



Guidance for 1-Hour SO₂ Nonattainment Area SIP Submissions

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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 (health based) 2010 National Ambient Air Quality Standard (NAAQS) for sulfur dioxide (SO₂) (75 FR 35520, June 22, 2010) and codified at 40 CFR 50.17. In the preamble for the final 2010 SO₂ NAAQS rule, the U.S. Environmental Protection Agency (EPA) provided general guidance concerning the Clean Air Act (CAA) provisions that states, tribes and SO₂ emissions sources needed to address when implementing the NAAQS. Additionally, the EPA stated in the preamble for that rule that we intended to develop and seek public comment on additional guidance for the use of modeling and the development of state recommendations for area designations, as well as for the development of nonattainment area SIPs (NAA SIP) for the 2010 SO₂ NAAQS to be submitted under sections 107, 110 and 191-192 of the CAA.

To this end, the EPA issued designations guidance in March 2011, and draft guidance on the development of SO₂ NAA SIP implementation in September 2011 for states and other interested parties to comment on our preliminary recommendations. Based on the comments received on the September 2011 draft guidance, the EPA is providing additional guidance through this document to assist states and tribes in preparing SO₂ NAA SIP submittals. The EPA is also developing a rulemaking on implementation of the SO₂ NAAQS for areas which may need more information on how to characterize the air quality of areas to indicate whether the areas are attaining the 2010 SO₂ NAAQS.

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

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others to consider as they develop information that will be used in future separate final actions, which may involve SIPs or TIPS. 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 agencies¹ need to address when implementing the 2010 SO₂ NAAQS in areas designated as nonattainment for that 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 SO₂ 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 nonattainment problems in a particular area, and to select the emissions reduction measures that the air agency judges to be most appropriate for the affected area to attain the 2010 SO₂ NAAQS as expeditiously as practicable based on a variety of local factors such as population exposure, enforceability, and economic impact. Under the CAA, to be approved by the EPA, NAA SIPs need to ensure that areas designated as nonattainment reach attainment as expeditiously as practicable. These plans may take into consideration emission reductions resulting from enforceable national control programs [such as the Clean Air Interstate Rule (CAIR), or the Maximum Achievable Control Technology (MACT) standards for mercury air toxics (MATS)] as well as from enforceable state, local or tribal programs not directly mandated under the CAA².

II. Background

In June 2010, the EPA promulgated a new 1-hour primary SO₂ NAAQS of 75 parts per billion (ppb), which is met at an ambient air quality monitoring site when the 3-year average of

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.

² The EPA would propose to grant credit for control measures being implemented to meet the requirements of MATS rule, as it relates to emissions reductions for SO₂, if the state adopts and implements an associated emission limit for SO₂.

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, effective October 4, 2013, 29 areas of the country as nonattainment for the 2010 SO₂ NAAQS. The EPA anticipates designating additional areas as information becomes available to determine the air quality of areas with regards to the 2010 SO₂ 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 SO₂ NAAQS. A substantial set of longstanding guidance reflects the EPA's recommendations regarding these requirements for SO₂, 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 SO₂ 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. The EPA received comments on the September 2011 draft SO₂ guidance from commenters who voiced concerns with the use of section 110(a)(1) of the CAA to require the submittal of substantive attainment demonstration SIPs for areas designated as "unclassifiable." After reviewing these comments, the EPA revisited its suggested approach on this issue. In April 2012, the EPA forwarded a letter to state environmental commissioners and tribal air quality agencies explaining that we would no longer expect states to submit SIPs by June 2013 to provide attainment plans for areas designated as "unclassifiable."

The EPA also received comments for and against revising its prior policy regarding averaging times for emission limits. Based on a reexamination of this policy, the EPA now

believes that emission limits based on averaging times longer than one hour, up to 30 days, may provide adequate assurance that the air quality standard will be attained, so long as the limit reflects comparable stringency as the one-hour average emission limit that modeling shows to provide for attainment. This is discussed 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, (2) Section V.D.1, discussing control strategies [including reasonably available control technology/reasonably available control measure (RACM/RACT)], (3) Section V.D.2, discussing the criteria necessary for setting SO₂ 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, and (5) Appendix A, providing clarifications to the modeling guidance.

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 SO₂ NAAQS through control programs directed at sources of SO₂ 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 SO₂ and other air pollutants that will facilitate attainment of the SO₂ NAAQS. The EPA will

review each 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 TIPSs. 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 SO₂ 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 SO₂ 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 SO₂ NAAQS to develop and submit a NAA SIP to the EPA meeting the requirements of subparts 5 and 1, 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 SO₂ 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 [*see* section 192(a) of the CAA]. For areas designated nonattainment in August 2013, with designation effective dates of October 4, 2013, SIPs are due by April 2015 which show 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 SO₂ NAAQS.³

V. SO₂ Nonattainment Area Planning Elements

A. Overview of Plan Elements

As mentioned in Section III of this document, all components of the SO₂ 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 SO₂ (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 also 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

³ 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>.

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 SO₂ 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 SO₂ 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 SO₂ 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 SO₂ 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; 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 SO₂ emission rates for the SO₂ 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 SO₂ modeling analysis.

C. Attainment Demonstration

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

The attainment demonstration should include analyses supporting the air agency’s proposed attainment date for the affected area. To be approved by the EPA, the attainment plan would need to show that sufficient emission reductions will occur in the affected area in order for the area to attain the 2010 SO₂ NAAQS as expeditiously as practicable, but no later than the

outside statutory attainment date for the area (i.e., 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, as described later in this section, supplemental analyses as appropriate) that attainment of the 2010 SO₂ NAAQS will be achieved throughout the entire nonattainment area by the statutory attainment date through the adoption and implementation, at a minimum, of emission controls representing RACM/RACT. The air agency, through the use of air quality dispersion modeling, should adopt and implement control measures that are deemed necessary to ensure attainment in the affected nonattainment area. In some cases, this may mean that control measures may need to be adopted and implemented on SO₂ sources that are located nearby the affected nonattainment area, which are deemed to have a direct impact on the area being able to demonstrate attainment of the standard. Therefore, the modeling for the attainment demonstration should include these sources in the modeling domain for analysis.

In general, the EPA expects all control measures to be adopted by the state and implemented as expeditiously as practicable in order to demonstrate attainment of the standard by the statutory attainment date. Air agencies should generally have all necessary controls in place so that the control measures will result in the achievement of 3 years of air quality monitoring data showing attainment by the statutory attainment date. However, a NAA SIP may be approvable if enforceable control measures will be operational prior to the attainment date even if the air agency does not anticipate having 3 calendar years of clean air quality data by the attainment date.⁴

As stated previously, for attainment demonstrations for the 2010 SO₂ NAAQS, the air

⁴ 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);

agency should demonstrate future attainment and maintenance of the NAAQS in the entire area 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 SO₂ NAAQS. For a short-term (*i.e.*, 1-hour) standard, the EPA believes that dispersion modeling, using allowable emissions, addressing stationary sources in the affected area, or those sources nearby the nonattainment area which are determined to affect attainment, is technically appropriate, efficient and effective in demonstrating attainment in nonattainment areas because it takes into account combinations of meteorological and source operating conditions that can contribute to peak ground-level concentrations of SO₂.

The area designated as nonattainment includes the nearby sources identified as likely causing or contributing to the violations of the NAAQS in the area.⁵ The modeling for the attainment demonstration should include results for a suitable network of receptors representing the entire nonattainment area, and should exhibit modeled 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 nearby the nonattainment area where sources are determined to affect attainment within the affected area. The modeling domain should also identify sufficient receptors throughout the domain in order to appropriately characterize changing gradients of air quality concentrations.

⁵ *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.

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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 as it relates to demonstrating attainment in nonattainment areas.

