

Draft Technical Support Document

Tennessee
Area Designations for the 2010 SO₂ 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 one-hour sulfur dioxide (SO₂) primary national ambient air quality standard (NAAQS). The CAA defines a nonattainment area as one that does not meet the NAAQS or that contributes to a violation in a nearby area. An attainment area is defined as any area other than a nonattainment area that meets the NAAQS. Unclassifiable areas are defined as those that cannot be classified on the basis of available information as meeting or not meeting the NAAQS.

Tennessee submitted updated recommendations on September 16, 2015, and an updated submission on October 30, 2015, ahead of a July 2, 2016, deadline for the EPA to designate certain areas. This deadline established by the U.S. District Court for the Northern District of California is the first of three deadlines established by the court for the EPA to complete area designations for the 2010 SO₂ NAAQS. Table 1 below lists Tennessee’s recommendations and identifies the counties or portions of counties in Tennessee that the EPA intends to designate by July 2, 2016, 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 Intended Designations

Area	Tennessee’s Recommended Area Definition	Tennessee’s Recommended Designation	The EPA’s Intended Area Definition	The EPA’s Intended Designation
Sumner County, Tennessee Area	Vicinity of the TVA Gallatin Fossil Plant in Sumner County within a 50 km radius of the facility, centered on the following coordinates: 36.3165, -86.4033	Attainment	Sumner County	Unclassifiable

Background

On June 3, 2010, the EPA revised the primary (health based) SO₂ NAAQS by establishing a new one-hour standard at a level of 75 parts per billion (ppb) which is attained when the three-year average of the 99th percentile of one-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 SO₂. 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.¹ However, the EPA is not currently designating areas on the basis of either of these two primary standards. Similarly, the secondary standard for SO₂, set at 500 ppb evaluated over 3 hours 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 one year after promulgation of a new or revised NAAQS, state governors must submit their recommendations for designations and boundaries to 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 will promulgate the designations that it deems appropriate. If a state or tribe disagrees with the EPA's intended designations, they are given an opportunity within the 120 day period to demonstrate why any proposed modification is inappropriate.

On August 5, 2013, the EPA published a final rule establishing air quality designations for 29 areas in the United States for the 2010 SO₂ 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 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.

¹ 40 CFR 50.4(e) provides that the two prior primary NAAQS will no longer apply to an area one 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 state implementation plan (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. The Tennessee area is not designated nonattainment under the prior NAAQS nor is it an area not meeting the requirements of a SIP Call under the prior NAAQS.

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 SO₂ 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 SO₂ or (ii) more than 2,600 tons of SO₂ with an annual average emission rate of at least 0.45 pounds of SO₂ per one million British thermal units (lbs SO₂/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 states 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 SO₂ Data Requirements Rule (DRR).

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 I-X. This memorandum supersedes earlier designation guidance for the 2010 SO₂ 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 SO₂ 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 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 SO₂. Notably, the EPA released its most recent versions of documents titled, "SO₂ NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) and "SO₂ NAAQS Designations Source-Oriented Monitoring Technical Assistance Document" (Monitoring TAD) in December 2013.

Based on ambient air quality data collected between 2012 and 2014, no monitored violations of the 2010 SO₂ NAAQS have been recorded in any undesignated part of the state.² However, there

² For designations based on ambient air quality monitoring data that violates the 2010 SO₂ NAAQS, the consent decree directs the EPA to evaluate data collected between 2013 and 2015. Absent complete, quality assured and certified data for 2015, the analyses of applicable areas for the EPA's intended designations will be informed by data collected between 2012 and 2014. States with monitors that have recorded a violation of the 2010 SO₂ NAAQS during these years have the option of submitting complete, quality assured and certified data for calendar year 2015 by April 19, 2016 to the EPA for evaluation. If after our review, the ambient air quality data for the area indicates

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 draft technical support document, 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 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 SO₂ NAAQS – The primary NAAQS for SO₂ promulgated in 2010. This NAAQS is 75 ppb, based on the three year average of the 99th percentile of the annual distribution of daily maximum one-hour average concentrations. See 40 CFR 50.17.
2. 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.
3. Designated nonattainment area – an area which the EPA has determined has violated the 2010 SO₂ NAAQS or contributed to a violation in a nearby area. A nonattainment designation reflects considerations of state 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 analysis, and any other relevant information.
4. Designated unclassifiable area – an area which the EPA cannot determine based on all available information whether or not it meets the 2010 SO₂ NAAQS.
5. 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 analysis, and any other relevant information.
6. Modeled violation – a violation based on air dispersion modeling.
7. Recommended attainment area – an area a state or tribe has recommended that the EPA designate as attainment.
8. Recommended nonattainment area – an area a state or tribe has recommended that the EPA designate as nonattainment.
9. Recommended unclassifiable area – an area a state or tribe has recommended that the EPA designate as unclassifiable.
10. Recommended unclassifiable/attainment area – an area a state or tribe has recommended that the EPA designate as unclassifiable/attainment.
11. 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.

that no violation of the NAAQS occurred between 2013 and 2015, the consent decree does not obligate the EPA to complete the designation. Instead, we may designate the area and all other previously undesignated areas in the state on a schedule consistent with the prescribed timing of the court order, i.e., by December 31, 2017, or December 31, 2020.

Technical Analysis for the TVA Gallatin – Sumner County Area

Introduction

Sumner County, Tennessee contains a stationary source that according to the EPA's Air Markets Database emitted in 2012 either more than 16,000 tons of SO₂ or more than 2,600 tons of SO₂ and had an annual average emission rate of at least 0.45 lbs SO₂/mmBTU. As of March 2, 2015, this stationary source had not met the specific requirements for being "announced for retirement." Specifically, in 2012, TVA Gallatin Power Plant (TVA Gallatin) emitted 21,731 tons of SO₂ and had an emissions rate of 0.62 lbs SO₂/mmBTU. Pursuant to the March 2, 2015 court-ordered schedule, the EPA must designate the area surrounding the facility by July 2, 2016.

In its submission, Tennessee recommended that the area surrounding TVA Gallatin, specifically the 50 kilometer (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 TVA Gallatin and other nearby sources which may have a potential impact in the area of analysis where maximum concentrations of SO₂ are expected. This boundary represents 12 whole and partial counties including all of Sumner and Trousdale, and portions of Wilson, Smith, Davidson and Macon, Robertson, Rutherford, DeKalb, Williamson, Cannon and Cheatham. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing allowable emissions.

