Technical Support Document:

Chapter 41
Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for the Commonwealth of Virginia

1. Summary

Pursuant to section 107(d) of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (the EPA, we, or us) must designate areas as either "nonattainment," "attainment," or "unclassifiable" for the 2010 1-hour sulfur dioxide (SO_2) primary national ambient air quality standard (NAAQS) (2010 SO_2 NAAQS). The CAA defines a nonattainment area as an area that does not meet the NAAQS or that contributes to a nearby area that does not meet the NAAQS. An attainment area is defined by the CAA as any area that meets the NAAQS and does not contribute to a nearby area that does not meet the NAAQS. Unclassifiable areas are defined by the CAA as those that cannot be classified on the basis of available information as meeting or not meeting the NAAQS. In this action, the EPA has defined a nonattainment area as an area that the EPA has determined violates the 2010 SO_2 NAAQS or contributes to a violation in a nearby area, based on the most recent 3 years of air quality monitoring data, appropriate dispersion modeling analysis, and any other relevant information. An unclassifiable/attainment area is defined by the EPA as an area that either: (1) based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS[1]. An unclassifiable area is defined by EPA as an area that either: (1) was required to be characterized by the state under 40 CFR 51.1203(c) or (d), has not been previously designated, and on the basis of available information cannot be classified as either: (i) meeting or not meeting the 2010 SO_2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and EPA does have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

[1] The term "designated attainment area" is not used in this document because the EPA uses that term only to refer to a previous nonattainment area that has been redesignated to attainment as a result of the EPA's approval of a state-submitted maintenance plan.

This technical support document (TSD) addresses designations for nearly all remaining undesignated areas in the Commonwealth of Virginia (Virginia or Commonwealth) for the 2010 SO_2 NAAQS. In previous final actions, the EPA has issued designations for the 2010 SO_2 NAAQS for selected areas of the country.[2] The EPA is under a December 31, 2017, deadline to designate the areas addressed in this TSD as required by the U.S. District Court for the Northern District of California.[3] We are referring to the set of designations being finalized by the December 31, 2017 deadline as "Round 3" of the designations process for the 2010 SO_2 NAAQS. After the Round 3 designations are completed, the only remaining undesignated areas will be those where a state began timely operation of a new SO_2 monitoring network meeting EPA specifications referenced in EPA's SO_2 Data Requirements Rule (DRR) (80 FR 51052). The EPA is required to designate those remaining undesignated areas by December 31, 2020.

Virginia submitted its first recommendation regarding designations for the 2010 1-hour SO_2 NAAQS on June 2, 2011, and recommended that all of Virginia be designated as unclassifiable. Virginia submitted air quality analyses and updated recommendations on January 11, 2017, and requested that its recommendation for the following jurisdictions be changed to attainment/unclassifiable: Chesterfield County, City of Hopewell, City of Colonial Heights, Charles City County, Fairfax County, Henrico County, Roanoke County, Rockingham County, City of Norfolk, City of Poquoson, York County, City of Richmond, City of Newport News, City of Hampton, Halifax County, Charlotte County, Mecklenburg County, Buchanan County, and City of Petersburg. In our intended designations, we have considered all the submissions from the state, except where a recommendation in a later submission regarding a particular area indicates that it replaces an earlier recommendation for that area we have considered the recommendation in the later submission.

For the areas in Virginia that are part of the Round 3 designations process, Table 1 identifies EPA's intended designations and the counties or portions of counties to which they would apply. It also lists Virginia's current recommendations. The EPA's final designation for these areas will be 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. Summary of the EPA's Intended Designations and the Designation Recommendations by Virginia

Area/County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Chesterfield County, Virginia	Chesterfield County	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

[2] A total of 94 areas throughout the U.S. were previously designated in actions published on August 5, 2013 (78 FR 47191), July 12, 2016 (81 FR 45039), and December 13, 2016 (81 FR 89870).
[3] *Sierra Club v. McCarthy*, No. 3-13-cv-3953 (SI) (N.D. Cal. Mar. 2, 2015).

Area/County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
City of Hopewell, Virginia	City of Hopewell	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
City of Colonial Heights, Virginia	City of Colonial Heights	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Charles City County, Virginia	Charles City County	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Henrico County, Virginia	Henrico County	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
City of Poquoson, Virginia	City of Poquoson	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
York County, Virginia	York County	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
City of Richmond, Virginia	City of Richmond	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
City of Newport News, Virginia	City of Newport News	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
City of Hampton, Virginia	City of Hampton	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Halifax County, Virginia	Halifax County	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Charlotte County, Virginia	Charlotte County	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Mecklenburg County, Virginia	Mecklenburg County	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

Area/County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
City of Petersburg, Virginia	City of Petersburg	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Buchanan County, Virginia	Buchanan County	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable
Remaining Undesignated Areas to Be Designated in this Action*	County or City Boundary	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

* Except for areas that are associated with sources for which Virginia elected to install and began timely operation of a new, approved SO_2 monitoring network meeting EPA specifications referenced in EPA's SO_2 DRR (*see* Table 2), the EPA intends to designate the remaining undesignated counties in Virginia as "unclassifiable/attainment" as these areas were not required to be characterized by the state and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the areas may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS. These areas that we intend to designate as unclassifiable/attainment (those to which this row of this table is applicable) are identified more specifically in section 11 of this TSD.