Appendix A of this document contains modeling guidance supplemental to that provided in the preamble to the final rulemaking promulgating the 2010 SO₂ NAAQS and in 40 CFR part 51, Appendix W. The guidance contained in Appendix A has also been updated to respond to issues raised during the comment period related to the September 2011 draft SO₂ 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 SO₂ NAAQS. Although AERMOD, (American Meteorological Society/Environmental Protection Agency Regulatory Model) 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 SO₂ 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 for 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 SO₂ emission

reductions from control measures that are permanent and enforceable.⁶ Air agencies should consider all RACM/RACT⁷ 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 SO₂ emissions that will significantly contribute to timely attainment of the 2010 SO₂ 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 SO₂ 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 require significant SO₂ 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.

Under Title II of the CAA there are rules that limit the sulfur content of the fuel used by automobiles, trucks, buses, motorcycles, non-road engines and equipment, marine vessels and locomotives. Emissions of SO₂ are also limited by new source performance standards (NSPS) for stationary sources under sections 111 and 129 of the CAA; and the national emission standards for hazardous air pollutants (NESHAP) for stationary sources under section 112 of the CAA, [such reductions resulting from control of hazardous air pollutants (HAP) such as hydrogen

⁶ See section 110(a)(2)(A) of the CAA.

⁷ See section 172(c)(1) of the CAA.

chloride (HCl) under those rules]. In addition, significant reductions in SO₂ 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.

Several recent and upcoming EPA air quality regulations on electric generating units (EGUs) and other large sources (such as various types of boilers and incinerators) have the potential to significantly reduce SO₂ emissions in the United States. Regulations under CAA section 112 MACT for EGUs, known as the MATS, were promulgated on February 16, 2012, at 77 FR 9304. These regulations are 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 SO₂ (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 SO₂. Indeed, under MATS, coal-fired facilities that operate flue gas desulfurization equipment may choose to demonstrate compliance with SO₂ 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, selected aspects of which it is further reconsidering. (*See* also 78 FR 38001, published June 25, 2013.) 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, HCl and carbon monoxide. While not all of these rules establish limits on

emissions of SO₂, 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 SO₂ 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, respectively⁸. 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 SO₂ emissions that may help certain areas attain the 2010 SO₂ NAAQS, particularly in the eastern United States. Clean Air Interstate Rule (CAIR)⁹, which the EPA published on May 12, 2005, implemented an SO₂ cap and trade program across 23 states and the District of Columbia. *See* 70 FR 25162. CAIR was projected to reduce SO₂ 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. the 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. the EPA*, 550 F.3d at 1178. CAIR compliance with NO_x and SO₂ programs began in 2009 and 2010 respectively. Although the EPA promulgated a replacement

⁸ *See* at 78 FR 7138; on February 1, 2013, at 78 FR 7488; and on February 7, 2013, at 78 FR 9111.

⁹ 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 SO₂ is an important PM_{2.5} precursor, CAIR requires substantial SO₂ reductions.

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. 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 SO₂ program. Authorizations to emit SO₂, known as allowances, are allocated to affected sources in the CAIR region. The SO₂ 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 SO₂ emissions. At the end of the year, however, each source must hold sufficient allowances to cover its emissions (where each allowance represents one ton of SO₂ emissions). Significant SO₂ emissions control measures have been installed on EGUs in the eastern United States to meet the requirements of CAIR, resulting in significant decreases in SO₂ emissions relative to pre-CAIR levels.

b. SO₂ reductions from national rules.

The SO₂ 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 SO₂ control equipment, the company may choose among various levels of SO₂ control efficiency, taking into account the number of SO₂ 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 affecting varying degrees of SO₂ removal. Controlled SO₂ emissions are also a function of the fuel sulfur content and various other factors. Dry sorbent injection is another control option, achieving SO₂ control efficiencies from 30 to 60 percent or higher. Thus, the actual post-control SO₂ emission level that can be achieved at a particular facility is a function of several site-specific factors. The SIP establishing SO₂ 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. SO₂ 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 SO₂ NAAQS. An air agency may only need to work with the affected facilities to establish suitable SO₂ emission limits that provide for attainment of the 2010 SO₂ NAAQS consistent with the facilities' plans for compliance with the relevant national and regional rules. The control measures and associated SO₂ 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.

Regional transport regulations (*e.g.* CAIR) require emission reductions from among a set of sources but do not require controls at particular sources. SO₂ 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 SO₂ 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 SO₂ 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 hazardous air pollutant (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 may result in ancillary reductions of SO₂ emissions.

However, because SO₂ is not a HAP, in most cases the MACT do not require a specific SO₂ emission level, and further state action, typically by permit or by rule, would be necessary to establish an enforceable SO₂ emission limit for SIP purposes. An exceptional case is incinerators subject to CAA section 129, for which the MACT rules establish a specific SO₂ emissions limit under section 129(a)(4). For industrial boilers and other analogous combustion sources, the MACT rules do not mandate achievement of specific SO₂ emissions levels. Therefore, the SO₂ emission reductions resulting from these rules (except section 129 rules) are creditable for SIP purposes, but only if the state establishes a specific, enforceable SO₂ emission limit for the

source.

In the case of EGUs, the MATS rule allows EGUs burning coal to choose either to demonstrate compliance with a limit on HCl emissions or to demonstrate compliance with a limit on SO₂ emissions as a surrogate for HCl. As a general matter, a requirement where a source has the option to meet either an HCl limit, or an SO₂ limit, cannot be considered an enforceable restriction on SO₂ emissions for SIP purposes. On the other hand, Title V requires sources to be subject to permits that include emission limitations and standards, including those operational requirements and limitations that assure compliance with all applicable requirements. In addition, Title V requires 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 SO₂ emission limit rather than the HCl limit. The EPA expects that these sources' Title V permits would specify that the source must meet the SO₂ limit in the MATS rule. In these cases, so long as this provision of the Title V permit is submitted and approved as part of the SIP (rendering it permanent rather than subject to expiration after 5 years, and requiring affirmative EPA approval to change the emission limit), the EPA believes that this SO₂ limit could be considered an enforceable requirement that is creditable for SIP purposes. Although Title V permits have a finite life and are subject to renewal, the SO₂ limit would then be an applicable requirement that would need to be retained in the renewed permit unless an EPA-approved SIP revision (generally involving a suitable replacement limit) has allowed otherwise. If the state does not subject the source to the MATS rule SO₂ limit in this manner (or if the MATS limit is insufficient to provide for attainment) then the state must establish a suitable, enforceable SO₂ limit by other means.

2. Setting SO₂ emission limits and averaging times.

a. Policy regarding averaging times for 1-hour 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.¹⁰ For example, under that guidance, the averaging time for an emission limit for complying with the 3-hour secondary SO₂ standard would not exceed 3 hours. Following this approach would suggest that emission limits for attaining the 1-hour SO₂ 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 guidance uses the term “critical value” to refer to the hourly emission rate that would result in the 99th percentile of daily maximum hourly SO₂ concentrations at the 1-hour NAAQS, given representative meteorological data for the area. Establishing 1-hour limits at the critical value is a conservative approach to developing a control strategy that ensures that NAAQS violations do not occur, and is an approach that EPA recommended in the September 2011 draft guidance and would still consider 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 value have an extremely low likelihood of causing a NAAQS exceedance. This conservatism, they argue, 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. Commenters suggested that designing a

¹⁰ See SO₂ 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>).

control strategy to ensure that emissions for any given hour never exceed the critical value might require limits that are extremely difficult to achieve in practice where there is such variability. These commenters suggested that 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 value that would create the potential for violations. In other words, they suggested that a control strategy based on hourly emission limits that, if met, completely eliminate the possibility that a sufficient number of exceedances could occur to result in a NAAQS violation (rather than simply rendering the chances extremely low) is the only way to ensure attainment.

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 one hour, but still provide for attainment of the 2010 SO₂ 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 EPA's general expectation that, if periods of hourly emissions above the critical value are a rare occurrence at a source, these periods would be likely to have relatively little 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 SO₂. The EPA believes that making this option available to states could reflect an appropriate balance between providing a very 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, the EPA believes that any provision for establishing emissions limits that govern averages of emissions over longer time periods should ensure with appropriate justification that the longer term average still provides for expeditious attainment and maintenance of the standard. In order to establish these longer term limits, the EPA expects that the attainment demonstration would need to, as a starting point, provide modeling to establish appropriate 1-hour emissions rates for each source that demonstrate attainment. The previous discussion does not eliminate the need for such a demonstration. It simply provides that once this demonstration is made, an air agency could adopt a limit into its SIP that uses a longer averaging time. If it elects to do so, these modeled hourly rates would serve as the basis for developing the longer term limits.