After careful review of the state's assessment, supporting documentation, and all available data, the EPA does not agree with the state's modeling analysis because it does not use the necessary technical information and approach to determine if the area is meeting the SO₂ NAAQS. Specifically, the EPA reviewed two scenarios that Tennessee provided in its submission and does not believe that either of these scenarios were performed consistent with the Modeling TAD or the EPA guidance on modeling for the SO₂ NAAQS. One scenario involved the consideration of TVA Gallatin's 2012-2014 actual emissions whereas the other scenario involved the consideration of future allowable potential to emit (PTE) emission limits based on installation of SO₂ controls (see consent decree discussion below). The latter scenario is the basis for Tennessee's attainment designation recommendation. The EPA has identified input errors for Tennessee's modeling analysis, and areas where further refinements of the modeling are necessary to be most consistent with the modeling approaches found in the Modeling TAD and the EPA guidance. Therefore, the EPA intends to designate Sumner County in its entirety as unclassifiable. The remainder of the counties recommended by the state as attainment, in addition to any remaining undesignated area of Tennessee, will be addressed by either December 31, 2017, or December 31, 2020, consistent with the deadlines in the final consent decree.

The EPA notes that the future allowable emission rates modeled for the Sumner County Area (and which the state uses to support its attainment recommendation) have not yet been

established as federally-enforceable³ by the state of Tennessee. It is for this reason as well, that the EPA intends to designate Sumner County as unclassifiable. In order for the EPA to consider the future allowable emission limit for TVA Gallatin for the designations to be finalized no later than July 2, 2016, the state will have to ensure that these limits are federally-enforceable (and the EPA has confirmed such) by the time this round of designations is complete. Regarding the TVA Gallatin future emission limit, if a limit with an averaging time longer than 1-hour is desired, supporting technical information will also need to include explanation, of whether the longer term average limit, that the EPA determines is comparatively stringent to a 1-hour limit at the critical emission value, ensures attainment of the SO₂ NAAQS.

According to an April 14, 2011, TVA Federal Facilities Compliance Agreement (FFCA)⁴, all TVA units are limited to a system-wide annual tonnage limitations for SO₂. This consent decree requires TVA Gallatin to install and commence continuous operations of SO₂ controls (e.g., flue gas desulfurization (FGD), renewable biomass, repower, or retirement) for units 1-4 no later than December 31, 2017. In its September 16, 2015 designation recommendation, Tennessee indicated that TVA Gallatin was installing FGD on two of the four coal-fired units to comply with the TVA agreement and expected the control upgrades to be complete and operational by April 16, 2016. Tennessee specified that currently two FGD systems are already on-line and operating. Tennessee stated that enforceable emission limits associated with these control upgrades are expected to be included in TVA Gallatin's title V permit by April 8, 2016. On October 30, 2015, Tennessee supplemented their recommendation to include a technical analysis to support their September 16, 2015 recommendation of attainment, including a modeling demonstration indicating that FGD on unit 4 was operational and that control of the remaining three units would be completed by April 2016.

In January 2016, Tennessee provided additional information to support the state's recommendation. The EPA has not yet had time to complete a full review of this information but will consider it prior to finalizing designations. If the state provides additional information prior to promulgation of final designations, the EPA will consider this information in our final designation for the Sumner County Area.

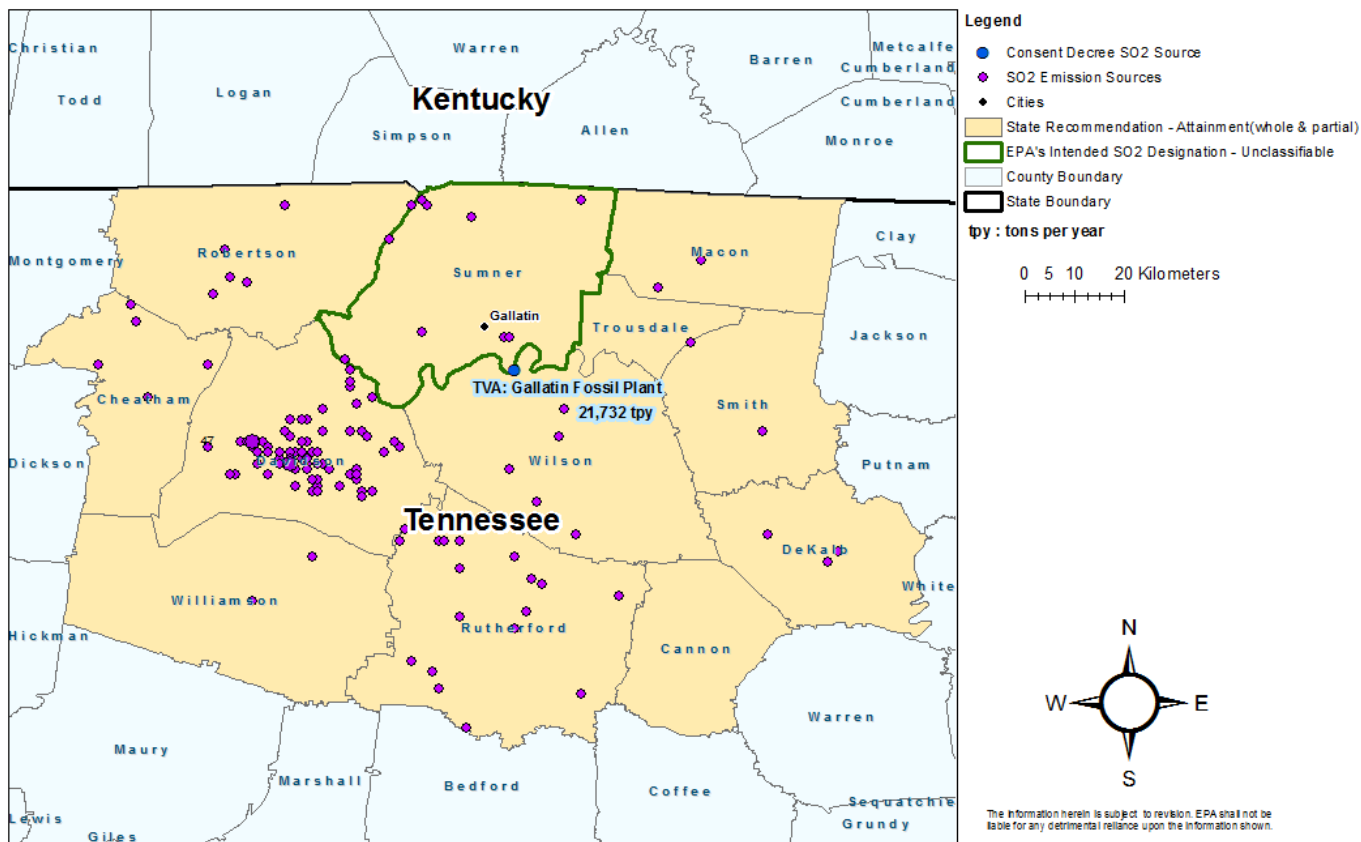
TVA Gallatin is located in central Tennessee in the southern portion of Sumner County. As seen in Figure 1 below, the facility is located approximately 5 kilometers (km) southeast of the center of Gallatin. Also included in the figure are the state's recommended area for the attainment designation, and the EPA's intended unclassifiable designation.

