5 years of NWS data or at least 1 year of site-specific data and applicability to the NAAQS.

The meteorological data used in the modeling should be processed with the latest available version of AERMET in order to take advantage of enhancements or formulation corrections in AERMET. This may require re-processing the data already used for modeling. If users are re-processing NWS data with the latest version of AERMET, users may want to update their data and process the most recent 5 years of data, unless the most recent 5 years are not readily available or they believe the years of data are still adequately representative of the area being modeled. The reviewing authority may want to coordinate with the Regional Office to confirm this. Regardless of the years of data, the data should be processed in the latest version of AERMET.

7.2.1. NWS data

NWS data are available from the National Climatic Data Center (NCDC) in many formats, with the most common one in recent years being the Integrated Surface Hourly data (ISH). Most available formats can be processed by AERMET. As stated in Section 7.1, when using data from an NWS station alone or in conjunction with site-specific data, the data should be spatially and temporally representative of conditions at the modeled sources. Key points regarding the use of NWS data can be found in the March 8, 2013 clarification memo "Use of ASOS meteorological data in AERMOD dispersion modeling" (U.S. EPA, 2013d). The key points are:

- The EPA has previously analyzed the effects of ASOS implementation on dispersion modeling and found that generally AERMOD was less sensitive than ISCST3 to the implementation of ASOS.
- The implementation of the ASOS system over the conventional observation system should not preclude the consideration of NWS stations in dispersion modeling.

- The EPA has implemented an adjustment factor (0.5 knots) in AERMET to adjust for wind speed truncation in ASOS winds
  The EPA has developed the AERMINUTE processor (U.S. EPA, 2011e) to process 2-minute ASOS winds and calculate an hourly average for input into AERMET. The use of hourly averaged winds better reflect actual conditions over the hour as opposed to a single 2-minute observation.

While the March 8, 2013 memo states that ASOS should not preclude the use of NWS data in dispersion modeling, and Section 8.3.1.2 of Appendix W recommends the most recent 5 years of NWS data, Section 8.3.1.2 also recognizes cases where professional judgment indicates that ASOS data are inadequate and pre-ASOS, or observer based data may be considered for use. The appropriate reviewing authority and Regional Modeler should be consulted when questions arise about the representativeness or applicability of NWS data.

7.2.2. Site-specific data

The use of site-specific meteorological data is the best way to achieve spatial representativeness. AERMET can process a variety of formats and variables for site-specific data. The use of site-specific data for regulatory applications is discussed in detail in Section 8.3.3 of Appendix W. Due to the range of data that can be collected onsite and the range of formats of data input to AERMET, the user should consult Appendix W, the AERMET User's Guide (U.S. EPA, 2004c; U. S. EPA, 2013c), and Meteorological Monitoring Guidance for Regulatory Modeling Applications (U.S. EPA, 2000). Also, when processing site-specific data for an urban application, Section 3.3 of the AERMOD Implementation Guide offers recommendations for data processing. In summary, the guide recommends that site-specific turbulence measurements should not be used when applying AERMOD's urban option, in order to avoid double counting the effects of enhanced turbulence due to the urban heat island.

7.2.3. Areas without representative meteorological data

In areas with SO_2 sources where the state has determined that there is no representative meteorological data, it may be difficult to perform accurate refined dispersion modeling for the implementation modeling without first collecting site-specific data for at least a year. Given the implementation timelines, this could prove to be difficult task. In nonattainment or unclassifiable areas composed of isolated sources, it may be possible to use AERSCREEN (U.S. EPA, 2011d) to conservatively determine the attainment status of an area. As noted in Section 5.1, AERSCREEN does not output a design value metric to compare to the SO_2 NAAQS but does output the maximum 1-hr concentration which can be used as a conservative estimate to compare to the NAAQS. Any use of AERSCREEN or screening meteorology in the absence of hourly representative meteorological data should be considered carefully and in consultation with the appropriate Regional Office modeling contact.

Currently, the screening meteorology created by the MAKEMET processor for use with AERSCREEN cannot be used to calculate an SO_2 design value. If screening meteorology is used in AERMOD, the SO_2 design value cannot be calculated. AERMOD will abort processing if screening meteorology is used and an SO_2 design value is requested in the input file.

7.2.4. Upper air data

AERMET requires full upper air soundings to calculate the convective mixing height. For AERMOD applications in the U.S., the early morning sounding, usually the 1200 UTC (Universal Time Coordinate) sounding, is typically used for this purpose. Recent upper air soundings, 1994 and later, are available for free download from NOAA's Earth Systems Research Laboratory's Global Systems Division's radiosonde database (*http://esrl.noaa.gov/raobs/*). Users should choose all levels or mandatory and significant pressure levels[56] when selecting upper air data. Selecting mandatory levels only would not be adequate for input into AERMET as the use of just mandatory levels would not provide an adequate characterization of the potential temperature profile.

8. Background concentrations

The inclusion of ambient background concentrations is important in determining cumulative impacts. The modeled contribution to the cumulative analysis should follow the form of the standard and be calculated as described in section 2.6.1.2 of the August 23, 2010 clarification memo on "Applicability of Appendix W Modeling Guidance for the 1-hr SO_2 National Ambient Air Quality Standard" (U. S. EPA, 2010a). This memo suggested a "first tier" approach to including a uniform monitored background contribution based on adding the overall highest hourly background SO_2 concentration from a representative monitor to the modeled design value. We recognize that this approach could be conservative in many cases and may also be prone to reflecting source-oriented impacts, increasing the potential for double-counting of modeled and monitored contributions. As discussed in U. S. EPA, (2011a), and the SO_2 NAAQS Designations Modeling TAD (U.S. EPA, 2013a) we recommend a less conservative "first tier" approach for a uniform monitored background concentration based on the monitored design values for the latest 3-year period, regardless of the years of meteorological data used in the modeling. Adjustments to this approach may be considered in consultation with the appropriate EPA Regional Modeling Contact with adequate justification and documentation of how the background concentration was calculated.

