

## Final Technical Support Document

### Tennessee Area Designations for the 2010 SO<sub>2</sub> Primary National Ambient Air Quality Standard

#### Summary

Pursuant to section 107(d) of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (EPA, or the Agency) must designate areas as either “unclassifiable,” “attainment,” or “nonattainment” for the 2010 1-hour sulfur dioxide (SO<sub>2</sub>) primary national ambient air quality standard (NAAQS). Section 107(d) of the CAA defines a nonattainment area as one that does not meet the NAAQS or that contributes to a NAAQS violation in a nearby area, an attainment area as any area other than a nonattainment area that meets the NAAQS, and an unclassifiable area as any area that cannot be classified on the basis of available information as meeting or not meeting the NAAQS.

July 2, 2016, is the deadline established by the U.S. District Court for the Northern District of California for the EPA to designate certain areas. This deadline is the first of three deadlines established by the court for the EPA to complete area designations for the 2010 SO<sub>2</sub> NAAQS. This deadline applies to certain areas in Tennessee because one emission source(s) meet the conditions of the court’s order.

The Tennessee Department of Environment and Conservation (TDEC) submitted updated recommendations on September 16, 2015, and an updated submission on October 30, 2015, with additional supporting information for the recommendation on January 6, 2016<sup>1</sup>, which was further revised on March 4, 2016.<sup>2</sup> Table 1 below lists Tennessee’s recommendations and identifies the county in Tennessee that the EPA is designating in order to meet the July 2, 2016 court-ordered deadline. After carefully considering all available information, the EPA concludes that it is unable to determine whether Sumner County is meeting the 2010 primary SO<sub>2</sub> NAAQS. Therefore, the EPA is designating the area as unclassifiable. This final designation(s) is based on an assessment and characterization of air quality through ambient air quality data, air dispersion modeling, other evidence and supporting information, or a combination of the above.

**Table 1 – Tennessee’s Recommended and the EPA’s Final Designations**

Area	State’s Recommended Area Definition	State’s Recommended Designation	The EPA’s Final Area Definition	The EPA’s Final Designation
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<sup>1</sup> This additional information from TDEC is dated December 28, 2015, however, the EPA received this information from TDEC on January 6, 2016 via email from Jimmy Johnston, Deputy Director, Division of Air Pollution Control, TDEC to Lynora Benjamin, Chief, Air Regulatory Management Section, U.S. EPA Region 4.

<sup>2</sup> The EPA notes that all subsequent information submitted by TDEC after September 16, 2015 was provided to support their original attainment designation for 50 km radius around the Tennessee Valley Authority (TVA) Gallatin facility.

Sumner County, Tennessee Area	Vicinity of the TVA Gallatin Fossil Plant in Sumner County within a 50 kilometers (km) radius of the facility, centered on the following coordinates: 36.3165, -86.4033	Attainment	Sumner County (Sumner County, TN)	Unclassifiable
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### Background

On June 3, 2010, the EPA revised the primary (health based) SO<sub>2</sub> NAAQS by establishing a new 1-hour standard at a level of 75 parts per billion (ppb) which is met at an ambient air quality monitoring site when the 3-year average of the 99th percentile of 1-hour daily maximum concentrations does not exceed 75 ppb. This NAAQS was published in the *Federal Register* on June 22, 2010 (75 FR 35520), and is codified at 40 CFR 50.17. The EPA determined this is the level necessary to protect public health with an adequate margin of safety, especially for children, the elderly, and those with asthma. These groups are particularly susceptible to the health effects associated with breathing SO<sub>2</sub>. The two prior primary standards of 140 ppb evaluated over 24 hours, and 30 ppb evaluated over an entire year, codified at 40 CFR 50.4, remain applicable.<sup>3</sup> However, the EPA is not currently designating areas on the basis of either of these two primary standards. Similarly, the secondary standard for SO<sub>2</sub>, set at 500 ppb evaluated over 3 hours, codified at 40 CFR 50.5, has not been revised, and the EPA is also not currently designating areas on the basis of the secondary standard.

### General Approach and Schedule

Section 107(d) of the CAA requires that not later than 1 year after promulgation of a new or revised NAAQS, state governors must submit their recommendations for designations and boundaries to the EPA. Section 107(d) also requires the EPA to provide notification to states no less than 120 days prior to promulgating an initial area designation that is a modification of a state's recommendation. If a state does not submit designation recommendations, the EPA may promulgate the designations that it deems appropriate without prior notification to the state, although it is our intention to provide such notification when possible. If a state or tribe disagrees with the EPA's intended designations, it is given an opportunity within the 120-day period to demonstrate why any proposed modification is inappropriate. The EPA is required to complete designations within 2 years after promulgation of a new or revised NAAQS, unless the EPA

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<sup>3</sup> 40 CFR 50.4(e) provides that the two prior primary NAAQS will no longer apply to an area 1 year after its designation under the 2010 NAAQS, except that for areas designated nonattainment under the prior NAAQS as of August 22, 2010, and areas not meeting the requirements of a SIP Call under the prior NAAQS, the prior NAAQS will apply until that area submits and the EPA approves a SIP providing for attainment of the 2010 NAAQS. Tennessee is not designated nonattainment under the previous primary NAAQS nor is it an area not meeting the requirements of a SIP Call under the prior NAAQS.

determines that sufficient information is not available, in which case the deadline is extended to 3 years. The 3-year deadline for the revised SO<sub>2</sub> NAAQS was June 2, 2013.

On August 5, 2013, the EPA published a final rule establishing air quality designations for 29 areas in the United States for the 2010 SO<sub>2</sub> NAAQS, based on recorded air quality monitoring data from 2009 - 2011 showing violations of the NAAQS (78 FR 47191). In that rulemaking, the EPA committed to address, in separate future actions, the designations for all other areas for which the Agency was not yet prepared to issue designations.

Following the initial August 5, 2013, designations, three lawsuits were filed against the EPA in different U.S. District Courts, alleging the Agency had failed to perform a nondiscretionary duty under the CAA by not designating all portions of the country by the June 2, 2013, deadline. In an effort intended to resolve the litigation in one of those cases, plaintiffs, Sierra Club and the Natural Resources Defense Council, and the EPA filed a proposed consent decree with the U.S. District Court for the Northern District of California. On March 2, 2015, the court entered the consent decree and issued an enforceable order for the EPA to complete the area designations according to the court-ordered schedule.