³ Consistent with past interpretations of legal requirements, control measures, emission limits and other curtailments need to be installed, operational and federally-enforceable to be considered when informing final designation decisions. The mechanisms for establishing federally enforceable emission limits, control measures, or curtailments for the purpose of informing SO₂ designations include: a source-specific state implementation plan (SIP)-approved by the EPA, a minor new source review (NSR) permit, a title v permit or a consent decree established through Federal civil litigation.

⁴ The FFCA requires TVA to reduce SO₂, nitrogen oxide and particulate matter emissions from coal-fired units. This includes addressing 92 percent of TVA's coal-fired system between 2011 and 2018 by either the installation of state-of-the-art pollution controls such as selective catalytic reduction (SCR), FGD, retirement, or repowering to renewable biomass. See <http://www2.epa.gov/sites/production/files/documents/tva-ffca.pdf>

Figure 1. The EPA’s intended designation for Sumner County Area

Tennessee Valley Authority: Gallatin Fossil Plant Sumner County, Tennessee



The discussion and analysis that follows below will reference the state’s use of the Modeling TAD, the EPA’s assessment of the state’s modeling in accordance with the Modeling TAD, and the factors for evaluation contained in the EPA’s March 20, 2015 guidance, as appropriate.

Detailed Assessment

Model Selection and Modeling Components

The EPA’s Modeling TAD notes that for area designations under the 2010 SO₂ 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

The state 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, 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, the state determined that it was most appropriate to use the rural dispersion coefficients.

Tennessee did not provide information to support using the rural option for modeling the TVA Gallatin neither the future allowable PTE emissions scenario nor the 2012-2014 actual emissions scenario. The information that has been provided to date does not enable the EPA to determine if rural dispersion coefficients are appropriate.

Modeling Parameter: Area of Analysis (Receptor Grid)

The EPA believes 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 SO₂ 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 SO₂ concentrations. For the Sumner County Area, the state assessed sources within the 12 county, 50 km area of analysis in all directions that emitted over 100 tpy based on 2014 emissions. The entire area of analysis covers over 100 SO₂ sources including TVA Gallatin. Only two other sources within Tennessee's analysis area (i.e., other than TVA Gallatin) emitted over 100 tpy of SO₂ in 2014. These sources are Vanderbilt University and Carlex Glass America, LLC, both located in Davidson County. Other emitting-sources in the area of analysis counties covers 100 sources that according to 2014 emissions inventory emitted a cumulative total of 67 of SO₂. Tennessee determined that none of these SO₂ emissions sources needed to be modeled because they would not likely cause concentration gradients in the area due to their 2014 SO₂ emissions inventory, and because of their distance to TVA Gallatin and Sumner County. Additionally, the state indicated that any impacts from other sources would be accounted for by using an appropriate background concentration from the chosen ambient air monitor in Nashville (Davidson County),

Tennessee. The state did multiple modeling runs using multiple receptor grids. The receptor spacing for the area of analysis chosen by the state is as follows:

- Initial receptor grid: 50-km polar grid centered in the middle of the facility with 250 m spacing;
- Refined 10 x 10 km Cartesian grid system (with 10404 receptors) was implemented with a 100 meter spacing receptor grid to assess the location of maximum impacts ;
- A smaller Cartesian grid with 1708 discrete receptors at 100-m resolution was applied for the final modeling analysis.

The final receptor network contained 10,404 receptors, and the network covered a small portion of Sumner and Wilson Counties in Tennessee.

Figures 2 and 3, included in the state’s recommendation, show the state’s chosen area of analysis surrounding the TVA Gallatin as well as the receptor grid for the area of analysis.

Consistent with the Modeling TAD, receptors for the purposes of this designation effort were placed only in areas where it would also be feasible to place a monitor and record ambient air impacts. The impacts of the area’s geography and topography will be discussed later within this document.

Figure 2: Sumner County Area of Analysis - Source: Tennessee’s Round 2 – Sulfur Dioxide Designations Recommendations prepared by TDEC October 30, 2015

