



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

AUG 23 2010

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Applicability of Appendix W Modeling Guidance for the 1-hour SO₂ National Ambient Air Quality Standard

FROM: Tyler Fox, Leader 
Air Quality Modeling Group, C439-01

TO: Regional Air Division Directors

INTRODUCTION

On June 2, 2010, EPA announced a new 1-hour sulfur dioxide (SO₂) National Ambient Air Quality Standard (1-hour SO₂ NAAQS or 1-hour SO₂ standard) which is attained when the 3-year average of the 99th-percentile of the annual distribution of daily maximum 1-hour concentrations does not exceed 75 ppb at each monitor within an area. The final rule for the new 1-hour SO₂ NAAQS was published in the Federal Register on June 22, 2010 (75 FR 35520-35603), and the standard becomes effective on August 23, 2010 (EPA, 2010a). This memorandum clarifies the applicability of current guidance in the *Guideline on Air Quality Models* (40 CFR Part 51, Appendix W) for modeling SO₂ impacts in accordance with the Prevention of Significant Deterioration (PSD) permit requirements to demonstrate compliance with the new 1-hour SO₂ standard.

SUMMARY OF CURRENT GUIDANCE

Current modeling guidance for estimating ambient impacts of SO₂ for comparison with applicable NAAQS is presented in Section 4 of Appendix W under the general heading of "Traditional Stationary Source Models." This guidance acknowledges the fact that ambient SO₂ impacts are largely a result of emissions from stationary sources. Section 4.2.2 provides specific recommendations regarding "Refined Analytical Techniques," stating that "For a wide range of regulatory applications in all types of terrain, the recommended model is AERMOD" (see Section 4.2.2.b). As described in Section 4.1.d, the AERMOD dispersion model "employs best state-of-practice parameterizations for characterizing the meteorological influences and dispersion" (Cimorelli, *et al.*, 2004; EPA, 2004; EPA, 2009).

Section 7.2.6 of Appendix W addresses the issue of chemical transformation for modeling SO₂ emissions, stating that:

The chemical transformation of SO₂ emitted from point sources or single industrial plants in rural areas is generally assumed to be relatively unimportant to the estimation of maximum concentrations when travel time is limited to a few hours. However, in urban areas, where synergistic effects among pollutants are of considerable consequence, chemical transformation rates may be of concern. In urban area applications, a half-life of 4 hours may be applied to the analysis of SO₂ emissions. Calculations of transformation coefficients from site specific studies can be used to define a “half-life” to be used in a steady-state Gaussian plume model with any travel time, or in any application, if appropriate documentation is provided. Such conversion factors for pollutant half-life should not be used with screening analyses.

The AERMOD model incorporates the 4 hour half-life for modeling ambient SO₂ concentrations in urban areas under the regulatory default option.

General guidance regarding source emission input data requirements for modeling ambient SO₂ impacts is provided in Section 8.1 of Appendix W and guidance regarding determination of background concentrations for purposes of a cumulative ambient air quality impact analysis is provided in Section 8.2.

APPLICABILITY OF CURRENT GUIDANCE TO 1-HOUR SO₂ NAAQS

The current guidance in Appendix W regarding SO₂ modeling in the context of the previous 24-hour and annual primary SO₂ NAAQS and the 3-hour secondary SO₂ NAAQS is generally applicable to the new 1-hour SO₂ standard. 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 new 1-hour 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. However, the PSD applicant and reviewing authority may need to reassess emission estimates for very short-term emission scenarios, such as start-up and shut-down operations, for purposes of estimating source impacts on the 1-hour SO₂ standard. This is especially true if existing emission estimates for 3-hour or 24-hour periods are based on averages that include zero (0) or reduced emissions for some of the hours.

Given the form of the new 1-hour SO₂ standard, we are providing clarification regarding the appropriate data periods for modeling demonstrations of compliance with the NAAQS vs. demonstrations of attainment of the NAAQS through ambient monitoring. While monitored design values for the 1-hour SO₂ standard are based on a 3-year average (in accordance with Section 1(c) of Appendix T to 40 CFR Part 50), Section 8.3.1.2 of Appendix W addresses the length of the meteorological data record for dispersion modeling, stating that “[T]he use of 5 years of NWS [National Weather Service] meteorological data or at least 1 year of site specific data is required.” Section 8.3.1.2.b further states that “one year or more (including partial years), up to five years, of site specific data . . . are preferred for use in air quality analyses.” Although the monitored design value for the 1-hour SO₂ standard is defined in terms of the 3-year average,

this definition does not preempt or alter the Appendix W requirement for use of 5 years of NWS meteorological data or at least 1 year of site specific data. The 5-year average based on 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. Modeling of “rolling 3-year averages,” using years 1 through 3, years 2 through 4, and years 3 through 5, is not required. Furthermore, since modeled results for SO₂ are averaged across the number of years modeled for comparison to the new 1-hour SO₂ standard, the meteorological data period should include complete years of data to avoid introducing a seasonal bias to the averaged impacts. In order to comply with Appendix W recommendations in cases where partial years of site specific meteorological data are available, while avoiding any seasonal bias in the averaged impacts, an approach that utilizes the most conservative modeling result based on the first complete-year period of the available data record vs. results based on the last complete-year period of available data may be appropriate, subject to approval by the appropriate reviewing authority. Such an approach would ensure that all available site specific data are accounted for in the modeling analysis without imposing an undue burden on the applicant and avoiding arbitrary choices in the selection of a single complete-year data period.