Section 8.2.2 of Appendix W gives guidance on background concentrations for isolated single sources and is also applicable for multi-source areas. One option is, as described in section 8.2.2.b:

> "Use air quality data in the vicinity of the source to determine the background concentration for the averaging times of concern. Determine the mean background concentration at each monitor by excluding concentrations when the source in question is impacting the monitor… For shorter time periods, the meteorological conditions accompanying concentrations of concern should be identified. Concentrations for meteorological conditions of concern, at monitors, not impacted by the source in question, should be averaged for separate averaging time to determine the average

[56] By international convention, mandatory levels are in millibars: 1,000, 850, 700, 500, 400, 300, 200, 150, 100, 50, 30, 20, 10,7 5, 3, 2 and 1.Significant levels may vary depending on the meteorological conditions at the upper-air station

background value. Monitoring sites inside a 90° degree sector downwind of the source may be used to determine the area of impact."

When no monitors or no representative monitors are located in the vicinity of the sources being modeled a "regional site" (i.e., one that is located away from the area of interest but is impacted by similar natural and distant man-made sources) may be used to determine background (Section 8.2.2.c, Appendix W). In cases of nonattainment areas designated by a monitor, it may be necessary to use a different representative monitor outside of the nonattainment area. This would especially be true where the violating monitor has a high number of observations impacted by modeled sources. In multi-source areas, background includes two components, nearby sources and other sources (Section 8.2.3 of Appendix W). Nearby sources are those sources that are expected to cause a significant concentration gradient in the vicinity of the source or sources under consideration, and should be explicitly modeled. Identification of nearby sources calls for professional judgment and consultation with the appropriate EPA Regional Modeling Contact. For other sources, such as natural sources, minor sources and distant major sources, the methodology of Section 8.2.2 should be used.

The EPA's SO_2 National Ambient Air Quality Standards Designations Modeling TAD (U.S. EPA, 2013a) describes an appropriate methodology of calculating temporally varying background monitored concentrations by hour of day and season (excluding periods when the source in question is expected to impact the monitored concentration). The methodology for SO_2 is to use the 99^{th} percentile concentration for each hour of the day by season and average across 3 years, excluding periods when the dominant source(s) are influencing the monitored concentration (i.e., 99^{th} percentile, or 4^{th} highest, concentrations for hour 1 for January or winter, 99^{th} percentile concentrations for hour 2 for January or winter, etc.). Recent updates included in AERMOD allow for the inclusion of temporally varying background concentrations in the design value calculation in combination with modeling results. *See* the AERMOD User's Guide Addendum for more details (U. S. EPA, 2013b).

As an illustrative example, Figure 4 shows the 2010 SO_2 NAAQS level, the design value (the 3-year average of the 99^{th} percentile of the annual distribution of daily maximum 1-hr concentrations), and 3-year averages of the 99^{th} percentile concentrations by season and hour of day. To calculate the 99^{th} percentile concentration for a season and hour of day combination (no consideration for day of week), the second highest concentration for that combination should be selected. Also shown are 3-year averages of the 99^{th} percentile concentration by hour of day (across all seasons), and the average concentration by hour of day across the 3 years[57]. In this example, the winter background concentrations show a distinct diurnal variability, with less for each of the other seasons.

[57]Modelers should use the 1^{st}-highest value for more detailed pairings, such as month by hour-of-day or season by hour-of-day *and* day-of-week (consider day of week in calculating values).