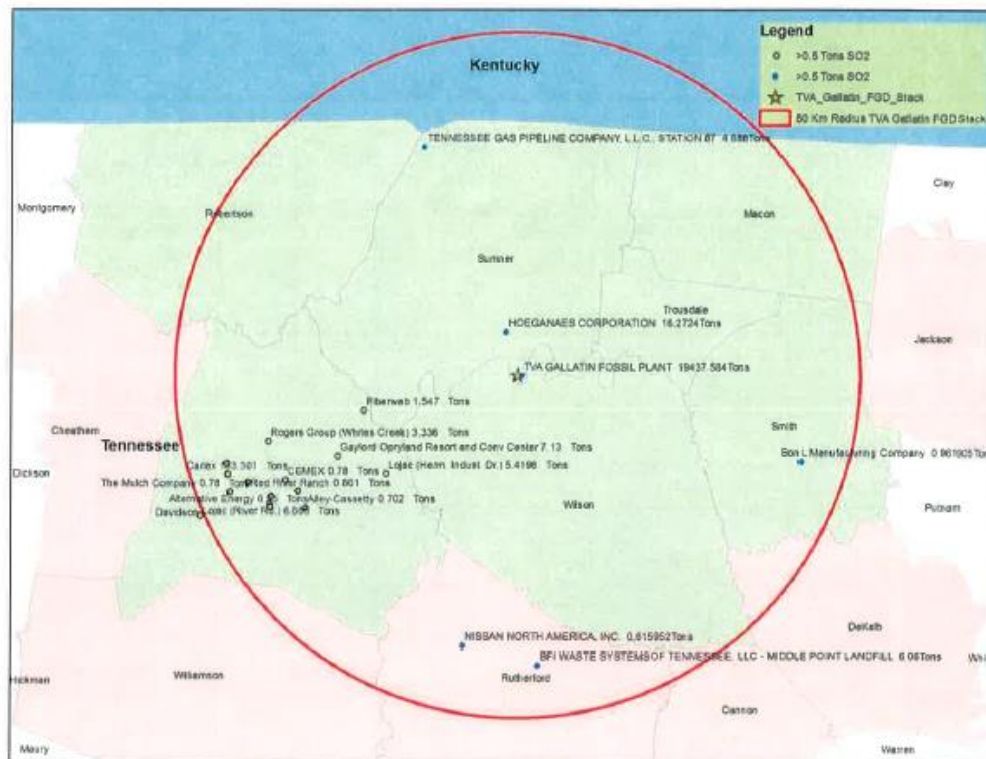
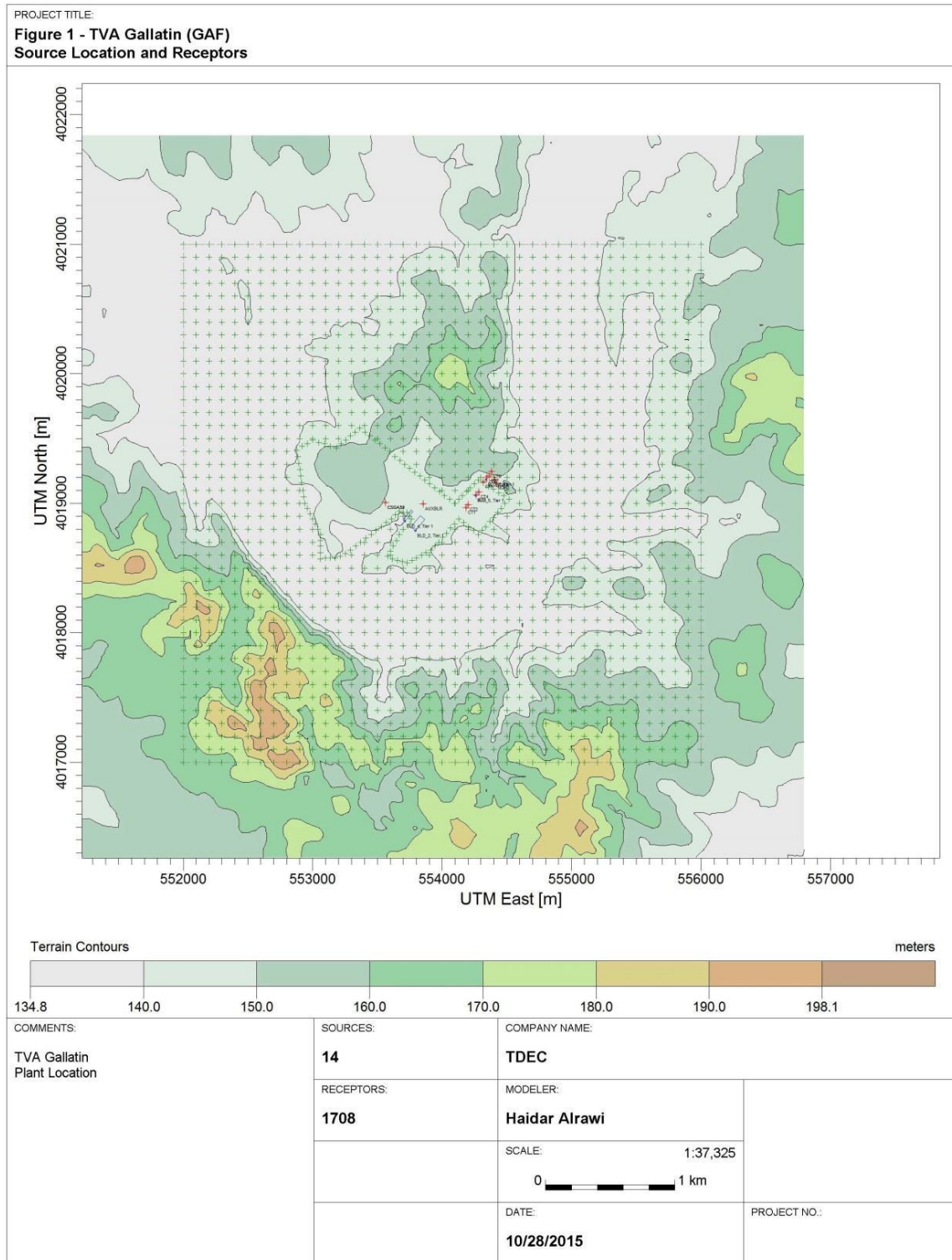


Figure 3: Final Receptor Grid for the Sumner County Area of Analysis - Source: Tennessee's Round 2 – Sulfur Dioxide Designations Recommendations prepared by TDEC October 30, 2015



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). Information provided by the state indicates that the BPIPPRIME preprocessor was used to evaluate the potential for building downwash for both the future allowable PTE emissions scenario and the 2012-2014 actual emissions scenario. However, information was not provided describing the building layouts and locations that were input into BPIPPRIME. Therefore, the EPA is unable to determine if the building downwash analysis using BPIPPRIME is acceptable. Also, for the future allowable PTE emissions modeling scenario, actual stack heights were used for modeling the four coal-fired boilers. This deviates from the Modeling TAD which recommends using good engineering practice (GEP) stack heights when modeling allowable PTE emissions.

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 does provide 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 sources should be used. For the 2012-2014 actual emissions modeling scenario, the state indicated that 2012-2014 CEMS data were used for the four primary coal fired boilers to model hourly varying emissions using the HOUREMIS keyword. However, the hourly varying emissions files containing the CEMS data were not provided by the state and no details were provided by the state to explain how the data in the hourly varying files were generated. The information provided the state indicates that hourly varying SO₂ emission rates were used in the modeling, but it appears that single, non-varying values of stack exit temperature and stack exit velocity were paired with these hourly emissions. If hourly varying temperatures and velocities are available, they should have been used in the modeling.

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 SO₂ 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 SO₂ 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 discussed in the “Introduction” section above, TVA Gallatin and the state chose to use modeling based upon future allowable PTE emissions limits as the basis for their attainment designation recommendation. The future allowable PTE emissions are based upon additional FGD controls being installed on TVA Gallatin’s four coal fired boilers pursuant to a 2011 FFCA consent decree. The future allowable PTE controlled emissions used by Tennessee for the AERMOD modeling were calculated by reducing the average 2012-2014 actual emissions by 90 percent, which is the estimated control efficiency of the controls on the four coal fired boilers. If the state is able to address all of the modeling concerns described throughout this Technical Support Document, the future allowable PTE emissions modeling may be determined to be acceptable, provided that appropriate federally enforceable limits are established. These units would need to restrict operation of the units to meet the conditions that have been included in revised modeling consistent with the EPA’s guidance. Tennessee has indicated that they expect the control upgrades for the four coal-fired boilers to be complete and operational by April 16, 2016, noting that two FGD systems are already on-line and operating. Furthermore, the state has also noted that enforceable emission limits associated with these control upgrades are expected to be included in TVA Gallatin’s title V permit by April 8, 2016.

For the Sumner County Area, Tennessee assessed SO₂ 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 SO₂ are expected. Along with TVA Gallatin in Sumner County, only 2 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 and 20 km, emitted 843.8 tons in 2014, and according to Tennessee shutdown its coal-fired boiler in 2014. According to a press release⁵, Vanderbilt converted to natural gas operation and decommissioned its last coal-fired boiler in 2014. The Carlex Glass America, LCC, located approximately 45 km from TVA Gallatin and 23 km from the Sumner County border, emitted 133.3 tons of SO₂ in 2014. Tennessee did not include either of these sources in the modeling analysis due to the shutdown of Vanderbilt University and the 2014 emissions relative to the distance for Carlex Glass America. However, the background monitor is located within the vicinity of both Vanderbilt University and Carlex Glass America, and therefore these sources’ impacts are likely captured by the background concentration.