The form of the new 1-hour SO₂ standard also has implications regarding appropriate methods for combining modeled ambient concentrations with monitored background concentrations for comparison to the NAAQS in a cumulative modeling analysis. As noted in the March 23, 2010 memorandum regarding “Modeling Procedures for Demonstrating Compliance with PM_{2.5} NAAQS” (EPA, 2010b), combining the 98th percentile monitored value with the 98th percentile modeled concentrations for a cumulative impact assessment could result in a value that is below the 98th percentile of the combined cumulative distribution and would, therefore, not be protective of the NAAQS. However, unlike the recommendations presented for PM_{2.5}, the modeled contribution to the cumulative ambient impact assessment for the 1-hour SO₂ standard should follow the form of the standard based on the 99th percentile of the annual distribution of daily maximum 1-hour concentrations averaged across the number of years modeled. A “first tier” assumption that may be applied without further justification is to add the overall highest hourly background SO₂ concentration from a representative monitor to the modeled design value, based on the form of the standard, for comparison to the NAAQS. Additional refinements to this “first tier” approach based on some level of temporal pairing of modeled and monitored values may be considered on a case-by-case basis, subject to approval by the reviewing authority, with adequate justification and documentation.

Section 8.2.3 of Appendix W provides recommendations regarding the determination of background concentrations for multi-source areas. That section emphasizes the importance of professional judgment by the reviewing authority in the identification of nearby and other sources to be included in the modeled emission inventory, and establishes “a significant concentration gradient in the vicinity of the source” under consideration as the main criterion for this selection. Appendix W also indicates that “the number of such [nearby] sources is expected to be small except in unusual situations.” See Section 8.2.3.b.

The representativeness of available ambient air quality data also plays an important role in determining which nearby sources should be included in the modeled emission inventory. Key issues to consider in this regard are the extent to which ambient air impacts of emissions

from nearby sources are reflected in the available ambient measurements, and the degree to which emissions from those background sources during the monitoring period are representative of allowable emission levels under the existing permits. The professional judgments that are required in developing an appropriate inventory of background sources should strive toward the proper balance between adequately characterizing the potential for cumulative impacts of emission sources within the study area to cause or contribute to violations of the NAAQS, while minimizing the potential to overestimate impacts by double counting modeled source impacts that are also reflected in the ambient monitoring data.

We would also caution against the literal and uncritical application of very prescriptive procedures for identifying which background sources should be included in the modeled emission inventory for NAAQS compliance demonstrations, including those described in Chapter C, Section IV.C.1 of the draft *New Source Review Workshop Manual* (EPA, 1990), noting again that Appendix W emphasizes the importance of professional judgment in this process. While the draft workshop manual serves as a useful general reference that provides potential approaches for meeting the requirements of New Source Review (NSR) and PSD programs, it is not the only source of EPA modeling guidance. The procedures described in the manual may be appropriate in some circumstances for defining the spatial extent of sources whose emissions may need to be considered, but not in others. While the procedures described in the NSR Workshop Manual may appear very prescriptive, it should be recognized that “[i]t is not intended to be an official statement of policy and standards and does not establish binding regulatory requirements.” See, Preface.

Given the range of issues involved in the determination of an appropriate inventory of emissions to include in a cumulative impact assessment, the PSD applicant should consult with the appropriate reviewing authority early in the process regarding the selection and proper application of appropriate monitored background concentrations and the selection and appropriate characterization of modeled background source emission inventories for use in demonstrating compliance with the new 1-hour SO₂ standard.

SUMMARY

To summarize, we emphasize the following points:

1. Current guidance in Appendix W for modeling to demonstrate compliance with the previous 24-hour and annual primary SO₂ standards, and 3-hour secondary SO₂ standard, is generally applicable for the new 1-hour SO₂ NAAQS.
2. While the 1-hour NAAQS for SO₂ is defined in terms of the 3-year average for monitored design values to determine attainment of the NAAQS, this definition does not preempt or alter the Appendix W requirement for use of 5 years of NWS meteorological data or at least 1 year of site specific data.

REFERENCES

Cimorelli, A. J., S. G. Perry, A. Venkatram, J. C. Weil, R. J. Paine, R. B. Wilson, R. F. Lee, W. D. Peters, R. W. Brode, and J. O. Paumier, 2004. AERMOD: Description of Model Formulation

with Addendum, EPA-454/R-03-004. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 1990. New Source Review Workshop Manual: Prevention of Significant Deterioration and Nonattainment Area Permitting – DRAFT. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 2004. User's Guide for the AMS/EPA Regulatory Model – AERMOD. EPA-454/B-03-001. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 2009. Addendum – User's Guide for the AMS/EPA Regulatory Model – AERMOD. EPA-454/B-03-001. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 2010a. Applicability of the Federal Prevention of Significant Deterioration Permit Requirements to New and Revised National Ambient Air Quality Standards. Stephen D. Page Memorandum, dated April 1, 2010. U.S. Environmental Protection Agency, Research Triangle Park, NC.

EPA, 2010b. Modeling Procedures for Demonstrating Compliance with PM_{2.5} NAAQS. Stephen D. Page Memorandum, dated March 23, 2010. U.S. Environmental Protection Agency, Research Triangle Park, NC.

cc: Richard Wayland, C304-02
Anna Wood, C504-01
Raj Rao, C504-01
Roger Brode, C439-01
James Thurman, C439-01
Dan deRoeck, C504-03
Elliott Zenick, OGC
Brian Doster, OGC
EPA Regional Modeling Contacts