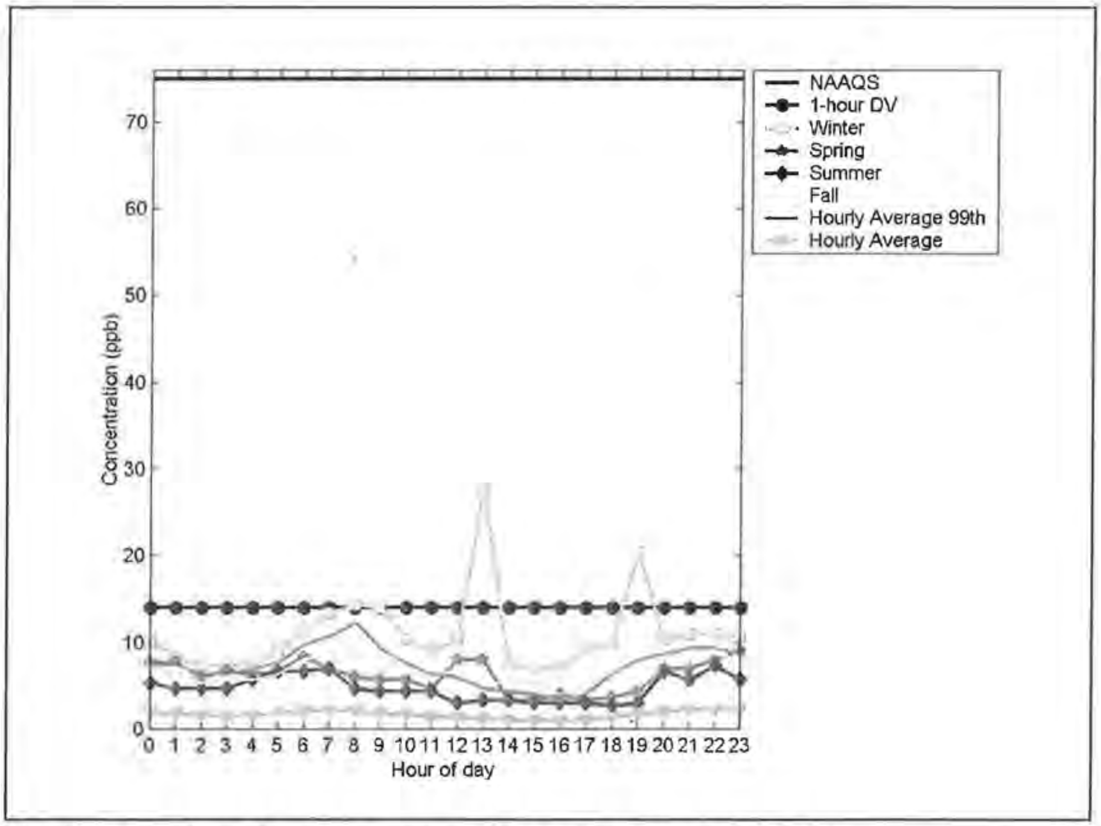

Figure 3. SO_2 monitored concentrations for various averaging times.

In summary background concentrations can be included as:

- "First tier" approach based on monitored design values added to modeled design values; or
- Temporally varying based on the 99th percentile monitored concentrations by hour of day and season added to modeled design values.

9. Determining design value metrics

Refined dispersion modeling for SIPs will provide predictions of SO_2 design values at each receptor that includes contributions from all modeled sources and background. Based on the form of the 2010 SO_2 NAAQS, the design value should be calculated as the average of the 99th percentile of the annual distribution of daily maximum 1-hr concentrations averaged across the modeled years.

9.1. Design value calculation methodology

Whether design values are calculated within AERMOD or outside of AERMOD, to calculate a design value to compare against the standard, the following steps should be followed:

1. At each receptor, for each hour of the modeled period, calculate a total concentration across all sources including background concentrations if applicable. This can be done in AERMOD using SRCGROUP ALL or by adding individual source groups outside of AERMOD, using hourly POSTFILEs. If the user is totaling the concentrations outside of AERMOD, the source groups used in the calculations need to be mutually exclusive, i.e. no one source should be in multiple source groups.
2. From the total concentrations calculated in step 1, obtain the 1-hr maximum concentration at each receptor for each modeled day.
3. From the output of step 2, for each year modeled, calculate the 99th percentile (4th highest) daily maximum 1-hour concentration at each receptor. If modeling 5 years of meteorological data, this results in five 99th percentile concentrations at each receptor.
4. Average the 99th percentile (or 4th highest) concentrations across the modeled years to obtain a design value at each receptor.
5. Modeled source contributions to a NAAQS violation can be determined by analyzing the hourly concentrations from the individual source groups POSTFILES corresponding to the same hour as the 4th daily maximum 1-hour concentration from each year. See 75 FR at 35540. For example, a receptor has a 5-year average design value of 200.8 mg/m^3 (or approximately 77 ppb) and AERMOD was modeled for the period January 1, 2005 through December 31, 2009 for four source groups. From the AERMOD output, the user can determine the date of the 4th highest daily maximum 1-hour concentrations that are used to calculate the 5-year average design value. Table 1 shows the 4th highest daily maximum 1-hour concentrations for each year and associated dates that are used in the design value calculation.

Table 1. 4th highest daily maximum 1-hour concentrations (μg/m^3) for 2005-2009.

Date (YYMMDDHH)	Concentration
05080101	200.1
06073105	201.5
07080403	207.1
08072705	197.1
09080104	198.1
5-YEAR AVG.	200.8

If output by source group is available, the user can extract each source group's concentration at each of the hours listed in Table 1. Table 2 shows example source contributions for each hour shown in Table 1 and indicates that Source 1 is the main contributor to the design value for all hours.

Table 2. Source contributions to 4th highest daily maximum 1-hour concentrations (μg/m^3) and 5-year average design values.

Date (YYMMDDHH)	TOTAL	SOURCE 1	SOURCE 2	SOURCE 3	SOURCE 4
05080101	200.1	155.1	25.1	1.5	18.4
06073105	201.5	157.4	26.2	0.5	17.4
07080403	207.1	161.5	20.5	2.1	23.0

08072705	197.1	159.2	23.1	1.7	13.1
09080104	198.1	155.3	22.6	2.0	18.2
5-YEAR AVG.	200.8	157.7	23.5	1.6	18.0

When calculating design values and in determining whether there are violations of the NAAQS, one may need to consider other percentiles below the 99th percentile (4th high of the daily 1-hour maximum concentration) as well. Examining percentiles below the 99th percentile (such as 5th, 6th of the daily maximum 1-hr concentrations) would be useful in the context of determining sources that may be significant contributors to a NAAQS violation, i.e. a source's contribution may be above the SIL. There may be cases in which a source is not a significant contributor to the design value as defined in the NAAQS, but may be a significant contributor at a lower percentile that is still above the NAAQS level. Sources that fit this category should not be immediately discounted when determining sources to control for attaining the NAAQS. To calculate design values based on other percentiles, one can just step down through the 5th, 6th, 7th, etc. highest of the annual distributions of daily maximum 1-hour concentrations in steps 3 through 5 in the five steps listed above until no concentrations exceed the NAAQS level. The individual sources' contributions can then be determined to be significant or not.

9.2. Running AERMOD and implications for design value calculations

Recent enhancements to AERMOD include options to aid in the calculation of design values for comparison with the SO_2 NAAQS. These enhancements include:

- The output of daily maximum 1-hr concentrations by receptor for each day in the modeled period for a specified source group. This is the MAXDAILY output option in AERMOD.
- The output, for each rank specified on the RECTABLE output keyword, of daily maximum 1-hour concentrations by receptor for each year for a specified source group. This is the MXDYBYYR output option.
- The MAXDCONT option, which shows the contribution of each source group to the high ranked values for a specified target source group, paired in time and space. The user can specify a range of ranks to analyze, or specify an upper bound rank, i.e. 4th highest, and a lower threshold value, such as the NAAQS for the target source group. The model will process each rank within the range specified, but will stop after the first rank (in descending order of concentration) that is below the threshold, specified by the user. A warning message will be generated if the threshold is not reached within the range of ranks analyzed (based on the range of ranks specified on the RECTABLE keyword). This option may be needed to aid in determining which sources should be considered for controls.