The remaining emissions inventory (excluding those sources over 100 tpy) within the 12 county area of analysis (Sumner, Davidson, Wilson, Smith, Davidson, Macon, Robertson, Rutherford, DeKalb, Williamson, Cannon and Cheatham) covers over 100 sources (some which reported no 2014 SO₂ emissions) that according to 2014 emissions inventory emitted a cumulative total of 67 tons of SO₂. Tennessee determined that none of these SO₂ emissions sources within the area of

⁵ See <http://news.vanderbilt.edu/2015/05/vu-exhaust-stack-demolition-complete/> and <http://news.vanderbilt.edu/2014/12/vanderbilt-power-plant-is-now-coal-free/>

analysis needed to be modeled because they would not likely cause concentration gradients in the area due to their 2014 SO₂ emissions inventory and their distance to TVA Gallatin and Sumner County. The EPA does not believe these sources would contribute to a violation of the SO₂ NAAQS near the Sumner County area of analysis nor cause concentration impacts within their respective county borders.

Table 2: Actual SO₂ Emissions from sources emitting greater than 100 tpy in 2014 from Facilities in the Sumner County Area of Analysis

County	Facility Name	2014 SO ₂ Emissions (tons per year (tpy)) ⁶
Sumner	TVA: Gallatin	19437.58
Davidson	Vanderbilt University (unit shutdown in 2014)	843.8
Davidson	Carlex Glass America, LLC	133.3

As previously noted, the state’s modeling only included emissions from TVA Gallatin and did not include other emitter of SO₂ within 50 km in the area of analysis. Tennessee determined that none of these SO₂ emissions sources within the area of analysis needed to be modeled because they would not likely cause concentration gradients in the area due to their 2014 SO₂ emissions inventory and their distance to TVA Gallatin and Sumner County. The EPA does not believe these sources would contribute to a violation of the SO₂ NAAQS near the Sumner County area of analysis nor cause concentration impacts within their respective county borders.

The state has chosen to model the facility using the future federally-enforceable PTE limits for SO₂ established pursuant to the Federal Facilities Compliance Agreement discussed above as the basis for their designation recommendation. The future allowable PTE rates are summarized below.

⁶ 2014 annual emissions data were provided by the state and represent emissions reported to the Emissions Inventory System (EIS) gateway, in which states report emissions pursuant to 40 CFR Part 51, Subpart A. The EIS gateway can be accessed via: <http://www3.epa.gov/ttnchie1/eis/gateway/>.

Table 3: SO₂ Emissions based on future allowable PTE from Facilities in the Sumner County Area of Analysis

Facility Name	Unit ID	Modeled SO ₂ Emissions (pounds per hour, based on PTE) ⁷
TVA Gallatin		
TVA Gallatin	CSGA12	227.44
TVA Gallatin	CSGA34	216.69
TVA Gallatin	CT1	0.00001
TVA Gallatin	CT2	0.00556
TVA Gallatin	CT3	0.00635
TVA Gallatin	CT4	0.00556
TVA Gallatin	AUXBLR	0.00000
TVA Gallatin	CT5	0.02302
TVA Gallatin	CT6	0.02302
TVA Gallatin	CT7	0.04603
TVA Gallatin	CT8	0.02302
TVA Gallatin	NGH1	0.00002238
TVA Gallatin	NGH2	0.00000706
TVA Gallatin	NGH3	0.00000573
Total Emissions	All Units	444.2626

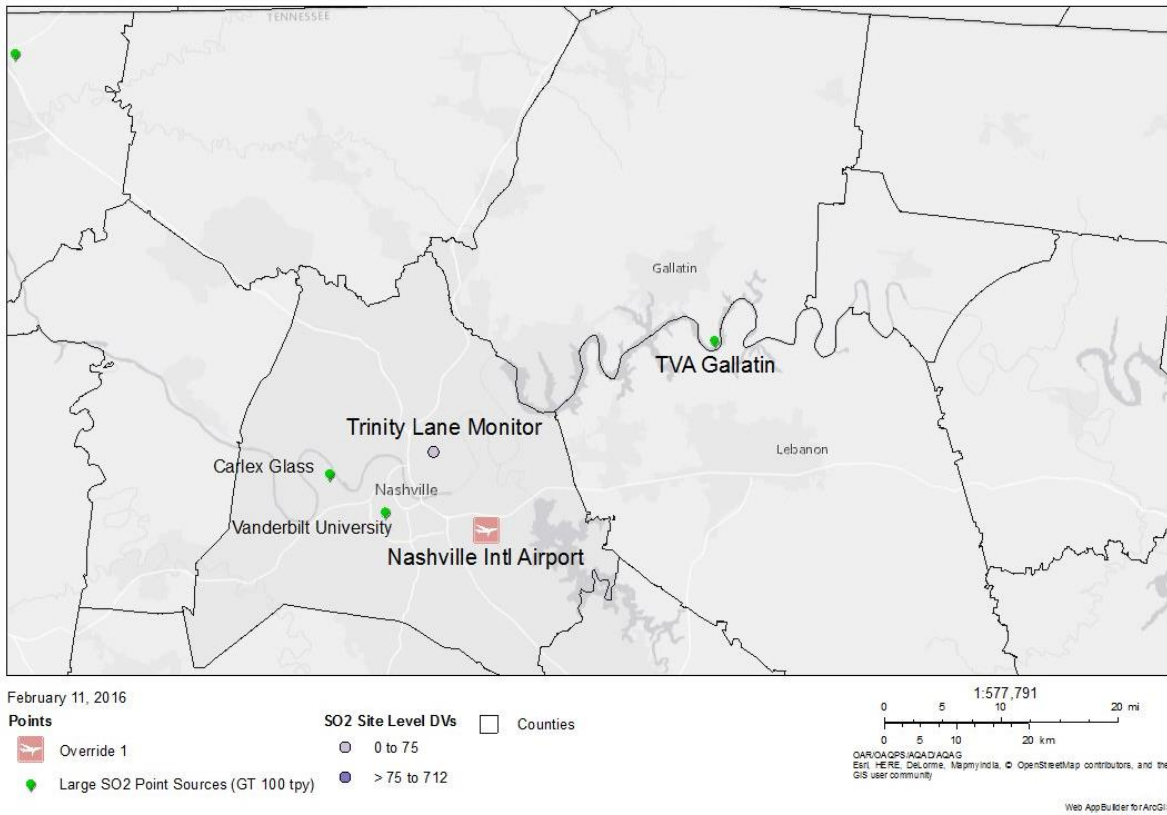
Modeling Parameter: Meteorology and Surface Characteristics

The most recent 3 years of 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, Federal Aviation Administration, and military stations.

For the Sumner County Area of analysis, surface meteorology from the Nashville International Airport NWS station (BNA) in Nashville, Tennessee approximately 20 miles to the southwest, and coincident upper air observations from the same NWS station (BNA) in Nashville, Tennessee were selected as best representative of meteorological conditions within the area of analysis.