The EPA expects to consider the following factors in evaluating the adequacy of control strategies that provide for longer averaging times: (1) whether the numerical value of the mass emissions limit averaged over a longer time is comparably stringent with the 1-hour limit upon which it is based; (2) whether the expected variability of post-control emissions within the averaging period (*i.e.*, over shorter time frames than the average) can be sufficiently well-characterized; (3) whether this expected variability is constrained in such a way that the short term periods of emissions above the critical value are limited in frequency and duration and, if they occur, are not expected to result in NAAQS violations; (4) whether the averaging time is sufficiently short to ensure that the frequency and duration of periods of emissions over the critical value are not expected to result in NAAQS violations; and (5) whether periods of emissions over the critical value are further constrained, as appropriate, by other types of limitations beyond mass/time limits [e.g., pounds per million British Thermal Units (lb/mmBTU)]

limits] of comparable stringency. The remainder of this section discusses these factors in more detail.

b. Developing 1-hour emission limits with longer averaging times.

The first factor listed above in applying a lengthened averaging time of an emissions limit is whether the stringency of such a limit is comparable to the stringency of a limit governing 1-hour emission values. 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. The EPA believes that appropriately developed SO₂ emission limits with averaging times from 1 hour up to 30 days could in specific cases be shown to suffice to assure attainment of the 1-hour SO₂ NAAQS. However, as a general matter, to make such a showing, 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.¹¹ 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.

After the state determines a source's 1-hour emission rate that would provide for NAAQS attainment (*i.e.* a rate that is less than or equal to the critical 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 1-hour rate that provides for attainment, reflecting an adjusted level that is justified by the state.

¹¹ Stack tests generally involve three runs of approximately one 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.

While even this adjusted limit could allow occasional emission spikes above the level that would be allowed with a 1-hour emission limit, this adjusted limit would also provide a compensating reduction in the likelihood of NAAQS violations by requiring emissions on average to be lower than they would be required to be with a 1-hour emission limit. Since shorter averaging times, such as 24 hours, provide less allowance of emission spikes than would longer averaging times, such as 30 days, the EPA expects that the length of the averaging time would be a factor in determining the level of adjustment to provide comparable stringency to the baseline 1-hour emission rate, and limits using shorter averaging times would be easier to justify.

In many cases, a combination of emission limits is the most appropriate means of limiting emissions from affected facilities. For example, in the emission limits for the Portland Generating Station in Pennsylvania, the EPA promulgated a 1-hour emission limit on mass emissions (in pounds per hour) without an averaging provision in combination with a supplemental 30-day average limit on emissions per mmBTU of heat input at the facility (*See* 76 FR 69052). For sources with variable emissions and high peak hourly rates, states considering longer-term averages should combine either a mass emission limit or a limit on emissions per unit heat input with additional limits to prohibit severe emission spikes. For example, a state could supplement a 30-day average limit with a limit on 1-hour peak emission rates, or could impose work practice restrictions that allow little or no operation when control equipment is not operating.

In analyses of the appropriate degree of adjustment of the level of longer-term emission limits, the EPA expects that the set of emission values averaged over the longer averaging time will be compared to 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.

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 emission 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. 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 at the source 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 size, operation, fuel, and control type may be useful for these comparisons. 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.

In a few cases, states may conclude that a suitable attainment plan includes existing limits with averaging times longer than 1 hour. The same principle described above also applies here,

namely that modeling in general may use a given emission rate, either based on a 1-hour average limit at that emission rate, or based on a longer term average limit at an appropriately adjusted lower level. Thus, modeling of the existing longer term average limit would use the level of the hypothetical 1-hour limit that would provide comparable stringency as the existing limit, reflecting the appropriate upward adjustment.

SO₂ 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 variables will likely be different, and so the analyses of the degree of adjustment necessary would need to be appropriate for the variable for which an emission limit is being set.

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 before formally submitting NAA SIPs. The following is an example of how appropriately adjusted longer term average emission limits might be determined. States may also apply other methods of determining longer term average limits with comparable stringency to the corresponding 1-hour limit, but states are especially urged to consult with their EPA Regional Office in such cases. In all cases, states applying longer term average limits must provide justification stating that emissions variability warrants the longer term average limits and that the limits adopted offer suitable assurance that the plan will provide for attainment.

c. Example calculations.

This example is for determining an appropriately adjusted allowable 30-day average of

hourly mass emissions, 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.

The first step in this example set of calculations is to conduct dispersion modeling to determine a source's 1-hour emission rate that would provide for attainment. While this rate could be used to establish a 1-hour emission limit with no averaging, here the rate serves as a baseline for determining a longer term average limit (in this example, a 30-day average limit). 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. Subsequent steps are intended to determine the percentage by which this 1-hour rate should be adjusted downward to determine a comparably stringent 30-day average limit.

The second step is to compile emissions data to develop a representative post-control emissions distribution. These emission data will presumably be obtained from Continuous Emission Monitoring Systems (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.

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. This example assumes that the source being addressed does not

currently operate flue gas desulfurization equipment. Thus, this example applies statistics based on the emission distribution of another source with comparable operational characteristics that is already implementing the control strategy that the target source anticipates using, which is judged to provide a better projection of the target source's post-control emission distribution than the source's own pre-control distribution. In other cases, the source may expect to implement a control strategy that will not significantly change the emission distribution (as may be true, for example, a strategy involving a switch to lower sulfur coal with similar sulfur content variability or one 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. Regardless of the origin of the emission distribution used to project the post-control statistical relationship, the example calculations illustrate how the appropriate adjustment for a longer term average limit may be estimated.

Several approaches are possible for computing 30-day averages. In MATS, only days with at least some operation are included in the computations. The averages are computed on a rolling average basis, in which a new 30-operating-day average is computed for each new operating day. Since the limit under MATS is expressed in pounds per megawatt-hour, the computations inherently consider only data from hours with actual operation. The corresponding approach with a limit on the total mass of emissions would be to compute the average hourly emissions during operating hours during 30 consecutive operating days. The approach used in the analysis should be the approach that is to be established for determining compliance with the limit.

The third step uses the distributions of the hourly values and the 30-day average values

obtained in step 2. 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.

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 that will only just comply 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. In particular, this example uses the 99th percentile among the hourly values and the 99th percentile among the 30-day average values.

The fourth step is to compute the ratio of the two 99th percentile values. The fifth and final step is to multiply this ratio times 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 be considered to have comparable stringency as would apply with a 1-hour limit at the modeled attainment level.

The following are example results of these steps, for purposes of illustration. Suppose that modeling (conducted in the first step) finds that a 1-hour limit of 600 pounds per hour is necessary and sufficient to provide for attainment. Suppose further that the source plans to install emission control equipment that will change the emission distribution, so that subsequent steps of the analysis should be based on hourly emissions data for another source that already operates

the pertinent control equipment but is otherwise comparable.¹² Suppose that analysis of these data (compiled in step 2) indicate that the 99th percentile value of 1-hour values and 30-day average values (computed in step 3, for this example computed for operating hours on 30 consecutive operating days) are 800 pounds per hour and 720 pounds per hour, respectively. The ratio of these values (computed in step 4) is 90 percent, which multiplied by the 1-hour value that would provide attainment (in step 5) gives a result of 540 pounds per hour. Thus, in this example, a 30-day average limit of 540 pounds per hour is estimated to be a 30-day average limit with comparable stringency to a 1-hour limit of 600 pounds per hour.

This example does not address circumstances where the nonattainment area contains multiple sources. As a general matter, if the state's attainment demonstration identifies 1-hour average emission rates at which the area would attain the NAAQS, and the SIP limits each relevant emission unit either to the pertinent 1-hour emission rate or to a limit based on a longer term average which for that unit is comparably stringent, the EPA would presume that the SIP would provide for attainment.

d. Sources without CEMS.