For more details about the enhancements see the AERMOD User's guide Addendum (U. S. EPA, 2013b).

Ideally, all explicitly modeled sources, receptors and background should be modeled in one AERMOD run for all modeled years. In this case, the use of one of the above output options can be used in AERMOD to calculate design values for comparison to the NAAQS and determine the area's attainment status and/or inform attainment/nonattainment boundaries. The use of these options in AERMOD allows AERMOD to internally calculate concentration metrics that can be used to calculate design values and therefore lessen the need for large output files, i.e. hourly POSTFILES.

However, there may be situations where a single AERMOD run with all explicitly modeled sources is not possible. These situations often arise due to runtime or storage space considerations during the AERMOD modeling. Sometimes separate AERMOD runs are done for each facility or group of facilities, or by year, or the receptor network is divided into separate sub-networks. In some types of these situations, the MAXDAILY, MXDYBYYR, or MAXDCONT output option may not be an option for design value calculations, especially if all sources are not included in a single run. If the user wishes to utilize one of the three output options, then care should be taken in developing the model inputs to ensure accurate design value calculations.

Situations that would effectively preclude the use of the MAXDAILY, MXDYBYYR, and MAXDCONT option to calculate meaningful AERMOD design value calculations include the following examples:

- Separate AERMOD runs for each source or groups of sources.
    - SIP modeling includes five facilities for 5 years of NWS data and each facility is modeled for 5 years in a separate AERMOD run, resulting in five separate AERMOD runs.
- Separate AERMOD runs for each source and each modeled year.
    - Five facilities are modeled for 5 years of NWS data. Each facility is modeled separately for each year, resulting in 25 individual AERMOD runs.

In the two situations listed above, the MAXDAILY, MXDYBYYR, or, MAXDCONT option would not be useful as the different AERMOD runs do not include a total concentration with contributions from all facilities. In these situations the use of hourly POSTFILES, which can be quite large, and external post-processing would be needed to calculate design values.

Situations in which the MAXDAILY, MXDYBYYR, or, MAXDCONT options may be used but may necessitate some external post-processing afterwards to calculate a design value include:

- The receptor network is divided into sections and an AERMOD run, with all sources and years, is made for each sub-network.
    - A receptor network of 1,000 receptors is divided into five receptor sub-networks. Each receptor network is modeled with all modeled facilities with 5 years of NWS data resulting in five AERMOD runs. After the AERMOD runs are complete, the MAXDAILY, MXDYBYYR, or, MAXDCONT results for each network can be re-combined into the larger network.
- All sources and receptors are modeled in an AERMOD run for each year.

- Five facilities are modeled with 5 years of NWS data. All facilities are modeled with all receptors for each year individually, resulting in five AERMOD runs. MAXDAILY, MXDYBYYR, or, MAXDCONT output can be used and post-processed to generate the necessary design value concentrations.

- The receptor network is divided and each year is modeled separately for each sub-network with all sources.

    - Five facilities are modeled with 5 years of NWS data. The receptor network is divided into five receptor networks. Each sub-network is modeled for each year separately, resulting in twenty-five AERMOD runs MAXDAILY, MXDYBYYR, or, MAXDCONT output can be used and post-processed to generate the necessary design value concentrations.

10. Documentation

It is expected that the state would submit a modeling and analysis protocol that details the methodology and model inputs before commencement of the modeling exercise. This information should support the states' implementation plans and provide a basis for the EPA's review and evaluation. The protocol should include the following:

- Characterization of the nonattainment problem or characterization of the modeled area in absence of a violating monitor,
- An emissions analysis around the violating monitor or area under consideration for the attainment and maintenance demonstration in absence of a violating monitor,
- Description of any other supplemental analyses (in addition to the characterization and emissions analyses noted above) intended to strengthen the attainment demonstration, and
- Methodology for preparing air quality and meteorology inputs including choice of meteorological data and representativeness of the data.

Additionally, post-modeling documentation should include:

- Summary and analysis of modeling results,
- Provision of modeling data inputs and outputs in electronic form, and
- Results of any supplemental analyses.

A meeting with the appropriate the EPA Regional Modeling Contact and other technical and planning staff to discuss the modeling and analysis protocol is recommended before submitting the protocol and beginning any refined modeling. For example modeling protocols, please see the SCRAM website on SO_2 Implementation at: *http://www. epa.gov/ttn/scram/SO2_modeling_guidance.htm*.

11. Supplemental Analysis

States may wish to conduct further analyses that examine available monitoring data and other information (e.g., emissions and meteorological data) as well as modeling results. In selected cases, such analyses may provide further insight on the control measures necessary to provide for attainment. States considering such analyses should consult with their EPA regional office during the planning and implementation of such analyses.