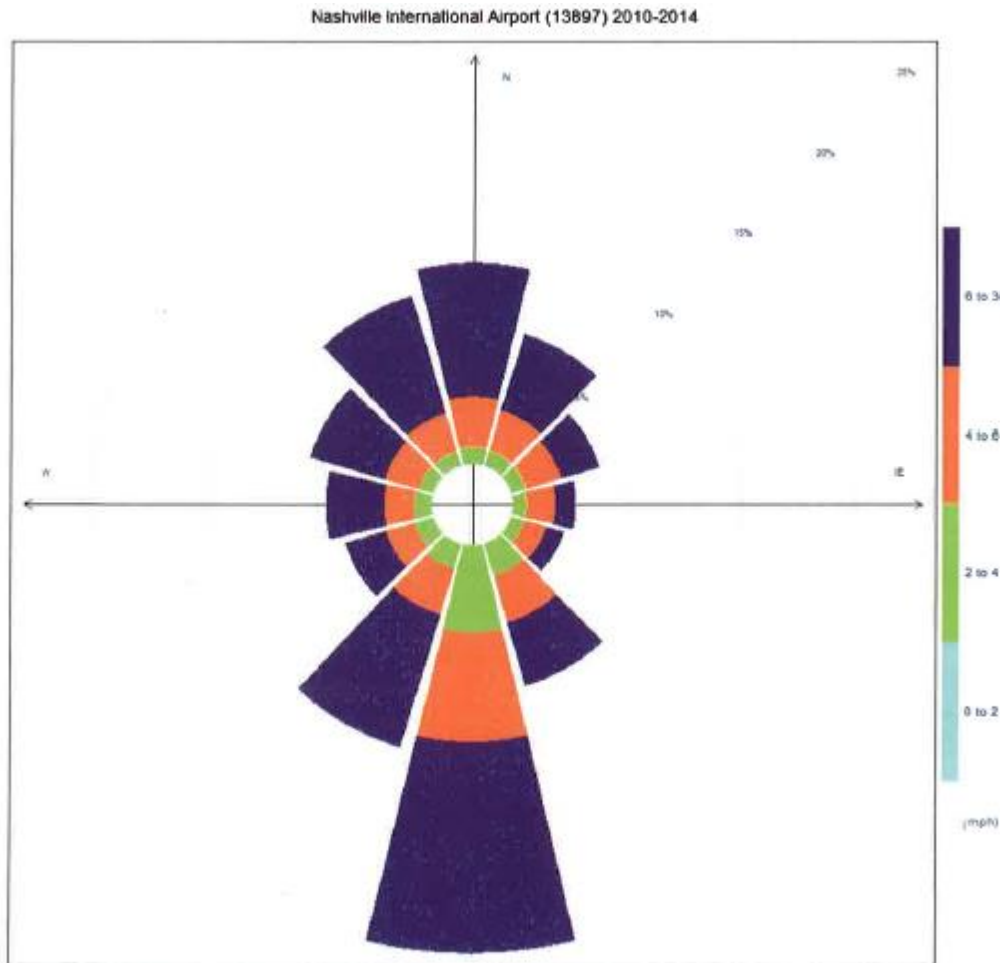
⁷ The total tons per year values based upon the new future allowable PTE emissions were not provided by the state, so this table provides the modeled pound per hour SO₂ emissions.

Figure 4: TVA Gallatin Facility location in relation to the Nashville International Airport NWS and the Trinity Lane background monitor



As part of its recommendation, the state provided the 5-year surface wind rose for Nashville, Tennessee. In Figure 5, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose shows that the winds blow predominately from the South with mid-high wind speeds.

Figure 5: Nashville, Tennessee Cumulative Annual Wind Rose for Years 2010 – 2014 - Source: Tennessee’s Round 2 – Sulfur Dioxide Designations Recommendations prepared by TDEC October 30, 2015



Documentation provided by the state indicates that the meteorological data from the above surface and upper air stations were used in generating AERMOD-ready files with the AERMET and AERMINUTE processors. These meteorological files were used by the state both the future allowable PTE emissions modeling and the 2012-2014 actual emissions modeling. Specific details of the AERMET and AERMINUTE processing of the raw meteorological data, including input and output files, were not provided by the state. Additionally, no information was provided by the state regarding the determination of surface characteristics (surface roughness, albedo and Bowen ratio) used in the AERMET processing. No indication was provided whether the EPA’s AERSURFACE tool was used for determining the appropriate surface characteristics or whether an alternate methodology was used. The detailed procedures for determining the surface characteristic parameters should be provided by the state.

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 modeling documentation submitted by the state indicates that the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors for both the future allowable PTE emissions scenario and the 2012-2014 actual emissions scenario. The source of the elevation data incorporated into the model is from the United States Geological Survey National Elevation Database (NED). However, the actual AERMAP input and output files and support NED files were not provided by the state to enable the EPA to review the procedures used in the AERMAP processing. These files should be provided by the state.

Modeling Parameter: Background Concentrations of SO₂

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO₂ 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 99th percentile monitored concentrations by hour of day and season or month. For the Sumner County Area of analysis, the state chose the “first tier” approach and used a single monitored design value 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. The background concentration for this area of analysis was determined by the state to be 28.8 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), or 11 ppb,⁸ and that value was incorporated into the final AERMOD results. The Trinity Lane monitor is located in the vicinity (approximately 10 km) of both the Vanderbilt University and Carlex Glass facilities, as shown in Figure 2. This background monitor likely covers the impacts from these two facilities. Additionally, the monitor is located between the two facilities and the TVA Gallatin facility so would account for any impacts from the facilities in the area of analysis around the TVA Gallatin facility.

Summary of Modeling Results

The AERMOD modeling parameters for the Sumner County Area of analysis are summarized below in Table 4.

⁸ The conversion factor for SO₂ (at the standard conditions applied in the ambient SO₂ reference method) is 1ppb = approximately 2.62 $\mu\text{g}/\text{m}^3$.

Table 4: 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	14
Modeled Structures	not available
Modeled Fencelines	1
Total receptors	10,404
Emissions Type	Future Allowable PTE
Emissions Years	New allowable limit effective in 2016/TBD
Meteorology Years	2010-2014
Surface Meteorology Station	Nashville, Tennessee
Upper Air Meteorology Station	Nashville, Tennessee
Methodology for Calculating Background SO ₂ Concentration	1 st tier single value
Calculated Background SO ₂ Concentration	11 ppb or 28.8 µg/m ³

The results presented below in Table 5 show the magnitude and geographic location of the highest predicted modeled concentration based on future allowable PTE emissions as this is the modeling scenario that the state relied upon for its designation recommendation.