Areas for which Virginia elected to install and began operation of a new, approved SO_2 monitoring network are listed in Table 2. The EPA is required to designate these areas, pursuant to a court ordered schedule, by December 31, 2020. Table 2 also lists the SO_2 emissions sources around which each new, approved monitoring network has been established.

Table 2 – Undesignated Areas Which the EPA Is Not Addressing in this Round of Designations (and Associated Source or Sources)

Area	Source(s)
Giles County	Lhoist North America – Kimballton Plant
Botetourt County	Roanoke Cement Company
City of Covington	WestRock Virginia Corporation - Covington
Alleghany County[4]	WestRock Virginia Corporation - Covington

Areas that the EPA previously designated in Round 1 (*see* 78 FR 47191) and Round 2 (*see* 81 FR 45039 and 81 FR 89870) are not affected by the designations in Round 3 unless otherwise noted. No areas in Virginia were designated in Round 1 or Round 2.

[4] In its 2011 recommendation, Virginia had recommended unclassifiable for Alleghany County. Virginia did not update its recommendation for this county in its 2017 updated recommendation. Upon review, however, the EPA found that a the WestRock facility is located within both Covington City and Alleghany County. The majority of the facility resides in Covington with a portion in Alleghany. The monitor is located within Covington City. Therefore, the EPA will address both Covington City and Alleghany County in Round 4.

2. General Approach and Schedule

Updated designations guidance documents were issued by the EPA through a July 22, 2016, memorandum and 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. These memoranda supersede earlier designation guidance for the 2010 SO_2 NAAQS, issued on March 24, 2011, and identify factors that the EPA intends to evaluate in determining whether areas are in violation of the 2010 SO_2 NAAQS. The documents also contain the factors that the EPA intends to evaluate in determining the boundaries for designated areas. 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.

To assist states and other interested parties in their efforts to characterize air quality through air dispersion modeling for sources that emit SO_2, the EPA released its most recent version of a draft document titled, "SO_2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) in August 2016.[5]

Readers of this chapter of this TSD should refer to the additional general information for the EPA's Round 3 area designations in Chapter 1 (Background and History of the Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard) and Chapter 2 (Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for States with Sources Not Required to be Characterized).

As specified by the March 2, 2015 court order, the EPA is required to designate by December 31, 2017, all "remaining undesignated areas in which by January 1, 2017 states have not installed and begun operating a new SO_2 monitoring network meeting EPA specifications referenced in EPA's" DRR. The EPA will therefore designate by December 31, 2017, areas of the country that are not, pursuant to the DRR, timely operating EPA-approved and valid monitoring networks. The areas to be designated by December 31, 2017, include the areas associated with four sources in Virginia meeting DRR emissions criteria that states have chosen to be characterized using air dispersion modeling, the areas associated with three sources in Virginia for which air agencies imposed emissions limitations on sources to restrict their SO_2 emissions to less than 2,000 tpy, and other areas not specifically required to be characterized by the DRR.

Because many of the intended designations have been informed by available modeling analyses, this preliminary TSD is structured based on the availability of such modeling information. There is a section for each city/county for which modeling information is available. The remaining to-be-designated cities/counties are then addressed together in section 11.

[4] https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf. In addition to this TAD on modeling, the EPA also has released a technical assistance document addressing SO_2 monitoring network design, to advise states that have elected to install and begin operation of a new SO_2 monitoring network. See Draft SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, February 2016, https://www.epa.gov/sites/production/files/2016-06/documents/so2monitoringtad.pdf.

The EPA does not plan to revise this TSD after consideration of state and public comment on our intended designation. A separate TSD will be prepared as necessary to document how we have addressed such comments in the final designations.

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

1) 2010 SO_2 NAAQS – The primary NAAQS for SO_2 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) 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 that, based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined either: (1) does not meet the 2010 SO_2 NAAQS, or (2) contributes to ambient air quality in a nearby area that does not meet the NAAQS.
4) Designated unclassifiable/attainment area – an area that either: (1) based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.
5) Designated unclassifiable area – an area that either: (1) was required to be characterized by the state under 40 CFR 51.1203(c) or (d), has not been previously designated, and on the basis of available information cannot be classified as either: (i) meeting or not meeting the 2010 SO_2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS..
6) Modeled violation – a violation of the SO_2 NAAQS demonstrated by air dispersion modeling.
7) Recommended attainment area – an area that a state, territory, or tribe has recommended that the EPA designate as attainment.
8) Recommended nonattainment area – an area that a state, territory, or tribe has recommended that the EPA designate as nonattainment.
9) Recommended unclassifiable area – an area that a state, territory, or tribe has recommended that the EPA designate as unclassifiable.
10) Recommended unclassifiable/attainment area – an area that a state, territory, or tribe has recommended that the EPA designate as unclassifiable/attainment.
11) Violating monitor – an ambient air monitor meeting 40 CFR parts 50, 53, and 58 requirements whose valid design value exceeds 75 ppb, based on data analysis conducted in accordance with Appendix T of 40 CFR part 50.