According to the court-ordered schedule, the EPA must complete the remaining designations by three specific deadlines. By no later than July 2, 2016 (16 months from the court's order), the EPA must designate two groups of areas: (1) areas that have newly monitored violations of the 2010 SO<sub>2</sub> NAAQS, and (2) areas that contain any stationary sources that had not been announced as of March 2, 2015, for retirement and that, according to the EPA's Air Markets Database, emitted in 2012 either (i) more than 16,000 tons of SO<sub>2</sub>, or (ii) more than 2,600 tons of SO<sub>2</sub> with an annual average emission rate of at least 0.45 pounds of SO<sub>2</sub> per one million British thermal units (lbs SO<sub>2</sub>/mmBTU). Specifically, a stationary source with a coal-fired unit that, as of January 1, 2010, had a capacity of over 5 megawatts and otherwise meets the emissions criteria, is excluded from the July 2, 2016, deadline if it had announced through a company public announcement, public utilities commission filing, consent decree, public legal settlement, final state or federal permit filing, or other similar means of communication, by March 2, 2015, that it will cease burning coal at that unit.

The last two deadlines for completing remaining designations are December 31, 2017, and December 31, 2020. The EPA has separately promulgated requirements for state and other air agencies to provide additional monitoring or modeling information on a timetable consistent with these designation deadlines. We expect this information to become available in time to help inform these subsequent designations. These requirements were promulgated on August 21, 2015 (80 FR 51052), in a rule known as the SO<sub>2</sub> Data Requirements Rule (DRR), codified at 40 CFR part 51 subpart BB.

Updated designations guidance was issued by the EPA through a March 20, 2015, memorandum from Stephen D. Page, Director, U.S. EPA, Office of Air Quality Planning and Standards, to Air Division Directors, U.S. EPA Regions 1-10. This memorandum supersedes earlier designation guidance for the 2010 SO<sub>2</sub> NAAQS, issued on March 24, 2011, and it identifies factors that the EPA intends to evaluate in determining whether areas are in violation of the 2010 SO<sub>2</sub> NAAQS. The guidance also contains the factors the EPA intends to evaluate in determining the boundaries

for all remaining areas in the country, consistent with the court's order and schedule. These factors include: 1) Air quality characterization via ambient monitoring or dispersion modeling results; 2) Emissions-related data; 3) Meteorology; 4) Geography and topography; and 5) Jurisdictional boundaries. This guidance was supplemented by two non-binding technical assistance documents intended to assist states and other interested parties in their efforts to characterize air quality through air dispersion modeling or ambient air quality monitoring for sources that emit SO<sub>2</sub>. Notably, the EPA's documents titled, "SO<sub>2</sub> NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) and "SO<sub>2</sub> NAAQS Designations Source-Oriented Monitoring Technical Assistance Document" (Monitoring TAD), were available to states and other interested parties. Both of these TADs were most recently updated in February 2016.

Based on complete, quality assured and certified ambient air quality data collected between 2013 and 2015, no violations of the 2010 SO<sub>2</sub> NAAQS have been recorded at ambient air quality monitors in any undesignated part of Tennessee. However, there is one source in the State meeting the emissions criteria of the consent decree for which the EPA must complete designations by July 2, 2016. In this final technical support document (TSD), the EPA discusses its review and technical analysis of Tennessee's updated recommendations for the areas that we must designate. The EPA also discusses any intended and final modifications from the State's recommendation based on all available data before us.

The following are definitions of important terms used in this document:

- 1) 2010 SO<sub>2</sub> NAAQS – the primary NAAQS for SO<sub>2</sub> promulgated in 2010. This NAAQS is 75 ppb, based on the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour average concentrations. See 40 CFR 50.17.
- 2) Attaining monitor – an ambient air monitor meeting all methods, quality assurance, and siting criteria and requirements whose valid design value is equal to or less than 75 ppb, based on data analysis conducted in accordance with Appendix T of 40 CFR part 50.
- 3) Design Value – a statistic computed according to the data handling procedures of the NAAQS (in 40 CFR part 50 Appendix T) that, by comparison to the level of the NAAQS, indicates whether the area is violating the NAAQS.
- 4) Designated nonattainment area – an area which the EPA has determined has violated the 2010 SO<sub>2</sub> NAAQS or contributed to a violation in a nearby area. A nonattainment designation reflects considerations of the state's recommendations and all of the information discussed in this document. The EPA's decision is based on all available information including the most recent 3 years of air quality monitoring data, available modeling analyses, and any other relevant information.
- 5) Designated unclassifiable area – an area for which the EPA cannot determine based on all available information whether or not it meets the 2010 SO<sub>2</sub> NAAQS.
- 6) Designated unclassifiable/attainment area – an area which the EPA has determined to have sufficient evidence to find either is attaining or is likely to be attaining the NAAQS. The EPA's decision is based on all available information including the most recent 3 years of air quality monitoring data, available modeling analyses, and any other relevant information.
- 7) Modeled violation – a violation based on air dispersion modeling.

- 8) Recommended attainment area – an area a state or tribe has recommended that the EPA designate as attainment.
- 9) Recommended nonattainment area – an area a state or tribe has recommended that the EPA designate as nonattainment.
- 10) Recommended unclassifiable area – an area a state or tribe has recommended that the EPA designate as unclassifiable.
- 11) Recommended unclassifiable/attainment area – an area a state or tribe has recommended that the EPA designate as unclassifiable/attainment.
- 12) Violating monitor – an ambient air monitor meeting all methods, quality assurance, and siting criteria and requirements whose valid design value exceeds 75 ppb, based on data analysis conducted in accordance with Appendix T of 40 CFR part 50.

## Technical Analysis for Sumner County, Tennessee Area

### Introduction

The Sumner County, TN, area contains one stationary source that, according to the EPA's Air Markets Database, emitted in 2012 either more than 16,000 tons of SO<sub>2</sub> or more than 2,600 tons of SO<sub>2</sub> and had an annual average emission rate of at least 0.45 lbs SO<sub>2</sub>/mmBTU. Specifically, in 2012, the Tennessee Valley Authority (TVA) Gallatin Fossil Plant electric generating facility emitted 21,731 tons of SO<sub>2</sub> and had an emissions rate of 0.62 lbs SO<sub>2</sub>/mmBTU. TVA Gallatin is located in central Tennessee in the southern portion of Sumner County approximately 5 km southeast of the center of Gallatin, TN. As of March 2, 2015, this stationary source had not met the criteria for being "announced for retirement." Pursuant to the March 2, 2015 court-ordered schedule, the EPA must designate the area surrounding this facility by July 2, 2016.