Table 5: Maximum Predicted 99th Percentile 1-Hour SO₂ Concentration in the Sumner County Area of Analysis Based on or PTE Emissions
*Equivalent to the 2010 SO₂ NAAQS set at 75 ppb

Averaging Period	Data Period	Receptor Location		SO ₂ Concentration (µg/m ³)	
		UTM/Latitude	UTM/Longitude	Modeled (including background)	NAAQS
99th Percentile 1-Hour Average	2010-2014	552000	4017500	40.5	196.5*

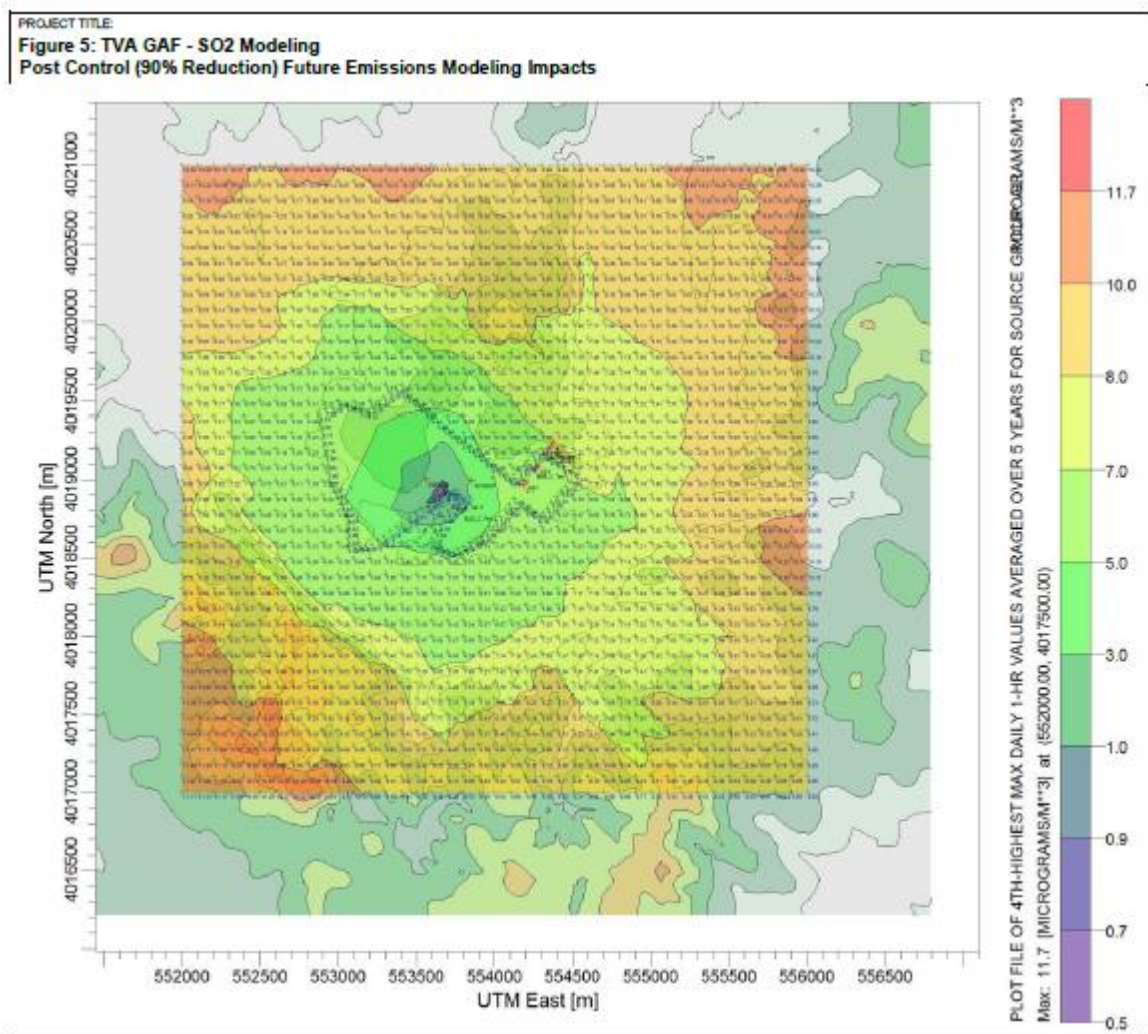
The state’s modeling indicates that the predicted 99th percentile 1-hour average concentration within the chosen modeling domain is 40.5 µg/m³, or 15.5 ppb. This modeled concentration included the background concentration of SO₂, and is based on future allowable PTE emissions from the facility. Figure 6 below was included as part of the state’s recommendation, and indicates that the predicted value occurred southwest of TVA: Gallatin. The state’s receptor grid is also shown in the figure. Consistent with past interpretations of legal requirements emission limits and other curtailments need to be installed, operational and federally-enforceable by April

19, 2016 to be considered when informing final designation decisions. The EPA notes that the future allowable emission rates modeled for the Sumner County Area have not been established as federally-enforceable⁹ by the state of Tennessee. If Tennessee: (1) addresses the technical modeling issues represented in this document; (2) demonstrates that the area meeting the SO₂ NAAQS; (3) and establishes TVA Gallatin's future modeled allowable emission rate federally-enforceable (through a federally-enforceable mechanism)¹⁰ and pursuant to the EPA's 2014 SO₂ Nonattainment Area SIP Guidance relating to a longer term average limit (if applicable) that the EPA can determine is comparatively stringent to a 1-hour limit at the critical emission value, the EPA may revise the designation to unclassifiable/attainment.

Tennessee has indicated that they expect the control upgrades for the four coal-fired boilers to be complete and operational by April 16, 2016 noting that two FGD systems are already on-line and operating. Furthermore, the state has also noted that enforceable emission limits associated with these control upgrades are expected to be included in TVA Gallatin's title V permit by April 8, 2016.

¹⁰ For example, a source-specific SIP approved by the EPA, a minor NSR permit, a title v permit or a consent decree established through Federal civil litigation

Figure 6: Maximum Predicted 99th Percentile 1-Hour SO₂ Concentrations in the Sumner County Area of Analysis Based on future allowable PTE Emissions



Jurisdictional Boundaries:

Once the geographic area of analysis associated with TVA Gallatin, other nearby sources, and background concentration is determined, existing jurisdictional boundaries are considered for the purpose of informing our intended unclassifiable area, specifically with respect to clearly defined legal boundaries. Tennessee’s boundary recommendation for TVA Gallatin is comprised of portions of 12 counties within a 50 km radius of the facility. However, based upon the EPA’s review of the state’s assessment, supporting documentation, and all available data, the modeling was not performed consistent with the Modeling TAD or the EPA’s guidance. Consequently, the EPA intends to designate Sumner County in its entirety as unclassifiable.