12) We, our, and us – these refer to the EPA.

3. Technical Analysis for the Chesterfield, Virginia Area of Analysis

3.1. Introduction

The EPA must designate the Chesterfield County, Virginia, (Chesterfield) area by December 31, 2017, because the area has not been previously designated and Virginia has not installed and begun timely operation of a new, approved SO_2 monitoring network to characterize air quality in the vicinity of any source in Chesterfield County.

3.2. Air Quality Monitoring Data for the Chesterfield, Virginia Area of Analysis

This factor considers the SO_2 air quality monitoring data in the area of Chesterfield, Virginia. The Commonwealth included monitoring data from the following monitors:

Table 3. Air Quality Monitoring Data for the Chesterfield Area of Analysis

County/City	AQS Monitor ID	latitude	longitude	2011-2013 Design Value	2012-2014 Design Value	2013-2015 Design Value	2014-2016 Design Value
Charles City County	51-036-0002	37.34438	-77.25925	29	27	29	27
Henrico County	51-087-0014	37.55652	-77.40027	11	7	8	7

Air Quality System monitor 51-036-0002 is located in Charles City County and is approximately 11 kilometers southeast of Chesterfield Power Station. Data collected at this monitor meets completeness criteria and indicates that the design value (DV) has been and continues to be well below the 75 parts per billion (ppb) standard, with the 2013-2015 DV being 29 ppb. Its 99th percentile daily maximum 1-hour concentration for 2015 and 2014 was 29 ppb and for 2013 was 30 ppb, well below the 75 ppb standard. Virginia intended all available data collected at this monitor to support and corroborate air dispersion modeling results; the discussion of these modeled results follows immediately below.

Air Quality System monitor 51-087-0014 is located in Henrico County approximately 19 kilometers north of Chesterfield Power Station. Data collected at this monitor meets completeness criteria and indicates that the DV has been and continues to be well below the 75 ppb standard, with the 2013-2015 DV being 8 ppb. Its 99th percentile daily maximum 1-hour concentration for 2015 and 2014 was 8 ppb and for 2013 was 6 ppb. Virginia intended all available data collected at this monitor to support and corroborate air dispersion modeling results; the discussion of these modeled results follows immediately below.

Additionally, the EPA also reviewed 2016 monitoring data and the 2014-2016 DV for both monitors (Table 3). These data were available to EPA for consideration in the designations

process, however, since it is unclear if these monitors are located in areas of maximum concentration, it is unclear if the data are representative of the area's actual air quality. There are no other air quality monitors located within Chesterfield County or the surrounding counties/cities. Air quality monitoring data discussed in this section can be found at https://www.epa.gov/air-trends/air-quality-design-values.

3.3. Air Quality Modeling Analysis for the Chesterfield, Virginia Area of Analysis Addressing the Chesterfield Power Station

3.3.1. Introduction

This section 3.3 presents all the available air quality modeling information for Chesterfield County, Virginia that includes the Chesterfield Power Station. (Chesterfield County and the other surrounding counties included in the analysis will collectively be referred to as "the Chesterfield area" within this section 3.3). This area contains the following SO_2 sources, (1) sources around which Virginia is either required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tons per year, and (2) other SO_2 emitters:

- The Chesterfield Power Station facility emits 2,000 tons or more annually. Specifically, the Chesterfield Power Station emitted 2,180 tons of SO_2 according to the 2014 NEI. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and Virginia has chosen to characterize it via modeling.

- The Philip Morris USA Manufacturing Center facility in the City of Richmond is not on the SO_2 DRR Source list. Emissions from the 2014 NEI totaled approximately 140 tons of SO_2 for this facility.

- The Honeywell International Inc – Hopewell facility in the City of Hopewell is not on the SO_2 DRR Source list. Emissions from the 2014 NEI totaled approximately 190 tons of SO_2 for this facility.

- The RockTenn CP LLC – Hopewell facility in the City of Hopewell is not on the SO_2 DRR Source list. Emissions from the 2014 NEI totaled approximately 539 tons of SO_2 for this facility.

- The Chemours James River Plant facility in the Chesterfield County is not on the SO_2 DRR Source list. Emissions from the 2014 NEI totaled approximately 51 tons of SO_2 for this facility.

- The Philip Morris USA Inc - Park 500 facility in the City of Richmond is not on the SO_2 DRR Source list. Emissions from the 2014 NEI totaled approximately 98 tons of SO_2 for this facility.

- The James River Cogeneration Company facility in the City of Hopewell is not on the SO_2 DRR Source list. Emissions from the 2014 NEI totaled approximately 1,943 tons of SO_2 for this facility.

- The Hopewell Cogeneration Ltd Partnership facility in the City of Hopewell is not on the SO_2 DRR Source list. Emissions from the 2014 NEI totaled approximately 43 tons of SO_2 for this facility.

- The Dominion-Hopewell Power Station facility in the City of Hopewell is not on the SO_2 DRR Source list. Emissions from the 2014 NEI totaled approximately 14 tons of SO_2 for this facility.