In its September 16, 2015, submission, TDEC recommended that the area surrounding TVA Gallatin electric generating facility, specifically the 50 km radius of the facility centered on coordinates 36.3165 and -86.4033, be designated as attainment based on an assessment and characterization of air quality from the facility and other nearby sources which may have a potential impact in the area of analysis where maximum concentrations of SO<sub>2</sub> are expected. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing allowable emissions.

On February 16, 2016, the EPA notified Tennessee that we intended to designate the Sumner County area as unclassifiable. Additionally, we informed Tennessee that our intended boundaries for the unclassifiable area consisted of the entirety of Sumner County. Our intended designation and associated boundaries were based on, among other things, unresolved issues with the State's October 30, 2015, modeling analysis, including controls that were not yet in place and operational and associated future potential to emit (PTE) limits that were not yet federally-enforceable. Specifically, the EPA reviewed two scenarios that Tennessee provided in their October 30, 2016, submission and determined that neither of the scenarios were performed consistent with the Modeling TAD or the EPA guidance on modeling for the SO<sub>2</sub> NAAQS. As a result of these unresolved issues the EPA explained in the February 16, 2016, intended designations that Tennessee's modeling analysis did not use the necessary technical information and approach to determine if the area is or is not meeting the SO<sub>2</sub> NAAQS, thus resulting in a proposed unclassifiable designation for Sumner County. The EPA indicated that if Tennessee resolved these issues then the Agency would consider revising the intended designations to unclassifiable/attainment. However, after careful review of Tennessee's subsequent information provided after February 16, 2016<sup>4</sup>, the EPA has determined that Tennessee has not addressed every specific issue outlined in the February 16, 2016, intended designations. Further discussion of the EPA's assessment of Tennessee's information is provided below.

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<sup>4</sup> Notably, in the EPA's February 16, 2016 intended designations, we indicated that Tennessee provided additional information in January 6, 2016 to support the state's recommendation but that the Agency did not have sufficient time to complete a full review of this information but indicated it would be considered prior to final designations. Tennessee subsequently updated the January 6, 2016 information with additional data on March 4, 2016.

Detailed rationale, analyses, and other information supporting our intended designation for this area can be found in the preliminary technical support document for Tennessee, and this document along with all others related to this rulemaking can be found in Docket ID EPA-HQ-OAR-2014-0464.

### Assessment of New Information

In our February 16, 2016, notification to Tennessee regarding our intended unclassifiable designation for the Sumner County, Tennessee area, the EPA requested that any additional information that the Agency should consider prior to finalizing the designation should be submitted by April 19, 2016. On March 1, 2016, the EPA also published a notice of availability and public comment period in the *Federal Register*, inviting the public to review and provide input on our intended designations by March 31, 2016 (81 FR 10563).

The EPA is explicitly incorporating and relying upon the analyses and information presented in the preliminary technical support document for the purposes of our final designation for this area, except to the extent that any new information submitted to the EPA or conclusions presented in this final technical support document and our response to comments document (RTC), available in the docket, supersede those found in the preliminary document.

Additionally, the EPA acknowledges that we received information from Tennessee on January 6, 2016 (with subsequent updates on March 4, 2016), regarding our intended designation for this area prior to the February 16, 2016, notification to the State. However, due to the timing of receipt relative to the scheduled timeline for announcing our intended designation, the EPA was not able to fully evaluate the information at that time; this final technical support document incorporates our analyses and conclusions regarding that information. Notably, Tennessee provided additional air dispersion modeling information on January 6, 2016, prior to the issuance of letters conveying our intended designation and the corresponding 120-day period, and subsequently revised modeling and information on March 4, 2016, during the comment period, asserting that the TVA Gallatin facility would meet a post-control limit for each of the four emitting units that would ensure attainment of the 2010 SO<sub>2</sub> NAAQS. This information was submitted to support a modification to our proposed designation.

Subsequent to our February 16, 2016, notification to the State, the EPA received additional information from Tennessee to support its recommended designation of attainment for the area surrounding the TVA Gallatin facility. The EPA received no comments or new information from any parties other than the State. Additional information, specifically air dispersion modeling, a minor source permit application, and a preliminary minor source permit revision, were submitted to the EPA on March 4, 2016, during the state and public comment period in order to revise the characterization of air quality in the Sumner County, Tennessee, area. This modeling analysis considered a future allowable PTE emissions limit to show attainment of the SO<sub>2</sub> NAAQS. However, as further detailed below, this new information is insufficient because it does not provide adequate information for EPA to determine whether the area is meeting or not meeting the SO<sub>2</sub> NAAQS. The review of this new information that follows references the Modeling TAD, Monitoring TAD, and the factors for evaluation contained in the EPA's March 20, 2015, guidance, as appropriate and applicable. The discussion will focus mainly on the most updated

information submitted to the EPA on March 4, 2016, as this includes the most recent and complete information available.

### *Model Selection and Modeling Components*

The EPA's Modeling TAD notes that for area designations under the 2010 SO<sub>2</sub> NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. In some instances the recommended model may be a model other than AERMOD, such as the BLP model for buoyant line sources. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRIME: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

Tennessee used AERMOD version 15131, and a discussion of the individual components will be referenced in the corresponding discussion that follows, as appropriate.

### *Modeling Parameter: Rural or Urban Dispersion*

The EPA's recommended procedure for characterizing an area by prevalent land use is based on evaluating the dispersion environment within 3 km of the facility. According to the EPA's modeling guidelines contained in documents such as the Modeling TAD, rural dispersion coefficients are to be used in the dispersion modeling analysis if more than 50 percent of the area within a 3 km radius of the facility is classified as rural. Conversely, if more than 50 percent of the area is urban, urban dispersion coefficients should be used in the modeling analysis. When performing the modeling for the area of analysis, Tennessee determined that it was most appropriate to run the model in rural model.

Tennessee did not originally provide information to support using the rural option for modeling the TVA Gallatin for either the future allowable PTE emissions scenario or the 2012-2014 actual emissions scenario. The information provided through December 28, 2015, did not enable the EPA to determine if rural dispersion coefficients are appropriate. However, the supplemental revised modeling demonstration submitted on March 4, 2016, included information on the selection of the classification utilized. Tennessee analyzed land use within a 3 kilometer radius of the facility to confirm that the land use surrounding the source is less than 50 percent urban thereby justifying the use of the rural option. Therefore, the state determined that it was most appropriate to run the model with rural dispersion coefficients and the EPA agrees with this determination.