The aforementioned 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

¹²Comparability would be judged on the basis of factors that might influence the relationship between 99th percentile 1-hour versus longer term average emission values. Thus, comparability of the absolute emission levels is less important than comparability of factors influencing emission patterns such as source type, emission control type (prospective compared to current), and operational patterns.

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.

Since sources without CEMS would almost by definition lack this robust basis 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 from 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.

e. 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 must 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 SO₂ emission limits is known collectively as Method 6, including Methods 6, 6A, 6B and 6C in 40 CFR 60 Appendix A. However, most of the sources that we expect will be subject to emission limits in SO₂ nonattainment plans are required to operate CEMS under other regulatory requirements. (*See* 40 CFR 51.214 and 40 CFR 51 Appendix P.) In accordance with the credible evidence rule [cf. 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 SO₂ 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 suitably be 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 SO₂ 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 SO₂. (Conversely, a source that installs SO₂ 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). 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 SO₂ 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.¹³ That is, for SO₂, there is usually a single “step” between pre-control nonattainment and post-control attainment. Therefore, for SO₂, 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 attainment date. We believe that this guidance continues to be appropriate for the implementation of the 2010 SO₂ NAAQS.

F. *Contingency Measures*

¹³ *See* SO₂ 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>).

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 SO₂ presents special considerations.¹⁴ 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 remain subject to significant uncertainties, in contrast with procedures for directly-emitted pollutants such as SO₂. 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 SO₂ control measures are well understood and are far less prone to uncertainty. Since SO₂ control measures are by definition based on what is directly and quantifiably necessary to attain the SO₂ NAAQS, it would be unlikely for an area to implement the necessary emission controls yet fail to attain the NAAQS. Therefore, for SO₂ programs, the EPA has explained that “contingency measures” can mean that the air agency has a comprehensive program to identify sources of violations of the SO₂ NAAQS and to undertake an “aggressive” follow-up for compliance and enforcement, including expedited procedures for establishing enforcement consent agreements pending the

¹⁴ See SO₂ 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>).

adoption of the revised SIP.¹⁵ The EPA believes that this approach continues to be a valid approach for the implementation of contingency measures to address the 2010 SO₂ NAAQS.

This approach to contingency measures for SO₂ 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 area NSR (NA 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 NA NSR permitting program applicable to areas previously designated nonattainment on the basis of the previous SO₂ NAAQS (annual, 24-hour or 3-hour averaging periods) may be able to use that existing program to authorize the construction and modification of major stationary sources of SO₂ that would locate in a new 2010 SO₂ nonattainment area¹⁶. However, because there are very few nonattainment areas designated under the previous SO₂

¹⁵ Id.

¹⁶ The annual and 24-hour primary SO₂ NAAQS generally will remain in effect for one year following the effective date of the initial area designations for the new 1-hour SO₂ NAAQS, however, the annual and/or 24-hour SO₂ NAAQS will remain in place for a longer period of time for any current nonattainment area for the annual or 24-hour SO₂ NAAQS, and any area for which a state has not fulfilled the requirements for a SIP call.

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NAAQS, some air agencies may not have NA NSR rules that apply when new nonattainment areas for SO₂ are designated. Consequently, air agencies may need to either revise their existing NA NSR programs or develop new ones to enable the permitting of any major stationary source of SO₂ locating in a nonattainment area under the 2010 SO₂ NAAQS.

Beginning on the effective date of any new nonattainment designation for the 2010 SO₂ NAAQS, proposed major stationary sources and major modifications of SO₂ will be required under section 173 of the CAA to obtain a NA NSR permit. Until such time that the EPA approves an air agency's revised SIP containing a NA NSR program for SO₂, on and after the effective date of a nonattainment designation for the 2010 SO₂ 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 SO₂ nonattainment areas.

In general, the NA NSR program should ensure that the construction and modification of major stationary sources of SO₂ will not interfere with reasonable further progress toward the attainment of the 2010 SO₂ NAAQS. More specifically, the statutory NA NSR requirements include but are not limited to:

- The installation of Lowest Achievable Emissions Rate (LAER) control technology;
- 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 alternatives and siting analysis 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 NA 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 SO₂ NAAQS, 100 tpy or more of SO₂ represents a major amount. Similarly, NA NSR requirements for SO₂ also apply to any existing major stationary source of SO₂ 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 SO₂. [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,¹⁷ 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, NO₂, carbon monoxide, lead or SO₂. As directed by CAA section 176(c)(6), general

¹⁷ 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 for the revised SO₂ 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 SO₂ 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 SO₂. 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 conformity rules provide that they do not apply to SO₂ unless either the EPA Regional Administrator or the director of the state air agency has found that transportation-related emissions of SO₂ 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 SO₂ NAAQS to the Revised SO₂ NAAQS

As air agencies transition from implementing the prior SO₂ NAAQS to implementing the

2010 SO₂ NAAQS, they will need to ensure that the health protection provided under the previous SO₂ NAAQS continues to be achieved as well as maintained. This means that air agencies will need to continue implementing attainment and maintenance SIPs (where maintenance SIPs have been approved by the EPA) associated with the prior 24-hour and annual primary SO₂ NAAQS until such time as they are subsumed by any new EPA-approved SIPs reflecting planning and control requirements associated with the 2010 SO₂ NAAQS. It also means air agencies will need to continue implementing preconstruction permitting and conformity requirements associated with prior SO₂ 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 SO₂ NAAQS final rule, the EPA's regulations provided that the prior 24-hour and annual primary SO₂ 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 SO₂ 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 SO₂ NAAQS would need to remain in effect after the 24-hour and annual primary SO₂ NAAQS are no longer in effect, unless their modification is consistent with CAA sections 110(l) and 193. 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.¹⁸ 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 SO₂ NAAQS. *See* 40 CFR 50.4(e). This SIP would need to meet all part D nonattainment area SIP requirements under the 2010 SO₂ NAAQS, as described above.

Also, the annual and 24-hour SO₂ increments contained in CAA section 163 and PSD regulations will remain in effect even after the time that the annual and 24-hour SO₂ NAAQS are no longer in effect.¹⁹ Thus, the owner or operator of a new or modified source would need to demonstrate compliance with the statutory annual and 24-hour SO₂ increments, even when the corresponding SO₂ NAAQS no longer apply. The EPA has previously explained that it does not believe that it can eliminate the annual and 24-hour SO₂ increments without appropriate legislative changes to the statutory SO₂ increments.

VII. Determinations of Attainment for SO₂ Nonattainment Areas

The EPA can make a determination of attainment for an SO₂ nonattainment area when relevant air quality information indicates that the 1-hr SO₂ NAAQS has been attained. There are

¹⁸ The areas that were designated as nonattainment for the previous SO₂ 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/inc.html>). The Billings/Laurel, MT area is the only area not meeting the requirements of a SIP call under the prior NAAQS.

¹⁹ The retention of the statutory annual and 24-hour SO₂ increments subsequent to the revocation of the annual and 24-hour SO₂ NAAQS has been previously discussed in various EPA documents. *See*, e.g., 75 FR 35520 (June 22, 2010) at page 35578; the EPA memorandum titled "Guidance Concerning Implementation of the 1-hour SO₂ NAAQS for the Prevention of Significant Deterioration," signed by Stephen D. Page on August 23, 2010.

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 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 as 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 SO₂ 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 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.²⁰

If the EPA finds that an area did not attain the NAAQS by the applicable deadline, the responsible air agency has 1 year 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 [CAA section 179(d)(2)].

This revised SIP is to achieve attainment of the 1-hr SO₂ NAAQS as expeditiously as

²⁰ 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.

practicable, but no later than 5 years from the date of notice of the area's failure to attain. [CAA section 179(d)(3)]. If the EPA determines that an area has attained the SO₂ NAAQS by the applicable deadline, the area will remain designated nonattainment until, as further discussed below, (1) the air agency has met the planning requirements for redesignation and requested redesignation to attainment under CAA section 107(d)(3), and (2) the EPA has approved the state's request and a maintenance plan, pursuant to section 175A of the CAA, for the area.