- The Dominion - Bellemeade Power Station facility in the City of Richmond is not on the SO_2 DRR Source list. Emissions from the 2014 NEI totaled approximately 42 tons of SO_2 for this facility.

- The Dominion - Darbytown CT Station facility in Henrico County is not on the SO_2 DRR Source list. Emissions from the 2014 NEI totaled approximately 19 tons of SO_2 for this facility.

- The Spruance Genco LLC facility in City of Richmond is not on the SO_2 DRR Source list. Emissions from the 2014 NEI totaled approximately 591 tons of SO_2 for this facility.

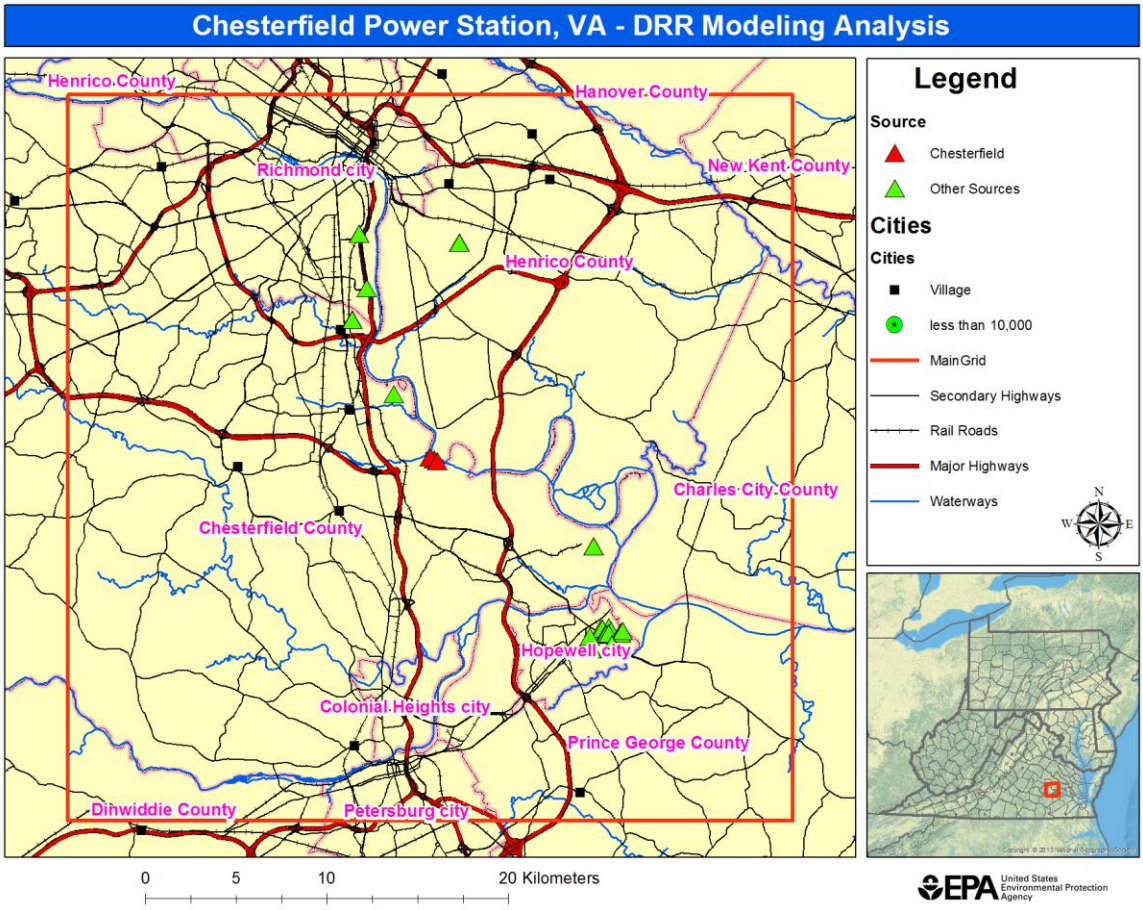
Because we have available results of air quality modeling in which these sources are modeled together, the area around this group of sources is being addressed in this section with consideration given to the impacts of all these sources.

In its submission, Virginia recommended that the area surrounding the Chesterfield Power Station, specifically the entirety of Chesterfield County, the City of Richmond, Henrico County, Charles City County, the City of Petersburg, the City of Hopewell, and the City of Colonial Heights, be designated as attainment/unclassifiable based on an assessment and characterization of air quality impacts from this facility and other nearby sources that may have a potential impact in the area where the 2010 SO_2 NAAQS may be exceeded. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the state's assessment, supporting documentation, and all available data, the EPA agrees with the state's recommendation for the area, and intends to designate the area as unclassifiable/attainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

The area that Virginia has assessed via air quality modeling is located in east-central Virginia and includes significant portions of Chesterfield County, the City of Richmond, Henrico County, Charles City County, the City of Petersburg, and the entirety of both the City of Hopewell and the City of Colonial Heights. It also covers small portions of Dinwiddie County, Prince George County, Hanover County, and New Kent County. Figure 1 shows the location of the Chesterfield Power Station. The EPA's intended unclassifiable/attainment designation boundaries are not

shown in this figure, but are shown in a figure in the section below that summarizes our intended designation.