### *Modeling Parameter: Area of Analysis (Receptor Grid)*



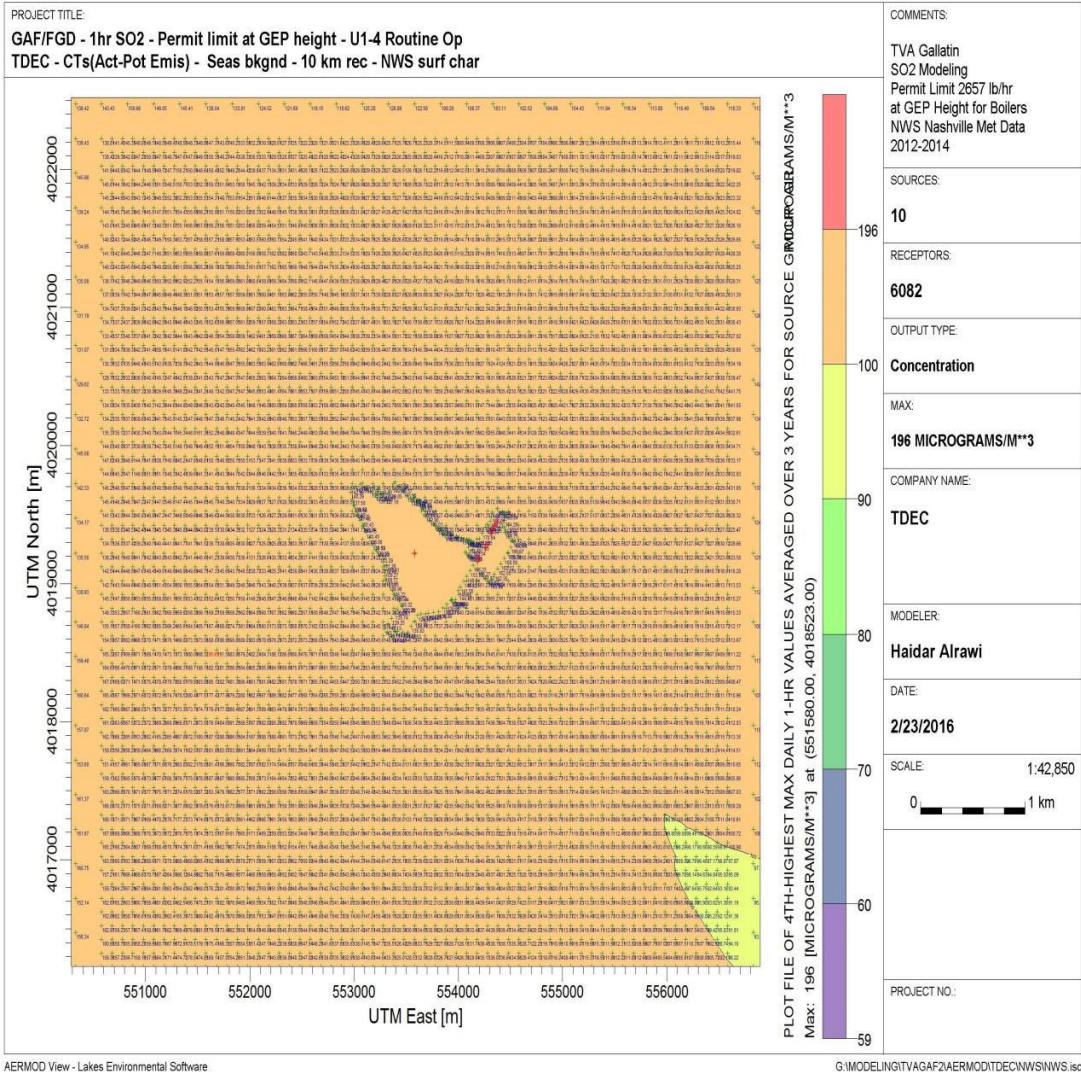
The EPA thinks that a reasonable first step towards characterization of air quality in the area surrounding TVA Gallatin is to determine the extent of the area of analysis, i.e., receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO<sub>2</sub> emission sources or facilities considered for modeling; the extent of significant concentration gradients of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO<sub>2</sub> concentrations.

The grid receptor spacing for the area of analysis chosen by Tennessee is as follows:

- 100 m out to 3 km
- 250 m out to 5 km
- 500 m out to 10 km

The original October 30, 2015 modeling analysis was over a 50 km grid, but the updated modeling provided in January and subsequently in March 2016 revised the grid to 10 km resulting in a decrease in the number of receptors from 10,404 to 6,082 covering the facility and the square area 10 km in each direction from the facility. Tennessee justified this reduced receptor grid size by indicating that there are no other SO<sub>2</sub> sources located in the modeling domain or are expected to cause a significant concentration gradient within the modeling domain. Figure 2, which was included in Tennessee's submission during the comment period, shows the chosen area of analysis surrounding the facility, as well as the receptor grid for the area of analysis. Receptors for the purposes of this designation effort were placed everywhere within the area of analysis, except that receptors falling within the facility fence line were excluded. The EPA finds that additional justification is needed, and should be provided by Tennessee, to demonstrate that the 10 km grid is adequate to fully characterize the maximum SO<sub>2</sub> concentrations in the area. The 10 km grid may not be adequate because of the tall stacks at Gallatin and the presence of complex terrain (terrain elevations above the stack heights) beyond 10 km from the facility. The impacts of the area's geography and topography will be discussed later within this document.

Figure 2: Receptor Grid for the TVA Gallatin Area of Analysis



For the area around TVA Gallatin, the State included no other emitters of SO<sub>2</sub> within 50 km of the facility in any direction. For the Sumner County Area, for the purpose of determining whether other sources should be included in the modeling analysis, Tennessee assessed SO<sub>2</sub> emitting sources within a 12 county, 50 km area of analysis that emitted 100 tpy or more based on 2014 emissions data. This area of analysis was chosen because Tennessee believes it represents the area where maximum concentrations of SO<sub>2</sub> are expected. Along with TVA Gallatin in Sumner County, only two other sources in the area of analysis, Vanderbilt University and Carlex Glass America, LLC in Davidson County emitted over 100 tpy in 2014. Vanderbilt University, located approximately 41 km southwest of TVA Gallatin, emitted 843.8 tons in 2014, and according to Tennessee shut down its coal-fired boiler in 2014. According to TDEC and a press release, Vanderbilt converted to natural gas operation and decommissioned its last coal-fired boiler in 2014. Carlex Glass America, LCC, located approximately 45 km from TVA

Gallatin and 23 km from the Sumner County border, emitted 133.3 tons of SO<sub>2</sub> in 2014. Tennessee did not include either of these sources in the modeling analysis due to the conversion and decommissioning of the coal fired boiler at Vanderbilt University and the low level of 2014 emissions from Carlex Glass America along with it being a large distance from the TVA Gallatin facility. In addition, Tennessee asserted that no other emitters of SO<sub>2</sub> besides TVA Gallatin were expected to significantly impact the area of analysis, and therefore no other sources were included in the modeling.