Along with TVA Gallatin in Sumner County, only 2 other sources in the area of analysis, Vanderbilt University and Carlex Glass America, LLC in Davidson County emitted over 100 tpy

in 2014. According to Tennessee and press releases, Vanderbilt University converted to natural gas operation and decommissioned its last coal-fired boiler in 2014. The Carlex Glass America, LCC, located approximately 45 km from TVA Gallatin and 23 km from the Sumner County border, emitted 133.3 tons of SO₂ in 2014. Tennessee did not include either of these sources in the modeling analysis due to the shutdown of Vanderbilt University and the 2014 emissions relative to the distance for Carlex Glass America. However, their emissions are likely captured by the background concentration. All other SO₂ emitting sources in the 12 county area of analysis (Sumner, Davidson, Wilson, Smith, Davidson, Macon, Robertson, Rutherford, DeKalb, Williamson, Cannon and Cheatham) covers over 100 sources that according to 2014 emissions inventory emitted a cumulative total of 67 tons SO₂. Tennessee determined that none of these SO₂ emissions sources within the area of analysis needed to be modeled because they would not likely cause concentration gradients in the area due to their 2014 SO₂ emissions inventory and their distance to TVA Gallatin and Sumner County. The EPA does not believe these sources are likely to contribute to a violation of the SO₂ NAAQS near the Sumner County area of analysis nor cause concentration impacts within their respective county borders. As a result, our intended unclassifiable area consisting of Sumner County in its entirety, is a suitable, defined legal boundary.

Other Relevant Information

The EPA has conducted a thorough review of the modeling performed by Tennessee for the TVA Gallatin facility to support their designation recommendation.¹¹ The EPA's review has identified a number of unresolved issues regarding the procedures and data used in the modeling which have led to the EPA intent to designate Sumner County as unclassifiable. The following is a brief summary of significant issues identified in the EPA's review of the modeling:

- The future allowable (PTE) controlled emissions used by Tennessee for the AERMOD modeling were calculated by reducing the average 2012-2014 actual emissions by 90 percent, which is the estimated control efficiency of the controls that have been installed or are in the process of being installed on TVA Gallatin's four units in order to meet the future enforceable terms of the FFCA consent decree. This may be acceptable if the TVA Gallatin permit is modified to incorporate these new allowable emission rates as 1-hour emissions limits and not as longer term averaging time limits (e.g., 30-day rolling average). If Tennessee and TVA Gallatin desire to use an averaging time longer than 1-hour, the recommendations provided in the EPA's 2014 SO₂ Nonattainment Area SIP Guidance should be followed. This guidance indicates that modeling to determine attainment with the 1-hour SO₂ NAAQS should use a higher 1-hour "critical value" to account for hourly emissions variability in longer-term (e.g., 30-day rolling average) allowable (PTE) limits. The details for the EPA's recommended procedure for calculating the adjustment factor between the 1-hour critical value and the equivalent 30-day rolling average emissions limit are provided in Appendices B and C of this EPA's 2014 SO₂ Nonattainment

¹¹ These comments pertain to Tennessee's October 30, 2015, updated recommendation, which includes a technical analysis and modeling to support their September 16, 2015 recommendation of attainment.

Area SIP Guidance.⁴ The EPA has informed Tennessee that an appropriate 1-hour critical value should be used in the modeling of future allowable PTE emissions if an averaging time longer than 1-hour is desired for the new allowable permit limits.

- Tennessee's modeling report indicates that the stack exit temperatures and velocities used for modeling the future allowable (PTE) controlled emissions are the same as the average of the 2012-2014 actual values. It is likely that the stack exit temperatures will be significantly reduced once new scrubber controls are installed. This would likely increase the modeled concentration results because the plume heights may be significantly lower due to a lower thermal buoyancy. Tennessee should verify that the stack parameters used in modeling the future allowable emissions reflect the actual design values from TVA Gallatin.
- For the 2012-2014 actual emissions modeling scenario, the state indicated that 2012-2014 CEMS data were used for the four primary coal fired boilers to model hourly varying emissions using the HOUREMIS keyword. However, the hourly varying emissions files containing the CEMS data were not provided by the state and no details were provided by the state to explain how the data in the hourly varying files was generated. The information provided by the state indicates that hourly varying SO₂ emission rates were used in the modeling, but it appears that single, non-varying values of stack exit temperature and stack exit velocity were paired with these hourly emissions. If hourly varying temperatures and velocities are available, they should be used in the modeling.
- For both the future allowable PTE emissions scenario and the 2012-2014 actual emissions scenario, Tennessee's modeling report and supporting modeling files do not provide information about how the surface characteristics (surface roughness, albedo and Bowen ratio) were calculated for the modeling. There is no indication whether the EPA AERSURFACE tool was used, and if so, what options and procedures were followed. Additionally, information has not been provided regarding how the AERMET and AERMINUTE processing was conducted, including how the surface characteristics were treated in AERMET. Tennessee should provide this information to the EPA for review.
- Tennessee did not provide information to support using the rural option for modeling the TVA Gallatin emissions or to enable the EPA to determine if rural dispersion coefficients are appropriate for both the future allowable PTE emissions scenario and the 2012-2014 actual emissions scenario. The EPA informed Tennessee of the need for this information. To date, the requested information has not been provided for review.
- Information provided by the state indicates that the BPIPPRIME preprocessor was used to evaluate the potential for building downwash for both the future allowable PTE emissions scenario and the 2012-2014 actual emissions scenario. However, information was not provided describing the building layouts and locations that were input into BPIPPRIME. This information should be provided by the state. Also, for

the future allowable PTE emissions modeling scenario, actual stack heights were used for modeling the four coal-fired boilers. This deviates from the Modeling TAD which recommends using GEP stack heights when modeling allowable PTE emissions. The future allowable PTE emissions modeling should be revised using the appropriate GEP stack heights.

The EPA did not receive any additional information about the area in the immediate vicinity of the TVA Gallatin facility to inform our intended designations.

Conclusion

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate Sumner County as unclassifiable for the 2010 SO₂ NAAQS due to unresolved issues with the state's modeling analysis. Based on all available information, including the reasons discussed above, EPA is unable at this time to determine whether the area is meeting or not meeting the NAAQS. Specifically, our intended boundary consists of Sumner County in its entirety which differs from the state's recommendation of 12 counties within a 50 km radius from TVA Gallatin. A summary of unresolved issues is provided in the discussion above.

If the state provides additional information prior to promulgation of final designations that adequately addresses the issues identified above, the EPA may consider this information in our final designation for the Sumner County Area. Tennessee has indicated that they expect the FGD control upgrades (pursuant to the 2011 FFCA) for the four coal-fired boilers to be complete and operational by April 16, 2016, noting that two FGD systems are 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 are 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, as discussed above 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. These issues would also have to be resolved to support an ultimate unclassifiable/attainment designation, if appropriate.

At this time, our intended designations for the state only apply to this area (Sumner County). Consistent with the conditions in the March 2, 2015 court-ordered schedule, the EPA will evaluate and designate all remaining undesignated areas in Tennessee by either December 31, 2017, or December 31, 2020.