Figure 1. Map of the Chesterfield Area of Analysis Showing the Chesterfield Power Station and Other Sources in the Modeling Analysis



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered only one modeling assessment, that which was submitted by Virginia.

3.3.2. Modeling Analysis Provided by the State

The Commonwealth of Virginia submitted a modeling analysis for the regions surrounding the Chesterfield Power Station prior to the January 13, 2017, DRR submission date. The modeling was developed by the Chesterfield Power Station's consultant, AECOM, with primary input from the Virginia Department of Environmental Quality (VADEQ).

A modeling protocol was established to outline procedures to follow for the final modeling analysis. The modeling protocol was developed based on relevant guidance outlined in EPA's Modeling TAD at the time of its preparation. EPA was given an opportunity to review the modeling protocol and provided comments to VADEQ in November of 2016. A final modeling protocol was completed for the final modeling analysis. The final DRR Modeling submittal included a response to comment section that included responses to comments VADEQ had provided to Chesterfield's final modeling report it reviewed prior to submitting the modeling analysis to the EPA as part of Virginia's DRR obligations.

3.3.2.1. Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. 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
- BPIPPIM: 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

Virginia used AERMOD version 15181 in regulatory default mode for this analysis. This was the regulatory version of the model prior to the recent publication of EPA revisions to the Guideline on Air Quality Models, which was published in the Federal Register on January 17, 2017.[6] The currently approved AERMOD platform is version 16216 that includes updates. However, the updates made to components of AERMOD version 16216 were not utilized in the air quality modeling assessment, such as ADJ_U*. A discussion of Virginia's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

3.3.2.2. Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the "urban" or "rural" determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD details the procedures used to determine if a source is urban or rural based on land use or population density.

For the purpose of performing the modeling for the area of analysis, the Commonwealth determined that it was most appropriate to run the model in rural dispersion mode. This determination was based on a visual inspection of the area within 3 km of the Chesterfield Power Station as described in the facility's January 2016 modeling protocol. This approach is based on the Auer method. EPA reviewed the modeling protocol and concurs with this conclusion.

[6] https://www3.epa.gov/ttn/scram/appendix_w/2016/AppendixW_2017.pdf

3.3.2.3. Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The sources of SO_2 emissions subject to the DRR in this area are described in the introduction to this section. For the Chesterfield area, Virginia has included eleven (11) other emitters of SO_2 within 20 kilometers of the Chesterfield Power Station in any direction. The state determined that this was the appropriate distance to adequately characterize air quality through modeling to include the potential extent of any SO_2 NAAQS exceedances in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. In addition to the Chesterfield Power Station, the other emitters of SO_2 included in the area of analysis are: Philip Morris USA Manufacturing Center, Honeywell International Inc – Hopewell, RockTenn CP LLC – Hopewell, Chemours James River Plant, Philip Morris USA Inc - Park 500, James River Cogeneration Company, Hopewell Cogeneration Ltd Partnership, Dominion - Hopewell Power Station, Dominion - Bellemeade Power Station, Dominion - Darbytown CT Station, and Spruance Genco LLC. No other sources beyond 20 km were determined by the state to have the potential to cause concentration gradient impacts within the area of analysis. The EPA agrees with the state's analysis.

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

Main Grid:

25-m spacing along Chesterfield's ambient boundary (~3.7 km in extent)
100 m Cartesian grid extending 3 km from Chesterfield
250 m Cartesian grid extending 3 km to 5 km from Chesterfield
500 m Cartesian grid extending 5 km to 10 km from Chesterfield
1,000 m Cartesian grid extending 10 km to 20 km from Chesterfield
100 m Cartesian grid centered on Main grid's model peak (near City of Hopewell)
50 m Cartesian grid centered on model peak from 100 m grid peak (near City of Hopewell)

The Main receptor network contained 7,388 receptors. The smaller 100 m and 50 m grids contained 676 and 25 receptors respectively. The Main receptor grid covered portions of Chester City, Chesterfield, Dinwiddie, Hanover, Henrico, New Kent, Prince George, City of Richmond and City of Petersburg. The cities of Hopewell and Colonial Heights were contained entirely inside the Main modeling domain. The 100 m (and of the 50 m) receptor grid is mainly contained inside the City of Hopewell and portions of Prince George County.

Figures 2 and 3 show Virginia's chosen area of analysis surrounding the Chesterfield Power Station as well as the receptor grid for the area of analysis.

Consistent with the Modeling TAD, Virginia placed receptors for the purposes of this designation effort in locations that would be considered ambient air relative to the primary DRR source (Chesterfield Power Station). Model receptors within other sources' potential ambient air boundaries were not removed. Receptor placement generally followed Section 4.2 of the Modeling TAD. The primary model peak occurs in the City of Hopewell near a cluster of non-DRR sources. This area may not be considered ambient air in relation to the sources in the City of Hopewell. A more refined analysis that excluded source impacts within each respective source's potential ambient air boundary, each in separate modeling runs, may have lowered the model peak concentration. Model receptors over the James River were not excluded from the modeling analysis, though these receptors could be omitted in accordance with EPA's modeling TAD.