The EPA's February 6, 2016, intended designations indicated that the Vanderbilt University and Carlex Glass America sources were located within the vicinity of the Trinity Lane background SO<sub>2</sub> monitor and therefore their potential impacts would be accounted for by use of the 2012-2014 design value background concentration. However, since the time of our February 6, 2016, intended designations, the EPA became aware that the 2012-2104 Trinity Lane design value was incomplete. As discussed in the Background Concentration section below, use of this incomplete data calls into question the results of the modeling analysis.

#### *Modeling Parameter: Source Characterization*

The modeling report and supporting model input and output files provide information for characterizing the sources that were modeled including source locations and stack parameters (stack heights, exit temperatures, exit velocities, and diameters). Tennessee's October 30, 2015, modeling utilized the BPIPPRIME preprocessor to evaluate the potential for building downwash for the future allowable PTE scenario and the 2012-2014 actual emissions scenario but did not provide sufficient information on building layout and locations that were input into BRIPPRIME. The revised March 4, 2016, modeling submittal provides a description of building layouts and locations which suggests that the use of BPIPPRIME adequately addresses building downwash. Tennessee provided two scenarios for modeling future allowable emissions in the March 4, 2016, submittal. The first scenario developed a critical emission limit<sup>5</sup> based on routine operation of the four coal-fired units, taking credit for the future operation of the scrubbers and actual stack heights. This approach deviates from the Modeling TAD because it uses actual stack heights instead of GEP heights. Therefore, the EPA is not able to rely upon them as a basis for concluding that the area is now meeting the 2010 primary SO<sub>2</sub> NAAQS. Tennessee's second modeled scenario utilized the future allowable permit limit by adjusting a proposed 30-day rolling average emission limit to an equivalent 1-hour limit and using GEP stack heights pursuant to the Modeling TAD rather than actual stack heights. EPA notes that TDEC adequately addressed the building downwash analysis using BPIPPRIME and GEP stack heights. Also, EPA notes that the future allowable emission limit based on a 30-day rolling average and critical emission limit was derived in a manner consistent with Appendices B and C of EPA's 2014 SO<sub>2</sub> Nonattainment Area SIP Guidance. However, these proposed future allowable limits are not yet federally enforceable nor effective. Therefore, the EPA is not able to rely upon them as a basis for concluding that the area is now meeting the 2010 primary SO<sub>2</sub> NAAQS.

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<sup>5</sup> The critical emission limit is the maximum emission rate at which the NAAQS would be met.

*Modeling Parameter: Emissions*

The EPA’s Modeling TAD notes that for the purposes of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also provides for the flexibility of using allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate.

The EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information when it is available and that these data are available for many electric generating units. In the absence of CEMS data, the EPA’s Modeling TAD highly encourages the use of AERMOD’s hourly varying emissions keyword HOUREMIS or through the use of AERMOD’s variable emissions factors keyword EMISFACT. When choosing one of these methods, the EPA believes that detailed throughput, operating schedules, and emissions information from the impacted source[s] should be used.

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. Specifically, a facility may have recently adopted a new federally enforceable emissions limit, been subject to a federally enforceable consent decree, or implemented other federally enforceable mechanisms and control technologies to limit SO<sub>2</sub> emissions to a level that indicates compliance with the NAAQS. These new limits or conditions may be used in the application of AERMOD. In these cases, the Modeling TAD notes that the existing SO<sub>2</sub> emissions inventories used for permitting or SIP planning demonstrations should contain the necessary emissions information for designations-related modeling. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, “Guideline on Air Quality Models.”

As previously noted, Tennessee included TVA Gallatin and no other emitters of SO<sub>2</sub> within 50 km in the area of analysis. Tennessee’s March 4, 2016 update modeled TVA Gallatin uses the future, not yet effective allowable PTE limits for SO<sub>2</sub>. The facility in Tennessee’s area of analysis and its associated PTE rates are summarized below.

Table 2: SO<sub>2</sub> Emissions based on future PTE from TVA Gallatin in the Sumner County Area of Analysis

Facility Name	SO <sub>2</sub> Emissions (tons per year, based on PTE)
TVA Gallatin: Unit 1	2,792.3
TVA Gallatin: Unit 2	2,792.3
TVA Gallatin: Unit 3	3,026.6
TVA Gallatin: Unit 4	3,026.6

Total Emissions From TVA Gallatin in Tennessee's Area of Analysis	11,637.8 <sup>6</sup>
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The future allowable PTE limit for TVA Gallatin was the result of ongoing installation and operation of flue gas desulfurization (FGD) on all four coal-fired units at the facility and a preliminary construction permit to include specific limits to avoid violation of the NAAQS. The EPA received a preliminary permit on February 23, 2016, that included a preliminary permit limit, but the permit has not been issued by the State, and consequently is not yet federally-enforceable. Moreover, the limit in the preliminary permit was 2,236 lb/hr based on a 30-day rolling average, and not the 1,966<sup>7</sup> lb/hr 30-day average limit utilized in the revised March 4, 2016, modeling. The EPA notes that the future allowable emission limit of 1,966 pounds per hour based on a 30-day rolling average and critical emission limit was derived in a manner consistent with Appendices B and C of the EPA's 2014 SO<sub>2</sub> Nonattainment Area SIP Guidance. However, this proposed future allowable limit is not yet federally enforceable or effective and relies upon invalid background monitoring data from the Trinity Lane Monitor as discussed in the Background Concentration of SO<sub>2</sub> Section below.

*Modeling Parameter: Meteorology and Surface Characteristics*

The most recent 3 years of available meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. As noted in the Modeling TAD, the selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data are 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 include National Weather Service (NWS) stations, site-specific or onsite data, and other sources such as universities, the Federal Aviation Administration, and military stations.