B. Information Necessary to Determine Attainment for SO₂ Nonattainment Areas

The EPA will determine whether or not an SO₂ nonattainment area has attained the NAAQS based on air quality monitoring data (when available), air quality dispersion modeling 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 have been implemented will normally be sufficient to make this demonstration).²¹ 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. If air quality monitoring data are used in the attainment determination, it should be data that is deemed to be complete, quality assured, and certified that has been entered into the EPA's Air Quality System (AQS) database. In addition, if EPA determines that the air quality monitors located in the affected area are located at 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 SO₂

²¹ See Memorandum from Sally L. Shaver, "Attainment Determination Policy for Sulfur Dioxide Nonattainment Areas", January 26, 1996.

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 SO₂ nonattainment areas, 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 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 (based on allowable emissions) to provide for attainment should in most cases 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 SO₂ 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 SO₂ 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 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 SO₂, the EPA has previously observed that the legal bases set forth in detail in those documents are equally pertinent to all NAAQS.²² *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

²² *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),

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 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 SO₂ areas designated as nonattainment. Specifically, under this policy, following a clean data determination by 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 submission 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 follows the rationale 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 [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 as long as a nonattainment area continues to attain the standard. If such an area should violate the SO₂ 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 SO₂ NAAQS 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 SO₂ NAAQS.²³ 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 SO₂ 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

²³ 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.

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.²⁴

c. Conformity

An area determined to be attaining the SO₂ standard under the clean data policy will be required to use the applicable regional emissions test, as required in the transportation conformity rule at 69 FR 40004 (July 1, 2004). This rule addresses the specific emissions tests for transportation plan and TIP conformity determinations that occur before and after an SO₂ SIP having motor vehicle emissions budgets is established.

5. NSR.

An attainment determination for an SO₂ nonattainment area pursuant to the clean data policy will 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 SO₂ 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.

²⁴ 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.

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

In general, to demonstrate that it is meeting the standards, a nonattainment area which was designated based on air quality monitoring data would first need to have 3 consecutive 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 SO₂, in the case of areas initially designated nonattainment based on monitoring data alone, it may be necessary for the air agency to also show, based on modeling of actual emissions, as appropriate, that the area is not violating the NAAQS. This is because, as the EPA has previously explained, the absence of violating monitors, in the context of SO₂, may not in all cases be sufficient to show that areas are not violating, or are not contributing to violations, of the 2010 SO₂ NAAQS. In such cases, additional information would be necessary to make the determination of attainment, either by (1) providing actuals-based modeling for the areas, or (2) providing a demonstration that the affected monitor is located in the area of maximum concentration, in which case the EPA believes that it would be appropriate to determine that the area is attaining the standard based on monitoring information alone. We recommend that air agencies conduct supporting monitoring and/or modeling that follows our recent draft Technical Assistance Documents (TADS) discussing suggested monitoring and modeling for future SO₂ designations, as this attainment determination approach mirrors the approach described in those documents.^{25,26} Upon completion of the supporting analysis, the air agency should notify the

²⁵ The SO₂ 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>.

appropriate EPA Regional Office that it believes a nonattainment area is attaining the 2010 SO₂ NAAQS and request an attainment determination under this policy.

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

Multi-state nonattainment areas should demonstrate attainment for the entire nonattainment area 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 Region, 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 SO₂ 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 some follow-up modeling to track any changes in SO₂ 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 determination that an area has violated the SO₂ NAAQS, the air agency would again be required to submit the pertinent planning requirements

²⁶ SO₂ NAAQS Designations Draft Modeling Technical Assistance Document, Office of Air Quality Planning and Standards, Air Quality Assessment Division, May 2013.

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 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 SO₂ Nonattainment Areas

The latest date by which an area designated as nonattainment is required to attain the SO₂ NAAQS is determined by the effective date of the nonattainment designation for the affected area. Once designations for the SO₂ 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 SO₂ 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.²⁷ Within 18 months of receipt of a complete redesignation request submittal, the EPA shall approve or deny such redesignation request.²⁸ 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

²⁷ Note that section 107 does not permit the EPA to redesignate any area from nonattainment to unclassifiable.

²⁸ 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 Office, 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.

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 Areas to Attainment" for a more detailed discussion of these criteria. These conditions are also discussed in the 1994 SO₂ 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 SO₂ NAAQS. As discussed in the previous section on attainment determinations, for SO₂, 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 SO₂, 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 at the point of maximum concentration. In cases where air quality monitors for the affected area are located at 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 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 are located at the area of maximum concentration for the affected area, then air quality dispersion modeling will be required to estimate SO₂

concentrations in the affected area. Such dispersion modeling should be conducted to estimate SO₂ 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 SO₂, may not in all cases be sufficient to show that areas are not violating, or are not contributing to violations, of the 2010 SO₂ 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 SO₂, 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, regional offices should consult with OAQPS for further guidance on addressing the need for modeling in specific circumstances.²⁹

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 requirements that apply to the area. "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."³⁰

C. Permanent and Enforceable Improvement in Air Quality

²⁹ 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.

³⁰ *Id.* 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 SIP elements and the redesignation request may occur simultaneously.

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. 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.³¹

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 nonattainment plans. Part D of title I consists of general requirements applicable to all areas designated nonattainment and specific requirements applicable to certain NAAQS.³²

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

³¹ 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.

³² 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.

requirements shall remain in place.”³³

The maintenance plan will constitute a SIP revision and under section 175A must provide for maintenance of the 2010 SO₂ 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.³⁴ (Even though the state should factor in this lead time for purposes of their maintenance demonstration, the EPA will attempt to redesignate areas to 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 must contain a contingency plan with measures to ensure prompt correction of any violation of the SO₂ 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.³⁵

Where the state has submitted an attainment plan for SO₂, 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

³³ See SO₂ 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>).

³⁴ 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.

³⁵ *Id.*

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 SO₂ 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.

An air agency may generally demonstrate maintenance of the NAAQS by either showing that future emissions of SO₂ 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.³⁶ As a part of the maintenance demonstration, the air agency should provide a listing of SO₂ 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

³⁶ *Id*

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.

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 SO₂ NAAQS. The air agency's submittal should indicate how it will track the progress of the maintenance plan for the area either through air quality monitoring or modeling.

5. Contingency plan.

CAA section 175A (d) provides that the maintenance plan must contain contingency provisions that will promptly correct any violation of the SO₂ 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.³⁷

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 SO₂. 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 SO₂ 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.

³⁷ *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 SO₂ 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>).

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 SO₂ NAAQS (75 FR 35520, published on June 22, 2010) after review of the existing two primary SO₂ standards, promulgated on April 30, 1971 (36 FR 8187).³⁸ The new primary SO₂ NAAQS is codified at 40 CFR 50.17, while the prior primary SO₂ NAAQS are set forth at 40 CFR 50.4. The EPA established the revised primary SO₂ 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 99th percentile of 1-hr 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 SO₂ NAAQS could be a technically appropriate and accurate means of assessing peak 1-hr SO₂ concentrations, and would be consistent with historic (past and more recent) implementation practice of using models to determine compliance with the SO₂ 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 Fall 2011 release of the SO₂ draft guidance. Changes made to this guidance include:

- Removal of references to the maintenance SIPs
- Modification of section 5.1 (Determining sources to model), based on the fact that guidance is now for nonattainment areas only and sources thought to cause or contribute to NAAQS violations have been identified in the designations process.
- 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)

³⁸ 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).

programs. Air quality modeling in this SIP process would need to employ air quality dispersion models that properly address the source-oriented nature of SO₂ 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; the EPA, 2003), including several field studies based on model-to-monitor comparisons of SO₂ 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.³⁹

Recently issued EPA guidance of relevance for consideration in modeling for attainment demonstrations includes:

- “Applicability of Appendix W Modeling Guidance for the 1-hr SO₂ NAAQS” August 23, 2010—confirming that Appendix W guidance is applicable for NSR/PSD permit modeling for the new SO₂ NAAQS (U.S EPA, 2010a).
- “Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hr NO₂ National Ambient Air Quality Standard” March 1, 2011— provides

³⁹ The Support Center for Regulatory Atmospheric Modeling (SCRAM) website is available at: <http://www.epa.gov/ttn/scram/>.

additional guidance regarding NO₂ permit modeling and also relevant to SO₂ (U. S. EPA, 2011a).