12. Summary

In summary, we emphasize the following key points of this modeling guidance:

- AERMOD is the EPA's preferred near-field dispersion model for regulatory applications and is applicable for SO_2 SIPs modeling consistent with the EPA's *Guideline on Air Quality Models*, also published as Appendix W of 40 CFR part 51.
- Sources should be modeled with maximum allowable 1-hour or short-term emission rates in the SIP modeling based on continuous operations at the source.
- Professional judgment, sound technical reasoning and consultation with the appropriate EPA Regional Modeling Contact should be used to determine which sources to model and which sources to represent via background concentrations.
- Modeling should be done with 5 years of representative NWS meteorological data or at least 1 year of site specific meteorology.
- Background concentrations can be included as:
    - "First tier" approach based on monitored design values added to modeled design values; or
    - Temporally varying based on the 99^{th} percentile monitored concentrations by hour of day and season added to modeled design values.
- States should submit a modeling and analysis protocol that details the methodology and model inputs before commencement of the modeling exercise. This information should support the states' recommended SIPs, and provide a basis for the EPA's evaluation of them.
- At any time during the SIP process when there are questions regarding modeling or interpretation of this guidance, the appropriate EPA Regional Modeling Contact should be consulted.

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Appendix B

Assessment of Air Quality Results of Setting Longer Term Average Emission Limits

As explained in section V.D.2, previous EPA guidance recommended the setting of limits with an averaging time that match the underlying NAAQS (e.g. to set 1-hour average emission limits to ensure attainment with a 1-hour NAAQS). The limits would need to be set no higher than the "critical emission value," i.e., the hourly emission rate that the model predicts would result in the 5-year average of the annual 99th percentile of daily maximum hourly SO_2 concentrations at the level of the NAAQS. The EPA is now issuing guidance that provides that longer term average limits may be justifiable, so long as the limits are of at least comparable stringency to a 1-hour limit at the critical emission value. The EPA acknowledges that even with an adjustment to provide this comparable stringency, a source complying with a longer term average emission limit could possibly have hourly emissions which occasionally exceed the critical emission value. An hour where emissions are above the critical value does not mean that a NAAQS exceedance is occurring in that hour. Indeed, the guidance states that "if periods of hourly emissions above the critical emission value are a rare occurrence at a source, these periods would be unlikely to have a significant impact on air quality, insofar as they would be very unlikely to occur repeatedly at the times when the meteorology is conducive for high ambient concentrations of SO_2." This appendix is intended to elaborate on the EPA's rationale and to document analyses testing this statement.

Exceedances of the SO_2 NAAQS occur when emissions from relevant sources are sufficiently high on occasions when the meteorology is conducive for those emissions to cause elevated SO_2 concentrations. An illustrative example would be a case in which a single source has a dominant impact on area concentrations, and the source only causes an exceedance at a particular location with light southwest winds with limited dispersion. In this example, the likelihood of an exceedance at that location will be a function of the likelihood of elevated emissions occurring during times of light southwest winds with limited dispersion. Stated more generally, the likelihood of an exceedance is a function of the likelihood of emissions being high when the meteorology is conducive for the source to cause an exceedance. By extension, the likelihood of a violation is a function of the likelihood of emissions being high on a sufficient number of times with meteorology conducive to having exceedances to have the average of the 99th percentile daily maximum values exceed the NAAQS. Viewed another way, the occasions when the meteorology is conducive for the source to cause an exceedance at a particular location are likely to be infrequent, and high concentrations are contingent on both emissions being sufficiently high and the meteorology being sufficiently conducive. The NAAQS itself is based on relatively rare occurrences, being based on the 99th percentile of daily maximum concentrations. Nevertheless, the point here is that the occurrence of high emissions will not cause an exceedance if it does not occur when meteorology is conducive to having an exceedance. Furthermore, a source with rare occurrences of high emissions and with much more frequent occurrences of moderate emissions is more likely to have moderate emissions on those occasions with meteorology conducive for exceedances, and the design value for the source may be more prone to reflect the moderate emissions than the high emissions.

Thus, at issue is the likelihood that a source complying with a 30-day average limit reflecting the adjustment generally recommended in this guidance would have sufficiently high emissions on a sufficient fraction of the potential exceedance days to cause an SO_2 NAAQS violation. This appendix documents analyses addressing this question. Although results will differ according to individual circumstances, the EPA views its analyses as indicating that suitably adjusted longer term average limits can generally be expected to provide adequate confidence that the attainment plan will provide for attainment.

The EPA performed its analyses for Canadys Station, located near Walterboro, South Carolina.[58] The modeling used AERMOD Version 13350 and used meteorological data for 2005 to 2009 from the Charleston, SC National Weather Service station. For simplicity of the analysis, a zero background concentration was applied.[59] Although the facility had three stacks, the EPA applied the simplifying assumption that emissions were always distributed in the same proportion among the stacks, so that the EPA's analysis assumed simple proportionality between emissions and air quality (such as can be assumed for areas with a single stack). In addition, while installation of emission control equipment commonly changes stack temperatures and potentially other stack parameters, EPA did not have information on these changes, and so all of the simulations in EPA's analysis used the same stack parameters (reflecting no control equipment).[60] These analyses focused on the ten receptors that had the highest modeled design values.

As a first step, the EPA modeled this source in a traditional manner, using a constant emission rate. Based on this modeling, the EPA identified a critical emission rate of 1831 pounds of SO_2 per hour. That is, this modeling indicated that an appropriate 1-hour emission limit for this source would be 1831 pounds of SO_2 per hour.

The EPA's next series of steps were to assess 30-day average emission limits that could be considered comparably stringent to a 1-hour emission limit of 1831 pounds per hour. The EPA expects such an assessment to be based on a set of emissions data that can be expected to reflect the variability of emissions once the subject source implements its attainment plan. For this analysis, the EPA assumed that the SIP would require installation of flue gas desulfurization. For purposes of our sample calculations, since Canadys did not operate such emission controls, the historic emission data for Canadys were judged not to provide an appropriate indicator of prospective emission variability. For these sample calculations, the EPA instead used emissions data from Unit 4 of the Weston Generating Station, located near Wausau, Wisconsin. This unit is controlled with flue gas desulfurization equipment in order to meet a best available control

[58] This plant has now shut down. Nevertheless, the EPA believes that these analyses provide a useful sample of the results that would be expected from plants that are continuing to operate.