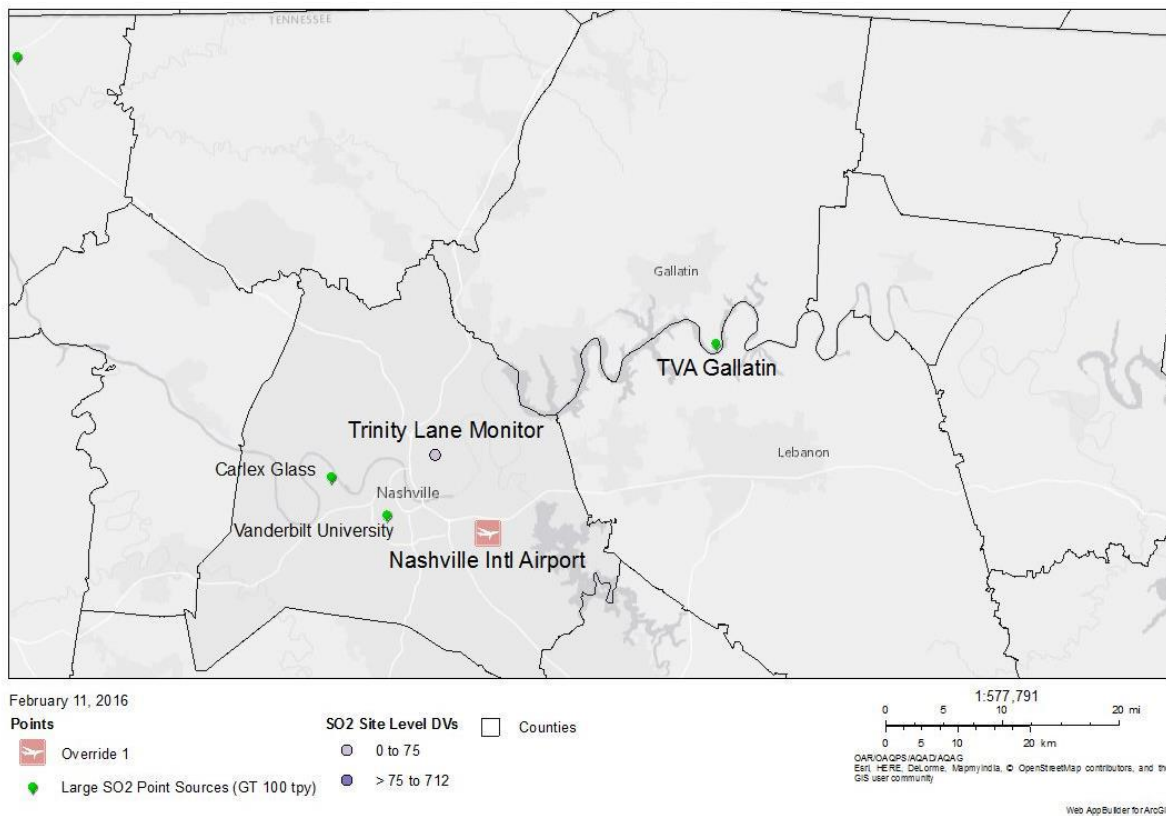
Tennessee's revised March 4, 2016, modeling analysis utilized the same meteorological data from the NWS station in Nashville, Tennessee (approximately 32 km to the southwest), including upper air observations as best representative of meteorological conditions within the area of analysis as discussed in the TSD for EPA's February 16, 2016, intended designations. The EPA observed that Tennessee's October 30, 2015, modeling analysis did not indicate how surface characteristics were derived (i.e. whether the AERSURFACE tool was utilized and what options and procedures were followed). However, the March 4, 2016, supplemental modeling assessment specifies that AERSURFACE version 13016 was used with data from the NWS station in Nashville, Tennessee (located at Latitude 36.110535, Longitude -86.688137), to estimate the surface characteristics of the area of analysis. Tennessee estimated values for 12 spatial sectors out to 1 km at a seasonal temporal resolution for average moisture conditions. Tennessee also estimated values for albedo (the fraction of solar energy reflected from the earth back into space), the Bowen ratio (the method generally used to calculate heat lost or heat gained in a substance), and the surface roughness (sometimes referred to as "Zo"). In the figure below

<sup>6</sup> Based on the total critical emission limit for units 1-4 (2,657 pounds per hours) and 8,760 hours per year of operation.

<sup>7</sup> The modeling was based on modeling a critical emission value of 2,657 pounds per hour total for all four units.

(generated by the EPA), the location of the Nashville, Tennessee, NWS station is shown relative to the TVA Gallatin area of analysis.

Figure 3: TVA Gallatin Facility Area of Analysis and the Nashville, Tennessee, NWS Station



Meteorological data from the above surface and upper air stations were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. Tennessee followed the methodology and settings presented in the EPA's Modeling TAD in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of 1 minute duration was provided from the same instrument tower, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE. These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of

meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates. Tennessee used AERMINUTE to process 1-minute ASOS data from Nashville, Tennessee, to generate hourly average winds for input to AERMET.

*Modeling Parameter: Geography and Terrain*

The terrain in the area of analysis is best described as generally rolling to hilly. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The source of the elevation data incorporated into the model was the United States Geological Survey National Elevation Database.

*Modeling Parameter: Background Concentrations of SO<sub>2</sub>*

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO<sub>2</sub> that are ultimately added to the modeled design values: 1) a “first tier” approach, based on monitored design values, or 2) a temporally varying approach, based on the 99<sup>th</sup> percentile monitored concentrations by hour of day and season or month. In the revised March 4, 2016, modeling, Tennessee chose to use the 2<sup>nd</sup> approach using temporally varying monitored concentrations from the Nashville/Davidson/Trinity Lane ambient monitor (AQS ID 47-037-0011). Tennessee described the Nashville monitor as a “conservative urban-based” background monitor. Since the time the EPA released our intended designations in February 2016, the EPA has become aware that the 2012-2014 design value from the Trinity Lane monitoring site was incomplete due to a significant amount of missing data during the 2012-2014 period. Use of this incomplete background monitored data calls into question the results of the Tennessee’s March 4, 2016, modeling analysis. Therefore, this modeling analysis does not provide necessary information to demonstrate attainment with the 1-hour SO<sub>2</sub> NAAQS.

*Summary of Modeling Results*

The AERMOD modeling parameters, as supplied by additional information from Tennessee during the comment period for the Sumner County area of analysis are summarized below in Table 3.

Table 3: AERMOD Modeling Parameters for the Sumner County Area of Analysis

Sumner County Area of Analysis	
AERMOD Version	15181
Dispersion Characteristics	Rural
Modeled Sources	1
Modeled Stacks	12
Modeled Structures	48
Modeled Fence lines	1
Total receptors	6,082
Emissions Type	Future Allowable PTE
Emissions Years	New allowable limit effective in 2016/TBD



Meteorology Years	2012 – 2014
Surface Meteorology Station	Nashville, Tennessee
Upper Air Meteorology Station	Nashville, Tennessee
Methodology for Calculating Background SO <sub>2</sub> Concentration	Hourly varying
Calculated Background SO <sub>2</sub> Concentration	varying

The results presented below in Table 4 show the magnitude and geographic location of the highest predicted modeled concentration based on future allowable PTE emissions.