- “SO₂ 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 SO₂ NAAQS (U. S. EPA, 2013a).

This guidance should not be confused with the May 2013 SO₂ NAAQS Designations Modeling Technical Assistance Document (U.S. EPA, 2013a) which offers recommendations of modeling SO₂ sources with actual emissions for the purposes of designations only. The guidance discussed in this implementation guidance is for modeling to demonstrate attainment of the SO₂ NAAQS.

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 SO₂ 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 procedures⁴⁰.

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*. 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 the American Meteorological Society/Environmental Protection Agency Regulatory Model (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 SO₂ primary NAAQS, AERMOD should be used unless use of an alternative model can be justified (Section 3.2, Appendix W), such as CALPUFF. As outlined in the August 23, 2010 clarification memo “Applicability of Appendix W Modeling Guidance for the 2010 SO₂ National Ambient Air Quality Standard”, AERMOD is the preferred model for single source modeling to address the 2010 SO₂ NAAQS as part of the NSR/PSD permit programs (U.S. EPA, 2010a). AERMOD is appropriate for the SIP development process because SO₂ concentrations result from direct emissions from combustion

⁴⁰ 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.

sources so that concentrations are highest relatively close to sources and are much lower at greater distances due to dispersion. 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 of this pollutant.

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

- AERMOD: the dispersion model (U.S. EPA, 2004a; U.S. EPA, 2012a)
- 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, 2012b)

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.

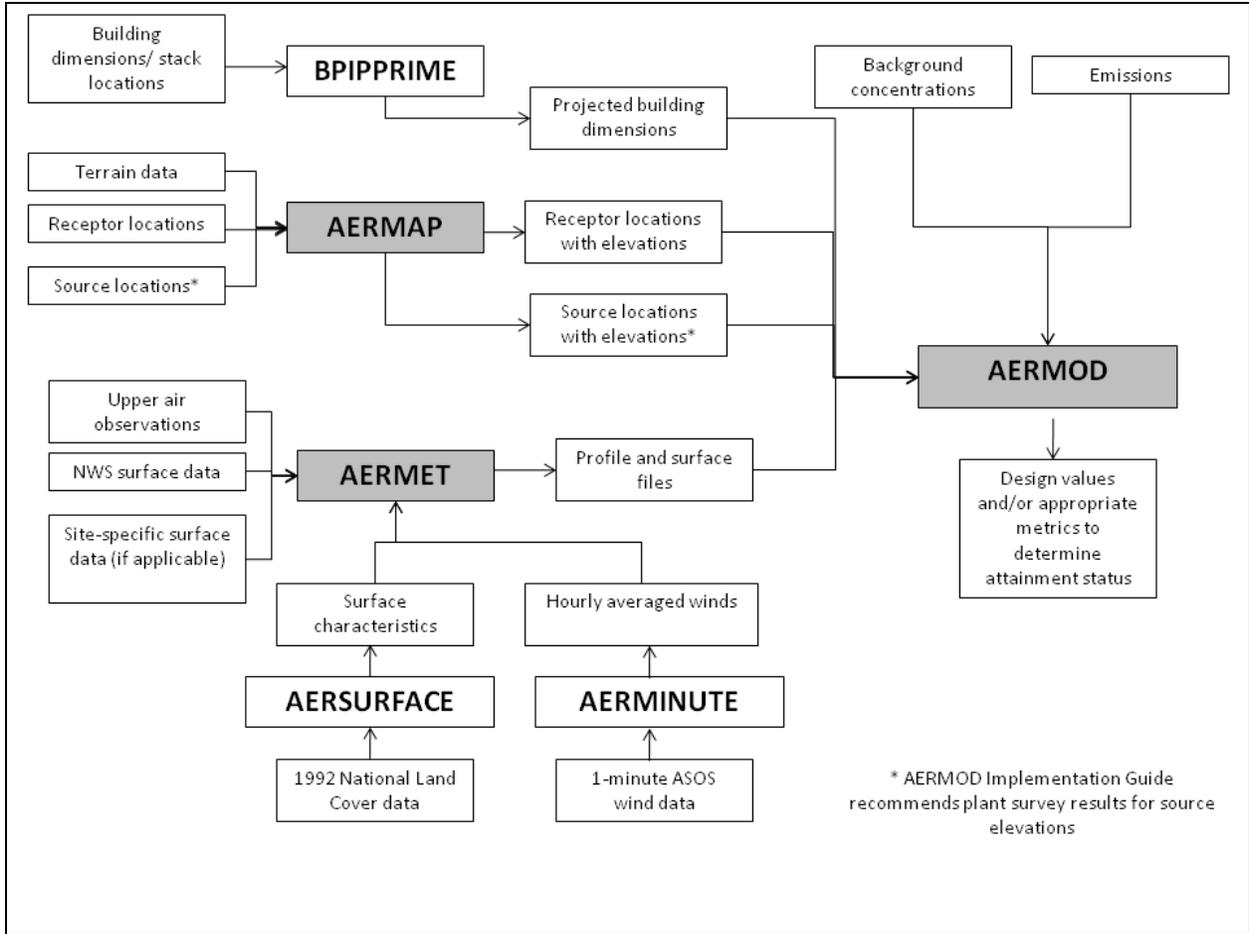


Figure 1. AERMOD modeling system framework. Regulatory components of the system are in gray boxes.

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 general steps include the following:

1. Gather information about SO₂ 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 rules⁴¹;
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;
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 SO₂ 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.

⁴¹ See Section B.3 of the SO₂ SIP guidance document for more information about national rules.