[59] Use of a non-zero background would require a tighter limit, which would presumably require a downward scaling of the emissions data used in these analyses. The EPA expects that modeling this alternate scenario would produce essentially the same final results.

[60] As with consideration of background concentrations, consideration of stack parameters such as lower stack temperatures that may result from operation of SO_2 emission control equipment may yield a lower critical emission value and require a tighter limit. However, this analysis reflects emissions scaled to comply with the applicable limit, and if EPA had analyzed a corresponding case with alternate stack parameters reflecting control equipment resulting in a lower limit, the analysis would also have used emissions downscaled by the same proportion. EPA expects that the net effect of these changes would be a showing of similar confidence of attainment as is shown here, regardless of the critical value and associated longer term average limit that was used as the starting point.

technology limit, and thus was judged to provide a suitable sample data base for use in this analysis. The calculations of a 30-day average limit judged to be comparably stringent as a 1-hour limit of 1831 pounds per hour are shown step-by-step in Appendix C. The resulting 30-day average emission limit is 1254 pounds per hour.

Next, the EPA used the hourly modeling results for Canadys along with the simplifying assumptions described above to assess the air quality that would be expected with varying emission rates in compliance with this 30-day average emission limit. The hourly emissions data were derived from the actual emissions data for Weston Unit 4 but scaling the emission values so that the data set only just meets the 30-day average emission limit of 1254 pounds per hour. The estimated design value for this scenario was 46 ppb.

The EPA then created 100 additional emission data sets by randomly assigning hourly emissions values from this scaled Weston 4 data set. As with the original data set, for each of these randomly created emission data sets, each hour's emissions rate was multiplied by the concentration per unit emissions estimated by AERMOD, and the resulting set of estimated concentrations was analyzed to determine the average 99th percentile of daily maximum concentrations. Since the likelihood of a violation is a function of the likelihood of high emissions occurring during times when the meteorology is conducive for exceedances, these simulations provide further insight into the likelihood of violations based on random reassignments of the emissions occurring during each hour. These 100 simulations yielded design values ranging from 50 to 58 ppb.[61] In each of these simulations, a substantial number of hours (on average, just under one percent) had emissions higher than the critical emission value. Nevertheless, given the margin between these values and the NAAQS level of 75 ppb, this analysis indicates that the likelihood of a violation occurring with these emissions values is extremely low.

The EPA modeled a number of additional scenarios to test the impact of emissions variability. First, the EPA modeled a scenario based on emissions variability for a unit without emission control equipment. This scenario may be representative of cases in which the attainment plan achieves attainment through the use of low sulfur coal. Since Canadys has shut down, the EPA for convenience used the emissions data from Weston Unit 3 for this analysis. As with the flue gas desulfurization scenario, the EPA modeled this scenario both with emissions varying according to the time pattern in the underlying data set and with 100 cases of randomly reassigned emissions. For this scenario, the simulation using the time pattern of the underlying emission data yielded a design value of 52 ppb, and the runs with randomly reassigned emissions yielded design values ranging from 51 to 57 ppb.

Second, the EPA conducted a series of additional runs using subsets of the Weston Unit 4 and the Weston Unit 3 emission data sets. Each year within these data sets reflected somewhat different emissions variability, and so the EPA conducted additional runs using emission data

[61] In these results, the randomly assigned emission scenarios have higher design values than original emissions scenario. This suggests that patterns in the original emissions data and in the meteorological data in this particular analysis are associating to cause lower design values, and that the higher design values in the randomized emission scenarios results from the disruption of those associations. However, investigation of these questions was beyond the scope of this analysis.

sets reflecting the variability found in 2009, 2010, 2011, 2012, and 2013, respectively, for both Weston units, as if that same pattern of emissions had occurred repeatedly for the 5 year simulation. For both the Weston Unit 3 and the Weston Unit 4 simulations, while the use of different years' emissions variability clearly affected the resulting design value, with design values ranging from 39 to 52 ppb for the flue gas desulfurization case and from 45 to 59 ppb for the low sulfur fuel case, the design values remained well below the NAAQS for all simulations.

As noted above, the likelihood that a long term average emission limit will provide for attainment depends in significant part on the probability of elevated emissions occurring when the meteorology is conducive for high concentrations. Assessment of whether a long term average limit sufficiently provides for attainment thus requires consideration of the emission patterns that would reasonably be expected to occur at a source operating in compliance with the limit. For example, in theory, less confidence of attainment would apply if the source has frequent occasions of elevated emissions (complying with the limit by also frequently having low emissions). In such cases, it is especially important to supplement the long term limit with additional limits recommended in this guidance that restrict the frequency and/or magnitude of the occurrences of elevated emissions. On the other hand, this pattern of operation is generally not followed in practice, and such a pattern would presumably result in adjustment to a lower long term average limit. Indeed, the adjustment of the longer term limit to a level lower than the critical emissions value provides essential means of constraining the allowable frequency and magnitude of occurrences of elevated emissions to have adequate confidence that the limit will provide for attainment. Considering the analyses described here, and considering historic emission patterns (according to emission data that EGUs have reported to the EPA) and the emission patterns that could be expected even when a source is just barely complying with a long term average emission limit, the EPA generally expects that a suitably set long-term average emission limit, especially in conjunction with supplemental limits more directly limiting occasions of elevated emissions, would be expected to require that elevated emissions be a sufficiently infrequent occurrence so as to provide adequate protection against NAAQS violations.

Appendix C
Example Determination of Longer Term Average Emission Limit

This appendix provides sample calculations to illustrate EPA's suggested approach for determining an appropriately adjusted 30-day average emissions limit, calculated on a rolling average basis. Similar techniques could be applied in determining adjustments for other averaging times and for other types of limits such as limits on emissions per unit heat input. For simplicity, this example addresses a plant with a single emission unit, which may be part of a plan in which other plants or other units are subject to other limits that may be evaluated similarly.

