UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

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MEMORANDUM

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

SUBJECT: Clarification on the AERMOD Modeling System Version for Use in SO_2 Implementation Efforts and Other Regulatory Actions

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TO: Regional Air Division Directors, Regions 1 – 10

On August 21, 2015, the Environmental Protection Agency (EPA) finalized the SO_2 Data Requirements Rule (SO_2 DRR) (80 FR 51052) to direct state, local, and tribal air agencies to characterize air quality around large SO_2 sources (greater than 2,000 tons/year or otherwise listed by air agencies or the EPA) via monitoring or modeling.[1] As directed by the SO_2 DRR for modeled sources, the modeling that initially characterized ambient air quality was due on January 13, 2017. The EPA provided a Technical Assistance Document to assist state, local, and tribal air agencies in this characterization of ambient air quality through dispersion modeling.[2] Many state, local, and tribal air agencies may expect that these SO_2 DRR modeling submittals will likewise be sufficient for the Round 3 – SO_2 designations.[3] However, given the recent revisions to the AERMOD Modeling System,[4] the EPA wants to clarify the situation in terms of what version of the model code is the most appropriate for consideration by the Agency in the upcoming SO_2 designations process, which will occur no later than December 31, 2017 for the affected sources. This clarification is also applicable for other current and future regulatory applications and compliance demonstrations. The information clarified in this memorandum does not change the status of any of the modeling already submitted for satisfying the SO_2 DRR air

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[1] "Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide (SO_2) Primary National Ambient Air Quality Standard (NAAQS); Final Rule", August 21, 2015. https://www.regulations.gov/document?D=EPA-HQ-OAR-2013-0711-0001.

[2] "Sulfur Dioxide (SO_2) National Ambient Air Quality Standards Designations Modeling Technical Assistance Document", August 2016 draft https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf. Note, the EPA released earlier drafts of this document in May and 2013 and February 2016.

[3] "Area Designation for the 2010 Primary Sulfur Dioxide National Ambient Air Quality Standard – Round 3", July 22, 2016, memorandum from Stephen Page, Director, Office of Air Quality Planning and Standards to EPA Regional Air Division Directors. https://www.epa.gov/sites/production/files/2016-07/documents/areadesign.pdf.

[4] The AERMOD modeling system refers to the AERMOD model as well as several pre-processors to AERMOD, such as AERMAP, AERMET, BPIPPRIME, etc...

quality characterization requirements and does not require remodeling to satisfy the SO_2 DRR initial characterization requirements.

Background information:

On December 20, 2016, then EPA Administrator Gina McCarthy signed a final rule revising the *Guideline on Air Quality Modeling* (Appendix W to 40 CFR Part 51 or *Guideline*) (82 FR 5182) that codified important scientific updates to the AERMOD Modeling System.[5] This final rule was published in the Federal Register on January 17, 2017.[6] In the proposal stage of this regulatory action, version 15181 of the AERMOD Modeling System was released with several beta options that were proposed to become regulatory options. Prior to the final rule, some of these beta options were available for use in regulatory applications and compliance demonstrations through approval as an alternative model by the appropriate EPA Regional Office with concurrence from the EPA's Model Clearinghouse per Section 3.2.2 of the *Guideline*.

In particular, there was a proposed adjustment to the surface frictional velocity (u*) in the AERMET meteorological preprocessor to the AERMOD dispersion model to improve overall model performance during periods of low-wind/stable conditions for a variety of source situations. Subject to certain conditions,[7] this "ADJ_U*" beta option in AERMET version 15181 was finalized as a regulatory option in AERMET version 16216, which was released as a component of the latest regulatory version of the AERMOD Modeling System at the same time as the final revisions to the *Guideline*. In doing so, the EPA discovered that the ADJ_U* beta option in AERMET version 15181 had a formulation bug that caused the ADJ_U* correction to be overstated and the resulting AERMOD concentrations to have an under prediction bias. The EPA corrected this formulation bug in AERMET version 16216 such that the model code now appropriately reflects the relevant scientific formulation found in the Qian and Venkatram (2011) scientific journal article.[8]

The vast majority of the SO_2 DRR modeling was submitted with either version 15181 or 16216 of the AERMOD Modeling System without the ADJ_U* option selected, beta or regulatory. Some SO_2 sources were modeled using version 15181 of the AERMOD Modeling System with the beta ADJ_U* option selected. Modeling for two of these SO_2 sources had received alternative model approval from the appropriate EPA Regional Office with concurrence from the

[5] Revision to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches to Address Ozone and Fine Particulate Matter; Final Rule. https://www.regulations.gov/document?D=EPA-HQ-OAR-2015-0310-0154.