Table 4: Maximum Predicted 99th Percentile 1-Hour SO<sub>2</sub> Concentration in the Sumner County Area of Analysis Based on future allowable PTE Emissions

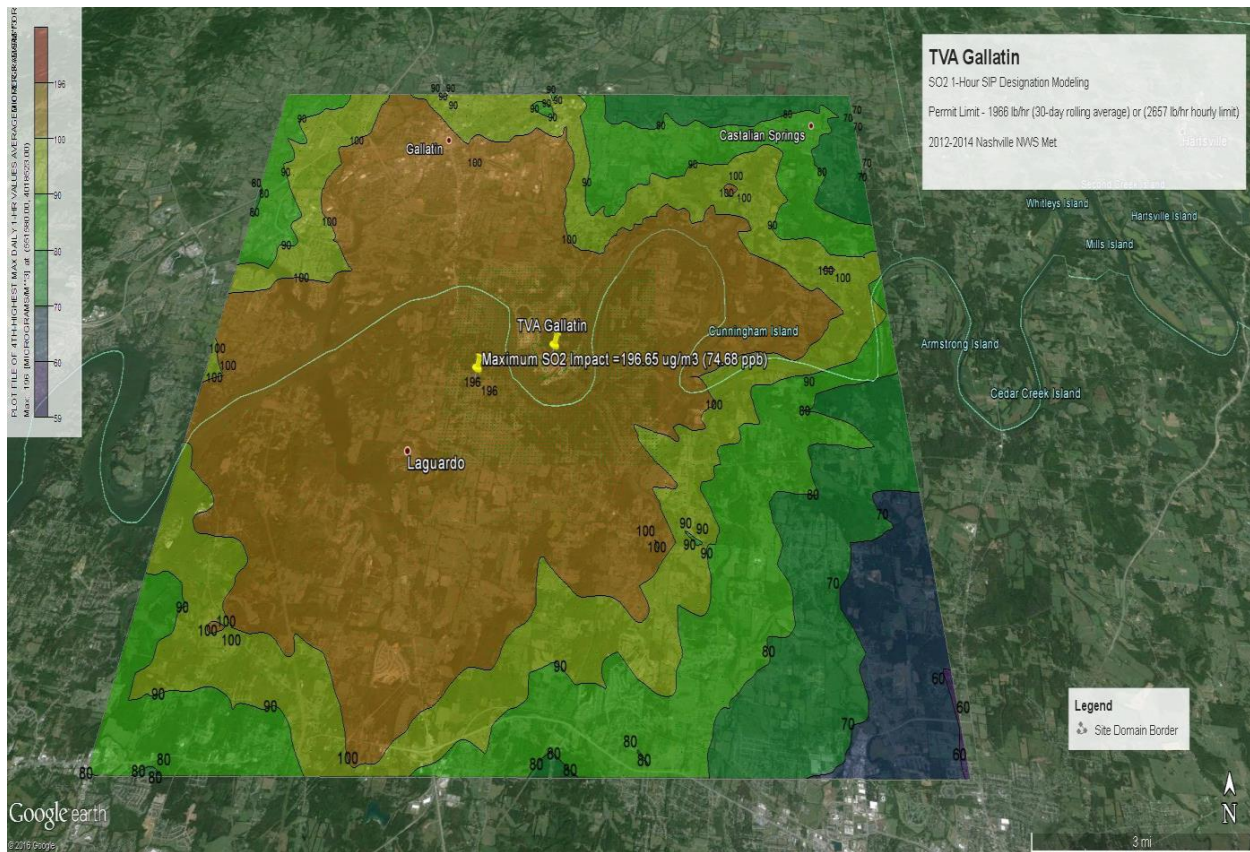
Averaging Period	Data Period	Receptor Location		SO <sub>2</sub> Concentration (µg/m <sup>3</sup> )	
		UTM/Latitude	UTM/Longitude	Modeled (including background)	NAAQS
99th Percentile 1-Hour Average	2012-2014	551580	4018523	195.7	196.5*

\*Equivalent to the 2010 SO<sub>2</sub> NAAQS set at 75 ppb

The State’s modeling indicates that the highest predicted 3-year average 99<sup>th</sup> percentile 1-hour average concentration within the chosen modeling domain is 195.7 µg/m<sup>3</sup>, or 74.6 ppb. This modeled concentration included a background concentration of SO<sub>2</sub> from the Trinity Lane Monitor, and is based on future not-yet-effective allowable PTE emissions from TVA Gallatin that has not yet become federally-enforceable. Additionally, as discussed in the Background Concentration Section of this TSD, the background concentration data from the Trinity Lane monitor is incomplete and therefore modeling that relies on this data is not sufficient to demonstrate that the area is attaining the SO<sub>2</sub> NAAQS. Figure 4 below was included as part of group’s submission and indicates that the predicted value occurred to the southwest of TVA Gallatin.

Figure 4: Maximum Predicted 99<sup>th</sup> Percentile 1-Hour SO<sub>2</sub> Concentrations in the Sumner County Area of Analysis Based on Future Allowable PTE