Various steps in the determination of appropriate limits may be dependent on the control strategy that is used to achieve the necessary emission control. In Step 1 of these example calculations, different control strategies can result in different stack parameters, and the modeling analysis that determines emission limits should use stack parameters that are appropriate to the expected control strategy. In Step 2, the selected emissions data base should reflect use of the expected control strategy. The EPA anticipates that the control strategy will be identified based on the modeling in Step 1, and the EPA expects that calculation of a comparably stringent longer term average limit in the subsequent steps will not lead to any changes in choice of control strategy.

Step 1. Step 1 of these calculations is to conduct dispersion modeling to determine a source's critical emission value, a term that refers to the hourly emission rate that the model predicts would result in the 5-year average of the annual 99^{th} percentile of daily maximum hourly SO_2 concentrations at the level of the NAAQS. While this rate could be established as a 1-hour emission limit without further averaging, here the rate also serves as a baseline for determining a longer term average limit (in this example, a 30-day average limit) consistent with this guidance.

The subsequent steps in the calculations are to determine the percentage by which the critical emission value should be adjusted downward to determine the value of a 30-day average limit that would be comparably stringent. No further dispersion modeling would need to be conducted. With these example calculations, the attainment demonstration modeling would use the critical emission value, while the limit in the SIP would be the adjusted 30-day average limit. The SIP submittal would provide the justification that the adjusted longer term average limit in the SIP provides comparable stringency as would be obtained with a 1-hour average limit at the modeled critical emission value, along with any additional information, particularly regarding prospective emissions variability, that addresses the adequacy of the longer term limit for providing for attainment of the NAAQS.

Step 2. Step 2 is to compile emissions data reflecting the distribution of emissions that is expected once the attainment plan is implemented. Emission distributions describe the frequency with which different emission levels occur, which may be depicted by graphing the number of hours per year (for example) that emissions are within a particular range, as a function of emission level.

A key element of this step is selection of an appropriate emissions data set. This step is especially important if the attainment plan is expected to involve installation of control equipment or other similarly significant changes in operations. The choice of control strategy can have a significant effect on the emission distribution. For example, installation and operation of flue gas desulfurization equipment, particularly in absence of requirements for continuous operation of the equipment, can lead to an emission distribution in which most emission values are significantly lower but occasional values remain relatively high, thus enlarging the difference between peak emission values and longer term average emission values. Consequently, if the source being addressed does not currently operate flue gas desulfurization equipment but the attainment plan is likely to involve installation and operation of such equipment, then the current emissions profile data for the source may not provide a suitable representation of the variability of emissions that might be expected after the attainment plan controls are in place.

In such cases, Step 2 would involve identifying another set of data that better reflects the source's expected emission variability, presumably from another comparable source that is already implementing the control strategy that the target source anticipates using. In selecting a data set to represent the source's expected emission variability, it is important to compare the characteristics of the source that obtained the candidate data set to the characteristics of the source under consideration in the control strategy, focusing on characteristics that would influence the emission patterns. The two sources should generally be in the same industry and be used in a similar manner; for example, an EGU generating electricity on a base load basis would tend to have a different emission pattern than an EGU generating electricity on a peak load basis. The data are used in a relative sense, so the magnitude of the emissions need not be the same (although two sources of the same type with similar emission levels may be more prone to have similar relative emission patterns).

In other cases, the air agency may determine that an area could attain through a control strategy that will not significantly change the emission distribution (as may be true, for example, for a strategy involving a switch to lower sulfur coal with similar sulfur content variability or for a strategy involving enhancement of existing control equipment). Where the control strategy does not significantly change the distribution, the source's current emission distribution may be the best indicator of the source's post-control emission distribution. Irrespective of whether the future emissions variability does or does not match the historic emissions variability at a source, a critical element of Step 2 is to assure that the data used to analyze prospective emissions variability at the source properly reflects the emissions variability that might be expected at the source once the SIP is implemented.

These emission data obtained in Step 2 will presumably be obtained from CEMS, since otherwise the quantity of data needed to determine an appropriate adjustment would likely be unavailable. The raw data should be compiled in the form of hourly emissions. For this example, these data are also used to compute rolling 30-day average emissions levels.

Step 3. Step 3 is to use the distribution of hourly emissions data obtained in Step 2 to compute a corresponding distribution of longer term emission averages. (In this example we compute 30-day emission averages.) Several approaches are possible for computing these averages. The EPA generally recommends using the data handling procedures of MATS, including calculation of a new 30-operating day average at the end of each operating day (defined as a day with any operation). Inherent in this recommended approach is that hours without operation are not included in the average. The approach used in the analysis should be the approach that is to be established for determining compliance with the limit..

Step 4. Step 4 uses the distributions of the hourly values compiled in Step 2 and the 30-day average values computed in Step 3. Specifically, Step 4 determines the 99th percentile of the 1-hour average emission values compiled in Step 2 and the 99th percentile of the 30-day average emission values computed in Step 3.

This example uses information from the upper end of the range of emissions, in order to best assess the relationship of 1-hour and 30-day average data when a source is exactly complying (i.e., with no compliance margin) with potential limits for those averaging times. Just as the NAAQS applies a 99th percentile statistic, to use a more robust statistic in evaluating air quality than the peak value, this example uses 99th percentile statistics to represent the relationship between 1-hour and 30-day average values for the highest emission values. By this means, this analysis focuses on the portion of the emissions distribution where compliance is most at issue, while using sufficient data to obtain an adequately robust result.