[6] On January 26, 2017 (82 FR 8949), the EPA extended the effective date of this final rule from February 16, 2017, to March 21, 2017, consistent with the Presidential directive as expressed in the memorandum of January 20, 2017, from the Assistant to the President and Chief of Staff, entitled ''Regulatory Freeze Pending Review.''

[7] The EPA has determined that the ADJ_U* option should not be used in AERMET in combination with use of measured turbulence data because of the observed tendency for model under predictions resulting from the combined influences of the ADJ_U* and the turbulence parameters within the current model formulation. (82 FR 5182 (A.1)(2)(ii))

[8] Qian, W., and A. Venkatram, 2011: "Performance of Steady-State Dispersion Models Under Low Wind-Speed Conditions", Boundary-Layer Meteorology, 138, 475-491.

EPA's Model Clearinghouse.[9] Modeling for several other SO_2 sources was not submitted until after the final rule revising the *Guideline* was signed on December 20, 2016, as the initial SO_2 DRR characterization modeling was due January 13, 2017. Most importantly, however, the SO_2 DRR modeling for these sources was submitted using version 15181 of the AERMOD Modeling System that contained the aforementioned ADJ_U* formulation bug.

EPA Recommendations

The EPA is providing these recommendations to give state, local, and tribal air agencies an opportunity, if they should so choose, to conduct updated AERMOD modeling of either version 15181 with AERMET in the regulatory default mode or the current regulatory version, 16216r, with the AERMET ADJ_U* regulatory option in order to best inform the proposed designations by the state, local, and tribal air agencies. Because the use of AERMET version 15181 with the ADJ_U* beta option contains a known and corrected formulation bug that leads to concentration under predictions, the associated AERMOD modeling results would be unreliable as a basis for determinations of SO_2 air quality in the modeled area.

Specifically, the EPA is recommending the following:

- For state, local, and tribal air agencies that submitted SO_2 DRR modeling based on AERMOD version 15181 without any beta options selected, the SO_2 DRR modeling results would not be affected by the formulation bug and provided they are otherwise representative may be a sufficient basis to inform the Round 3 – SO_2 designations process.
- For state, local, and tribal air agencies, with or without alternative model approval, that submitted SO_2 DRR modeling based on AERMOD version 15181 that included AERMET version 15181 meteorological data processed with the ADJ_U* beta option, the SO_2 DRR modeling results would be affected by the formulation bug and, consequently, would not be considered sufficiently representative to inform the Round 3 – SO_2 designations. This is because the known and corrected formulation bug that results in AERMOD modeled concentrations have an under prediction bias. In these situations, the EPA is recommending that state, local, and tribal air agencies consider submitting updated modeling with AERMOD version 16216r to best inform the EPA's consideration in the Round 3 – SO_2 designations process. Note, because the EPA must consider all available information for designation determinations, any 3rd party modeling submitted to the EPA that uses the AERMOD version 16216r with or without the ADJ_U* regulatory option could be an important consideration, especially if no updated modeling is provided by the state, local, or tribal air agency.

Additionally, any SO_2 DRR modeling submitted based on the use of any other beta options in the AERMOD Modeling System or alternative modeling techniques that also did not gain alternative

[9] EPA Region 1 – Schiller Station Energy Generating Facility (https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=16-I-01) and EPA Region 8 – R.M. Heskett Station facility (https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=16-VIII-01).

model approval from the appropriate EPA Regional Office with concurrence from the EPA's Model Clearinghouse per Section 3.2.2 of the *Guideline*, should be supplemented with the appropriate justification and provided to the appropriate EPA Regional Office for approval as an alternative model to best inform the EPA's consideration in the Round 3 – SO_2 designations process. In all situations, an open dialogue and coordination between the state, local, and tribal air agencies and the respective EPA Regional Office is strongly encouraged.