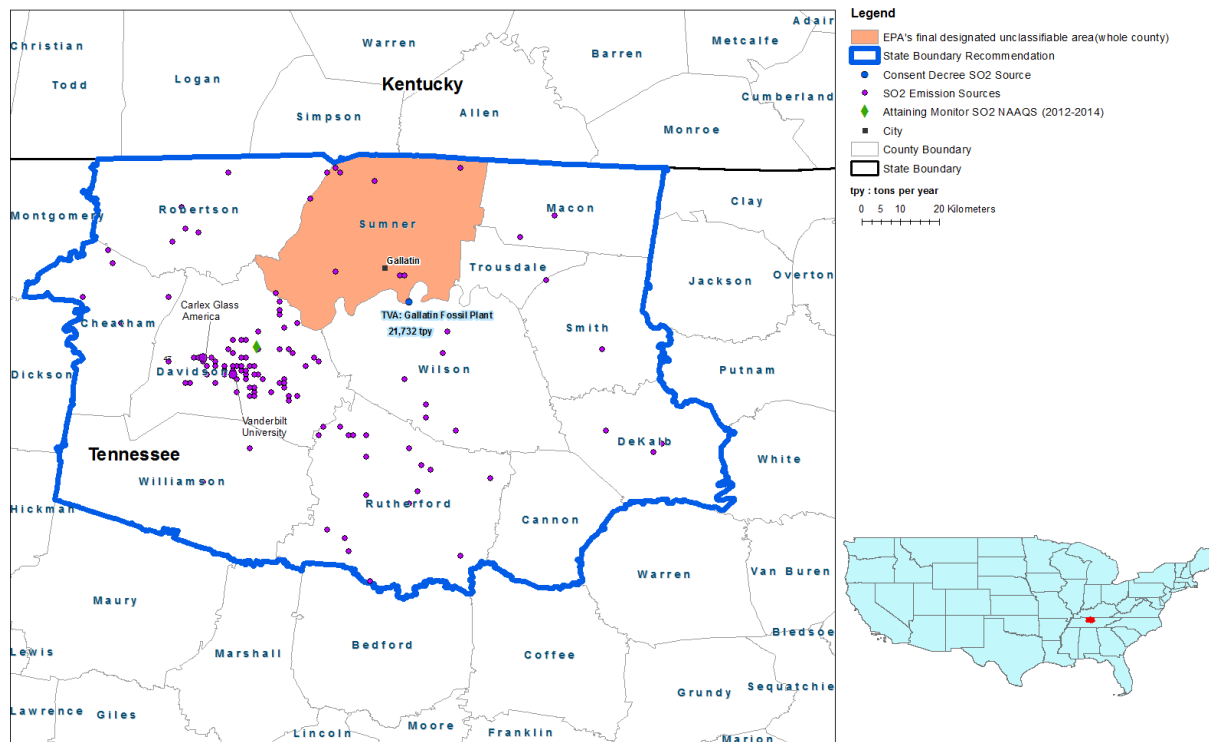


**Jurisdictional Boundaries:**

Once the geographic area of analysis associated with TVA Gallatin, other nearby sources of SO<sub>2</sub>, and background concentration is determined, existing jurisdictional boundaries are considered for the purpose of informing our final unclassifiable area, specifically with respect to clearly defined legal boundaries. Tennessee’s original boundary recommendation for TVA Gallatin was comprised of portions of 12 counties within a 50 km radius of the facility. The revised modeling demonstration extended to 10 km rather than the original 50 km area, but the suggested boundary was not directly addressed or revised with this revised modeling. Based upon the EPA’s review of the State’s assessment, supporting documentation, and all available data, the modeling was based upon future allowable SO<sub>2</sub> emissions limits that are not yet federally-enforceable. Consequently, the EPA intends to designate Sumner County in its entirety as unclassifiable. The EPA believes that our final unclassifiable area, consisting of the entirety of Sumner County, is comprised of a clearly defined legal boundary. We find this boundary to be a suitably clear basis for defining our final unclassifiable area.

The boundary for this unclassifiable area consists of the entirety of Sumner County, and is shown in the figure below. Also included in the figure are nearby emitters of SO<sub>2</sub> and Tennessee’s recommended area.

Figure 5: The EPA’s final unclassifiable area: Sumner County, Tennessee



## Conclusion

After careful evaluation of the State’s recommendation and all information received during the state and public comment period, and additional relevant information as discussed in this document, the EPA has determined that there is insufficient information to determine if the area around TVA Gallatin is or is not meeting the 2010 SO<sub>2</sub> NAAQS, and therefore is designating the area as unclassifiable for the 2010 SO<sub>2</sub> NAAQS. Specifically, the area is comprised the entirety of Sumner County.

The detailed discussion provided above in this TSD summarizes additional modeling analyses provided by Tennessee using a future allowable PTE emissions limit intended to show attainment of the SO<sub>2</sub> NAAQS. However, the EPA observes that the information provided does not resolve all the specific issues regarding the State’s modeling analysis as discussed in our February 16, 2016, intended designations. The EPA’s February 16, 2016, TSD explicitly outlined seven issues regarding Tennessee’s then October 30, 2015, modeling analysis. While Tennessee’s March 4, 2015, revised modeling addresses each of the EPA’s issues cited in the February 16, 2016 TSD, Tennessee has not yet provided sufficient information on a final new federally-enforceable allowable SO<sub>2</sub> emissions limit that models attainment of the SO<sub>2</sub> standard. Furthermore, based on the EPA’s awareness of the incomplete data for the 2012-2014 Trinity Lane background monitor design value, TDEC has not considered an appropriate background

concentration. This includes accounting of impacts from the Vanderbilt University and Carlex Glass America sources in Davidson County. Therefore, the EPA is unable to determine whether the area is or is not attaining the SO<sub>2</sub> NAAQS.

Additionally, Tennessee indicated in their October 30, 2015, modeling analysis that they expected the flue gas desulfurization (FGD) control upgrades<sup>8</sup> for the four coal-fired boilers to be complete and operational by April 16, 2016, noting that two FGD systems were already on-line and operating. In its technical submission and in discussions, the State has also noted that enforceable emission limits associated with these control upgrades were expected to be included in TVA Gallatin's title V permit by April 8, 2016, and, establishes TVA Gallatin's future modeled allowable emission rate federally-enforceable (through a federally enforceable mechanism) and, would include a longer term average limit (if applicable) that the EPA determines is comparatively stringent to a 1-hour limit at the critical emission value. The EPA notes Tennessee submitted a proposed construction permit establishing a new allowable PTE limit on February 23, 2016. However, the permit has not been issued by the state and consequently is not yet federally-enforceable. Additionally, the limit in the preliminary permit was 2,236 lb/hr based on a 30-day rolling average, and not the 1,966 lb/hr 30-day average limit utilized in the revised March 4, 2016, modeling.

The EPA is designating the area around TVA Gallatin as unclassifiable for the 2010 SO<sub>2</sub> NAAQS because the State's modeling analysis relies upon a future allowable SO<sub>2</sub> emissions limit, that is not yet federally-enforceable and that does not correspond to the State's preliminary permit limit's rate, to determine if the area is meeting the SO<sub>2</sub> NAAQS, and because the State has not appropriately accounted for background concentrations. The boundaries for this unclassifiable area consist of the entirety of Sumner County. At this time, our final designation for the State only applies to this area. Consistent with the court-ordered schedule, the EPA will evaluate and designate all remaining undesignated areas in Tennessee by either December 31, 2017, or December 31, 2020.

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<sup>8</sup> The PTE limit for TVA Gallatin is based on installation and operation of FGD on all four coal-fired units at the facility mandated by an April 14, 2011, Federal Facilities Compliance Agreement which requires TVA system-wide annual tonnage limitations for SO<sub>2</sub>.