Step 5. Step 5 is to compute the ratio of the two 99th percentile values. These values are taken from the same point in the respective distributions, and maybe presumed to reflect a comparable control regime. The 99th percentile of the hourly emission values would not be expected to match the critical emission value; this statistic is only used in a relative way, to compare to the 99th percentile of the 30-day averages, as a means to estimate how much lower a 30-day average limit would need to be to have comparable stringency to a 1-hour limit at the critical emission value.

Step 6. Step 6, the final step, is to multiply this ratio times the critical emission value, i.e., the 1-hour emission limit that modeling found to provide for attainment. The result of this multiplication is a 30-day average emission limit which may generally be considered to have comparable stringency as a 1-hour limit at the modeled attainment level.

The following are example results of these steps, for purposes of illustration. This example uses the data for the scenario presented in Appendix B, to compute a suitable 30-day average limit for a hypothetically restarted Canadys plant.

In Step 1, a modeling analysis determined that a limit of 1831 pounds per hour is necessary and sufficient to provide for attainment near Canadys.

In Step 2, the historic Canadys emissions data, which reflected no emission control equipment, were determined not to provide an appropriate representation of future emissions variability, insofar as the SIP was expected, in this illustrative example, to require installation of flue gas desulfurization equipment (based on the judgment that this would be necessary to meet the 1831 lbs per hour limit). The flue gas desulfurization equipment would be expected to alter emissions variability significantly. Therefore, Step 2 involved obtaining emission data from a different source, in particular a source using flue gas desulfurization. In this example, emission

Appendix D

Review of Relationships Among SO_2 Emissions Data With Various Averaging Times

Using data available in the EPA's Clean Air Markets Division Air Markets Program Data (ampd.epa.gov) of electric generating unit SO_2 emissions data, the EPA conducted a review of the relationships among averages of SO_2 emissions calculated with various averaging times. This review was intended to determine typical relationships among emission limits reflecting different averaging times that might be considered to be comparably stringent.

For reasons discussed in the associated guidance document, the statistical relationships within the highest subset of emissions data are most germane in determining limits with different averaging times that could be considered comparably stringent, in part because these data best indicate emission patterns during times when compliance will be most challenging. To assure the use of reasonably robust data, Appendix C presents sample calculations that use the top one percent of the emissions data. In particular, these sample calculations determine the ratio of the 99^{th} percentile of 30-day average emission values to the 99^{th} percentile of 1-hour emission values, as a means to estimate the ratio of 30-day to 1-hour emission limits that could be considered comparably stringent. The purpose of the review described in this appendix is to assess typical values of this ratio.

This review used data for all sources meeting the following criteria: (1) the source operated and reported data for some part of every year from 2009 to 2013, (2) the source operated and reported data for the equivalent of 3 years out of these 5 years (1,095 days), (3) the source burned coal as the primary fuel for all 5 years, and (4) the SO_2 emission control equipment operated at the source was the same across all 5 years. This review analyzed data for the 615 sources that met these criteria.

The EPA subdivided the sources into three categories, based on control type, in order to highlight differences in emission patterns as a function of control type that are evident in the data. These three categories are: (1) sources controlled with a wet scrubber (210 sources), (2) sources controlled with a dry scrubber (90 sources), and (3) sources with no advanced SO_2 control equipment installed (315 sources).

The EPA computed a variety of statistics according to the methods in Appendix C. Tables 1 and 2 summarize the results of most interest, reporting ratios of 99^{th} percentile SO_2 emission values and standard deviations of the ratios, respectively, for 30-day average SO_2 emission values (computed on a rolling daily basis) versus 1-hour values, and 24-hour average SO_2 emission values (computed on a calendar day basis) versus 1-hour values, for each of the above three source types.

data for Unit 4 of the Weston plant were determined to provide a suitable representation of the SIP source once flue gas desulfurization is implemented.

In Step 3, 30-operating day averages of these emissions were calculated.

In Step 4, the 99th percentiles of the 1-hour values and of the 30-day average values were determined to be 493 pounds per hour and 338 pounds per hour, respectively.

In Step 5, the ratio of these values (i.e., 338 divided by 493 pounds per hour) was calculated to be 0.685, or 68.5 percent.

In Step 6, this ratio was multiplied by the critical emission value (68.5 percent times 1831 pounds per hour) to obtain a result of 1254 pounds per hour. Thus, in this example, a 30-day average limit of 1254 pounds per hour is estimated to be a 30-day average limit with comparable stringency to a 1-hour limit of 1831 pounds per hour. That is, in this example, while a 30-day average limit of 1254 pounds per hour provides more flexibility to accommodate emissions variability, coupled with a requirement that emissions generally be lower than they are required to be with a 1-hour limit of 1831, approximately the same control strategy is expected to be required by either limit.

Table 1. Average ratio of 99th percentile 30-day average SO_2 emission value and of 99th percentile 24-hour average SO_2 emission value to the 99th percentile of hourly SO_2 emission value

Source Type	30-day vs. 1-hour	24-hour vs. 1-hour
Sources with wet scrubbers	0.71	0.89
Sources with dry scrubbers	0.63	0.81
Sources with no control equipment	0.79	0.93

Table 2. Standard deviations of the ratios of 99th percentile 30-day average SO_2 emission value and of 99th percentile 24-hour average SO_2 emission value to the 99th percentile of hourly SO_2 emission value

Source Type	30-day vs. 1-hour	24-hour vs. 1-hour
Sources with wet scrubbers	0.23	0.14
Sources with dry scrubbers	0.19	0.19
Sources with no control equipment	0.07	0.04

These results indicate the significant effect of control type on emission distributions. Review of the underlying data suggests that an important part of the variability of emissions for sources with emission control equipment is the variability in control equipment operation. These results also provide insight into the range of adjustment factors that may be considered typical.