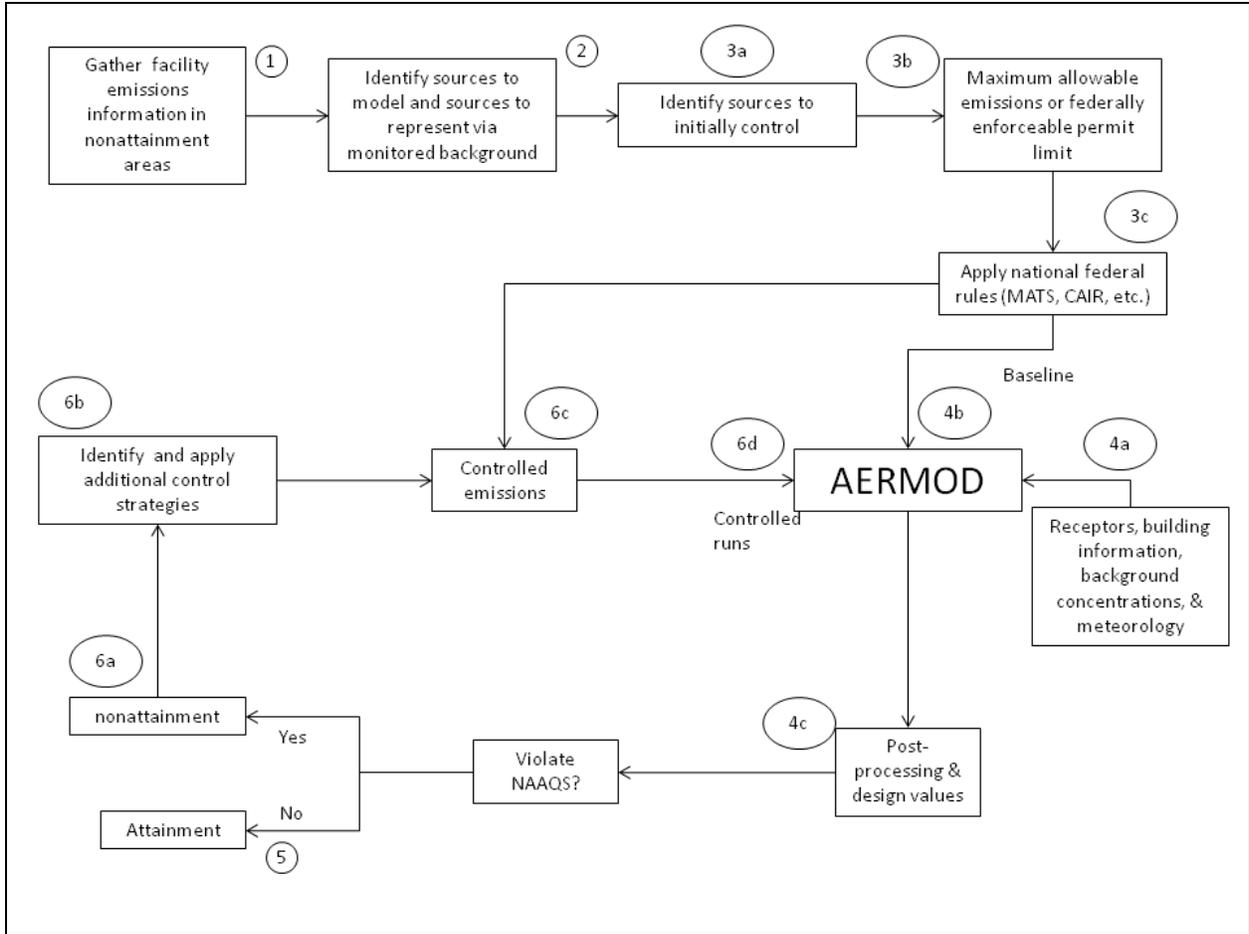


Figure 2. Flowchart of SO₂ Modeling Framework for SIP Demonstration.

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 includes 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 SO₂ NAAQS and the fact that SO₂ 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 NO₂ memorandum (U.S. EPA, 2011a) also offers recommendations for determining nearby sources, and those recommendations are relevant for SO₂ as well. The NO₂ 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 MXDYBYR 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. The March 1 NO₂ memorandum (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 the March 1, 2011 NO₂ memorandum (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)⁴². If a source exceeds the EPA interim SIL or a state-selected impact criterion, it should be evaluated 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 should be evaluated 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 should place receptors at key locations such as around facility fence lines (which define the ambient air boundary for a

⁴² The 3 ppb interim SIL for the 2010 SO₂ 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 SO₂ NAAQS for the Prevention of Significant Deterioration Program.”

particular source) or monitor locations (for comparison to monitored concentrations for model 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 SO₂ 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% 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 SO₂ 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 SO₂ 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 SO₂ standards (≤ 24 hours) have been in existence for decades, existing SO₂ emission inventories used to support modeling for compliance with the 3-hour and 24-hour SO₂ standards should serve as a useful starting point, and may be adequate in many cases for use in assessing compliance with the 2010 SO₂ 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.⁴³

However, if short-term emissions are not readily available, they may be calculated using the methodology shown in Table 8-1 of Appendix W. 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 NO₂ National Ambient Air Quality Standard” (U. S. EPA, 2010b). Although the example is for NO₂, the calculation methodology would be the same for SO₂. In the example, an emission rate for modeling is based on the design capacity of a natural gas fired boiler and the design capacity 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.

Appendix W (Section 8.1.2) also recommends modeling at 50% and 75% of design capacity to determine the load that may cause the highest concentration because changes in stack parameters in loads less than 100% of capacity may cause higher ground level concentrations⁴⁴. 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 SO₂ attainment demonstrations should follow the recommendations in the March 1, 2011 memo “Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hr NO₂ National Ambient Air Quality Standard” (U. S. EPA, 2011a). As stated in this memo, the EPA suggests the most appropriate data to use for compliance demonstrations for the 1-hr NO₂ 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 NO₂ permit modeling, the common 1 hour averaging time and form of both the NO₂ and SO₂ standards makes this modeling guidance relevant to the 2010 SO₂ NAAQS and, thus, useful for SO₂ modeling in support of attainment demonstrations. For more details, refer to the NO₂ 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 the EPA Regional Modeling Contact.

6.2. Modeling of additional Controls

As stated in Section 4 and shown in Figure 1, 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.

⁴³ The August 23, 2010 memo refers to modeling for PSD and Table 8-2 refers to PSD applications.

⁴⁴ 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.”

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 1). 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 B.1 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 SO₂ 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 B.3 of the SIP guidance document for more information about control strategies.

6.3. Good Engineering Practice (GEP) stack height

Consistent with previous SO₂ 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 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 BPIP/PRIME 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 SO₂ 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 SO₂ 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 SO₂ 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)⁴⁵ 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 BPIPRIME 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, 2012a), 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 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-hr 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.

⁴⁵ 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.

In addition, for SO₂ modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half life⁴⁶ for urban SO₂ sources (See Section 7.2.6 of Appendix W) due to SO₂ removal by conversion to H₂SO₄ (catalytic and photochemical) and adsorption onto particular matter (Turner, 1964). This would only be done for urban sources when the POLLUTID keyword in AERMOD is set to “SO₂” 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 DCAYCOEFF 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 DCAYCOEFF 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.

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/km², 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.

⁴⁶ Over a 4-hour period, SO₂ concentrations decrease by half from the initial value.

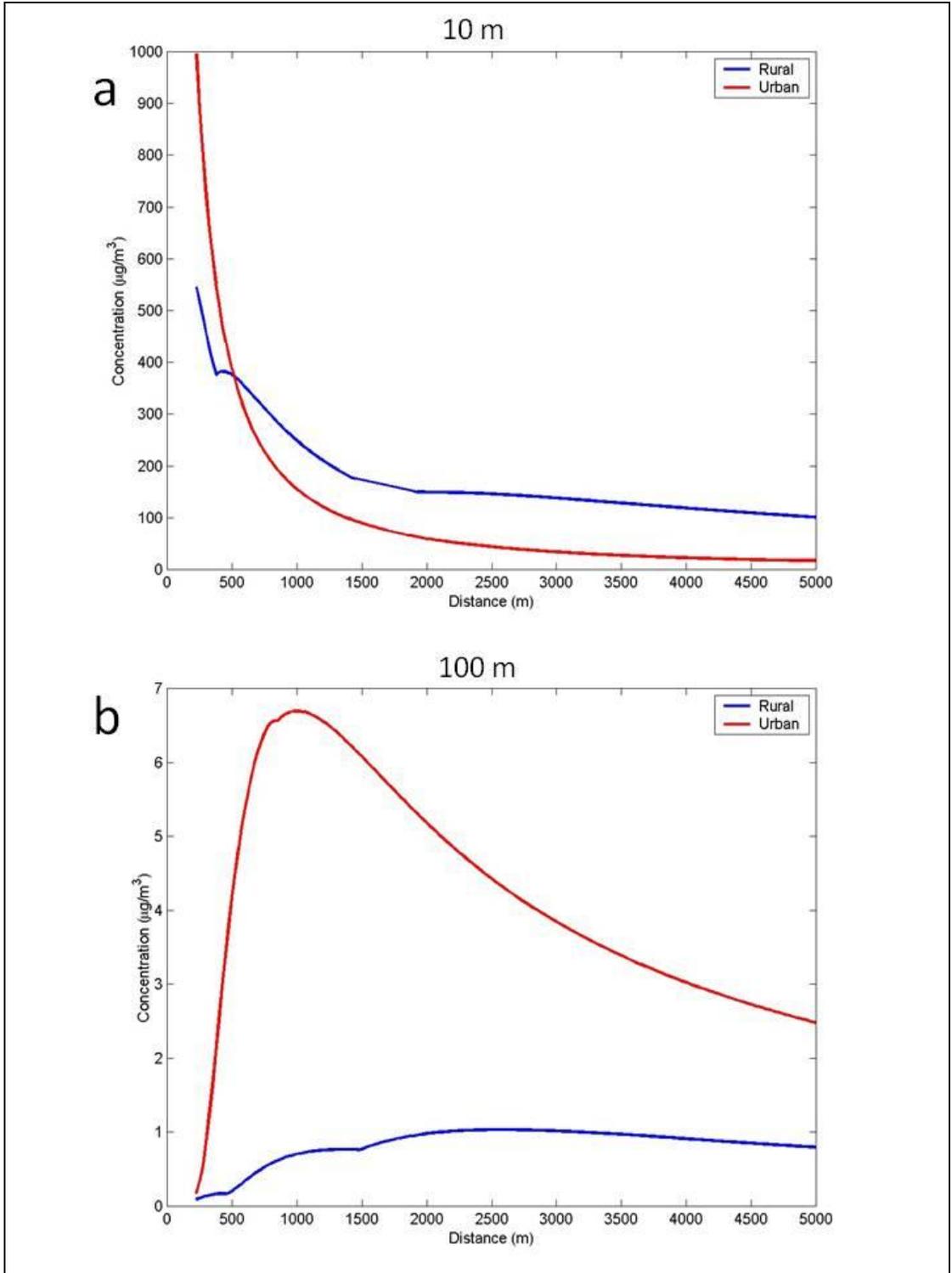


Figure 3. Urban (red) and rural (blue) concentration profiles for (a) 10 m buoyant stack release, and (b) 100 m buoyant stack release.

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:

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

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, 2012a). 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. 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, 2012b), the surface characteristics of the meteorological site should be used [Section 8.3.c of Appendix W and 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 one 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 five years are preferred and if one or more years (including partial years) of site-specific data are available, those data are preferred. While the form of the SO₂ NAAQS contemplates obtaining three 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 one year of site-specific data in the modeling. The 5-year average based on the use of NWS data, or an average across one 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 (See the August 23, 2010 Clarification Memorandum on “Applicability of Appendix W Modeling Guidance for the 1-hr SO₂ National Ambient Air Quality Standard” (U. S. EPA, 2010a). See the memorandum for more details on the use of 5 years of NWS data or at least one 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 five years of data, unless the most recent five 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, 2013b). 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 read 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 five 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, 2012b), 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 SO₂ 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 SO₂ 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 SO₂ design value. If screening meteorology is used in AERMOD, the SO₂ design value cannot be calculated. AERMOD will abort processing if screening meteorology is used and an SO₂ 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. Upper air soundings can be obtained from the Radiosonde Data of North America CD for the period 1946-1997. Upper air soundings for 1994 through the present are also available for free download from the Radiosonde Database Access website. Users should choose all levels or mandatory and significant pressure levels⁴⁷ 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 SO₂ 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 SO₂ concentration from a representative monitor to the modeled design value. We recognize that this approach could be overly 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 the EPA’s March 1, 2011 memo “Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hr NO₂ Ambient Air Quality Standard” (U. S. EPA, 2011a), and the SO₂ National Ambient Air Quality Standards 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

⁴⁷ 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

question, should be averaged for separate averaging time to determine the average 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 SO₂ 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 SO₂ is to use the 99th percentile concentration for each hour of the day by season and average across three years, excluding periods when the dominant source(s) are influencing the monitored concentration (i.e., 99th percentile, or 4th highest, concentrations for hour 1 for January or winter, 99th 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, 2012a).

As an illustrative example, Figure 4 shows the 2010 SO₂ NAAQS level, the design value (the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hr concentrations), and 3-year averages of the 99th percentile concentrations by season and hour of day. To calculate the 99th 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 99th percentile concentration by hour of day (across all seasons), and the average concentration by hour of day across the three years⁴⁸. In this example, the winter background concentrations show a distinct diurnal variability, with less for each of the other seasons.

⁴⁸Modelers should use the 1st-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).

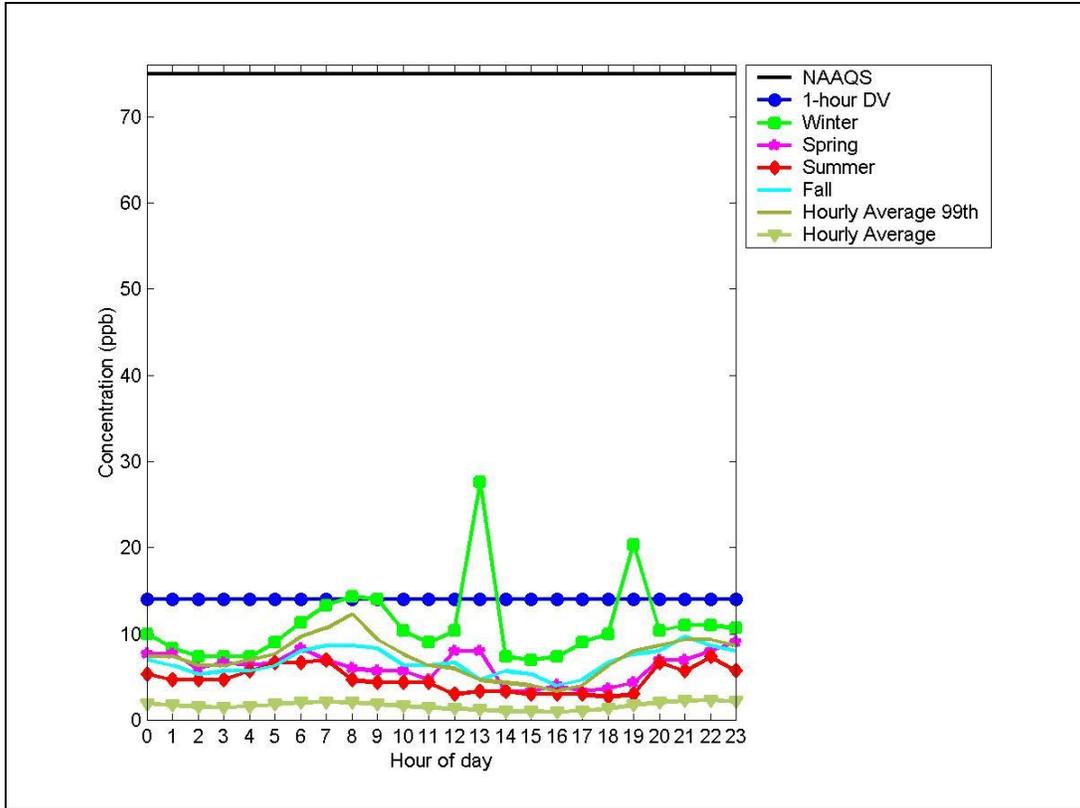


Figure 4. SO₂ monitored concentrations for various averaging times.

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 SO₂ design values at each receptor that includes contributions from all modeled sources and background. Based on the form of the 2010 SO₂ 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 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-hr 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 corresponding to the same hour as the 4th daily maximum 1-hr concentration from each year. See 75 FR at 35540. For example, a receptor has a 5-year average design value of 200.8 mg/m³ (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-hr concentrations that are used to calculate the 5-year average design value. Table 1 shows the 4th highest daily maximum 1-hr concentrations for each year and associated dates that are used in the design value calculation.

Table 1. 4th highest daily maximum 1-hr concentrations (µg/m³) 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-hr concentrations (µg/m³) 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-hr 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-hr 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 SO₂ 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-hr concentrations by receptor for each year for a specified source group. This is the MXDYBYR 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. THE EPA, 2012a).

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, MXDYBYR, 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, MXDYBYR, 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 five years of NWS data and each facility is modeled for five 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, MXDYBYR, 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, MXDYBYR, 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 five years of

NWS data resulting in five AERMOD runs. After the AERMOD runs are complete, the MAXDAILY, MXDYBYR, 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 five years of NWS data. All facilities are modeled with all receptors for each year individually, resulting in five AERMOD runs. MAXDAILY, MXDYBYR, 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 five 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, MXDYBYR, 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 SO₂ Implementation at: [http://www.theEPA.gov/ttn/scram/SO₂_modeling_guidance.htm](http://www.theEPA.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 SO₂ 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-hr or short-term emission rates in the SIP modeling based on continuous operations at the source.
- It is reasonable to initially focus on larger emitters, i.e. –100 or more tons per year but smaller sources, especially those with short stacks and/or located in complex terrain can possibly cause or contribute to NAAQS violations.
- Modeling should be done with five years of representative NWS meteorological data or at least one 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 99th 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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