EPA has reviewed the Chesterfield Power Station's analysis and agrees it is appropriate.

Figure 2. Area of Analysis for the Chesterfield Area

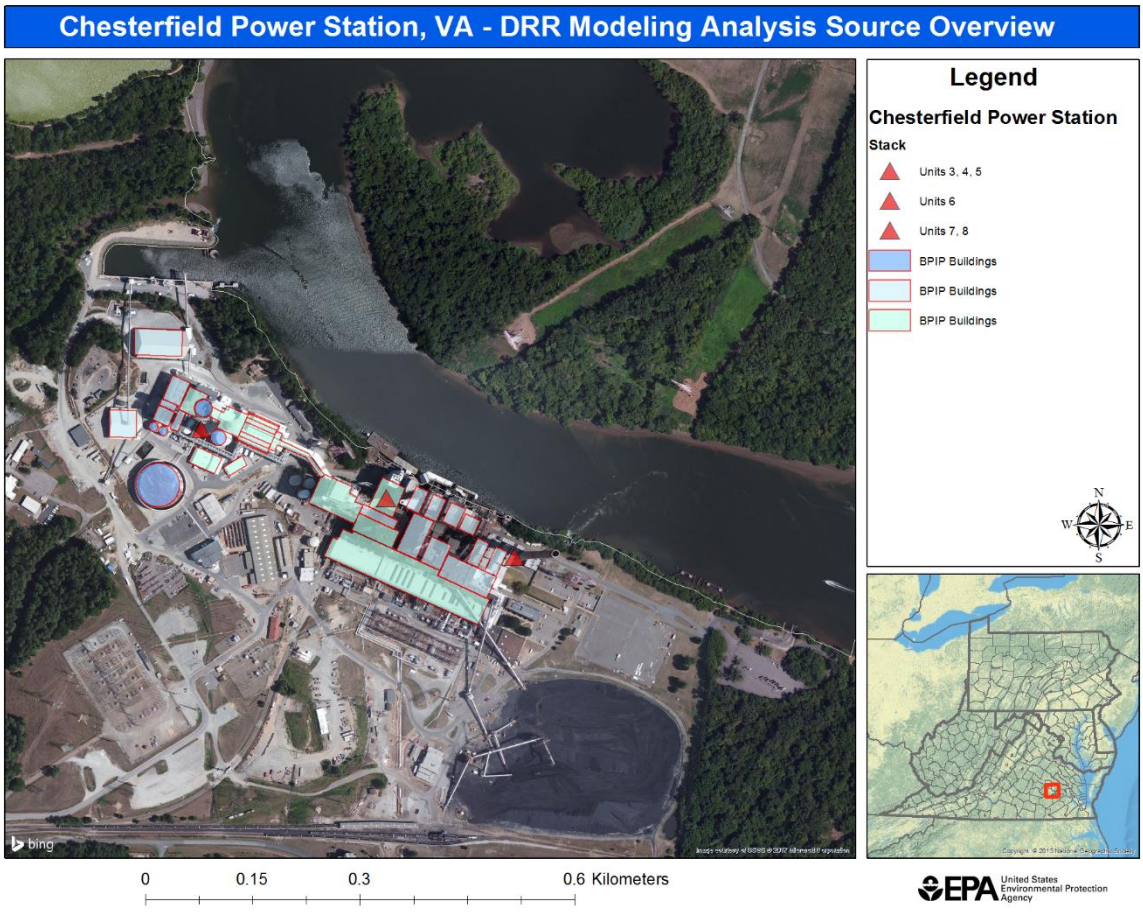


Figure 3. Area of Analysis for the Chesterfield Area from the North

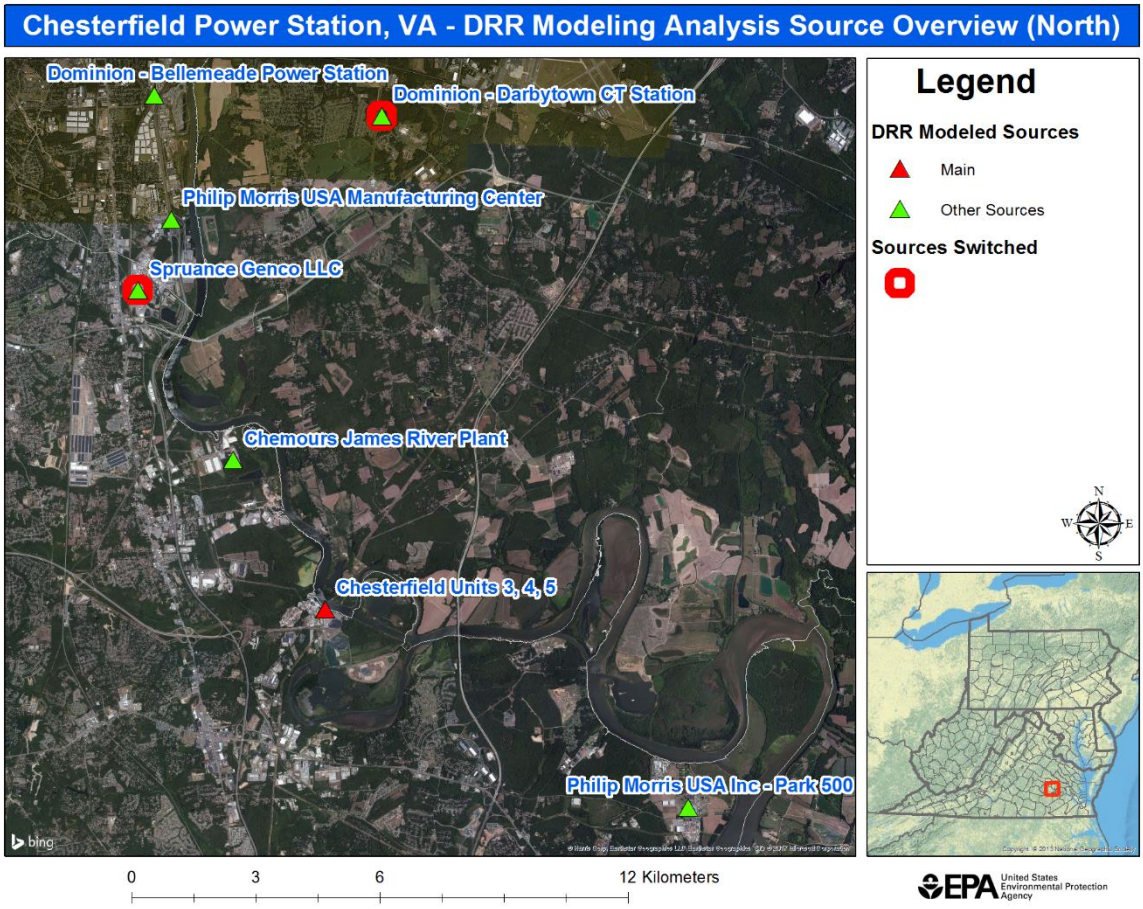


Figure 4: Area of Analysis for the Chesterfield Area from the South

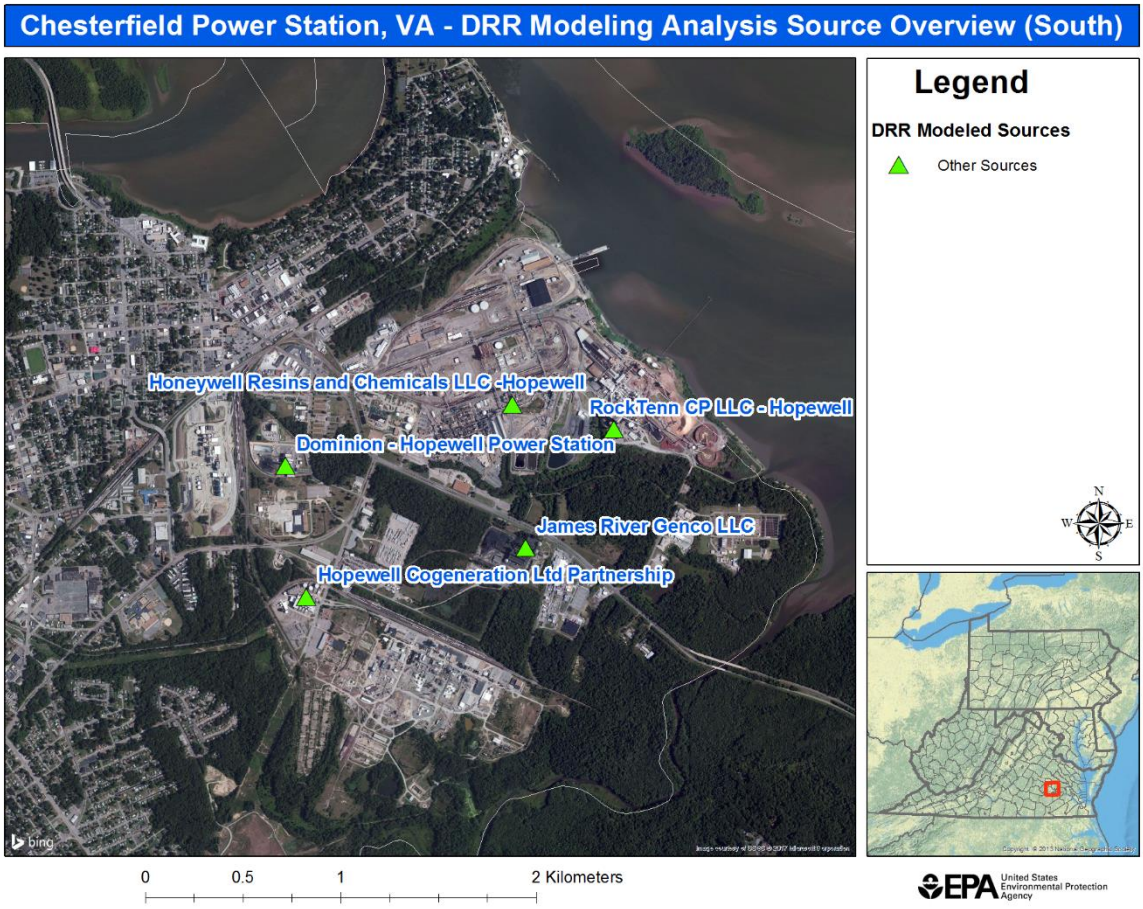
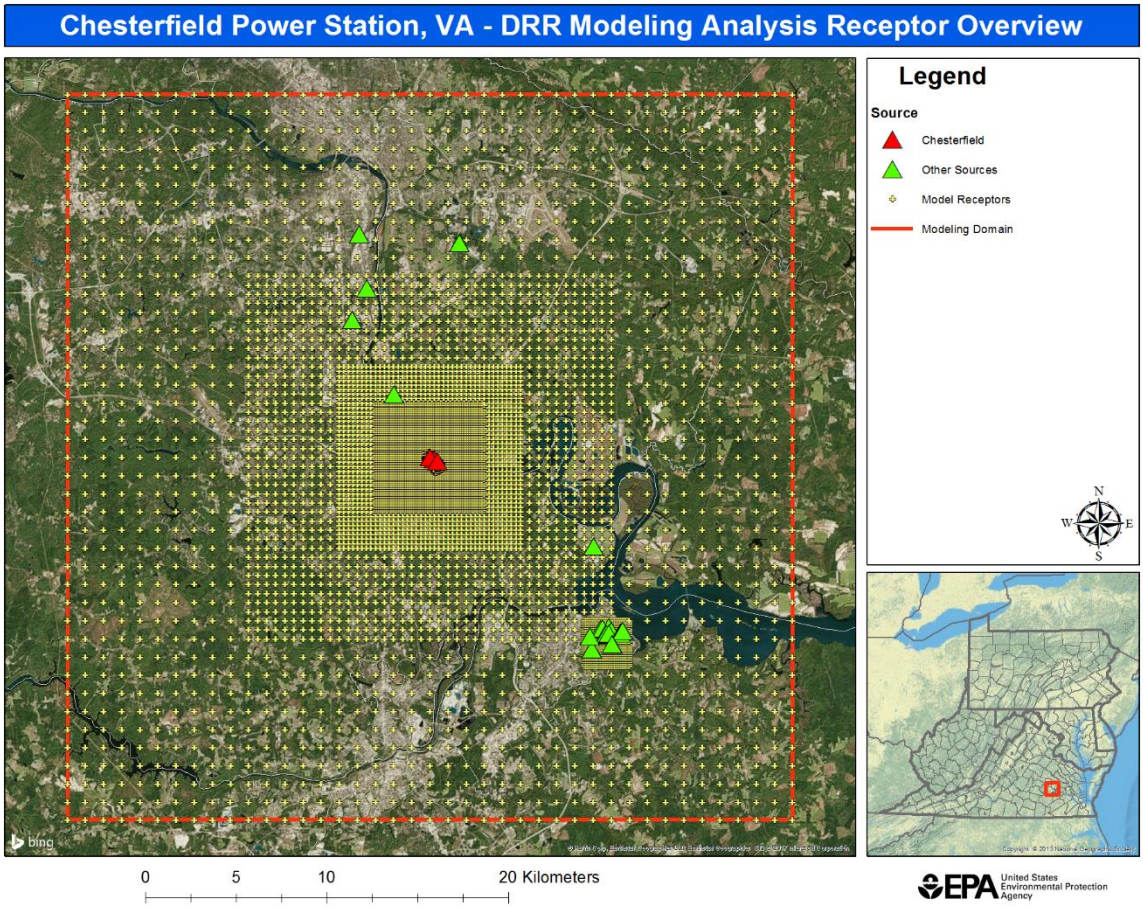


Figure 5. Receptor Grid for the Chesterfield Area of Analysis



3.3.2.4. Modeling Parameter: Source Characterization

Section 6 of the Modeling TAD offers recommendations on source characterization including source types, use of accurate stack parameters, inclusion of building dimensions for building downwash (if warranted), and the use of actual stack heights with actual emissions or following GEP policy with allowable emissions.

Virginia included the Chesterfield Power Station along with eleven (11) other facilities in the modeling domain. Emissions from the eleven (11) non-DRR sources ranged from less than 1 tpy up to 1,900+ tpy. All sources were characterized as point sources. Including this number of small sources along with a monitored background concentration from a site within the modeling domain is likely a conservative approach since many of the impacts from small sources are expected to be captured in the background concentration

Virginia characterized these sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, Virginia used actual stack heights in conjunction with actual emissions. Virginia also adequately characterized the DRR source's

building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRM was used to assist in addressing building downwash for the primary DRR source.

The EPA has reviewed the sources included in the modeling analysis and believes all sources that may cause concentration gradients have been included and properly characterized. During our analysis we noted and confirmed that two (2) source locations were switched in the modeling analysis. Virginia inadvertently switched the locations for Dominion – Darbytown and Spruance Genco. This location switch should not significantly impact the final peak model concentration. We expect the model peaks for these two (2) facilities to occur within 1 km of each based their stack heights (< 100 m in height). They would, therefore, have little to no impact on the area of maximum model impacts located near the City of Hopewell, which is over 20 km away from the displaced sources.

3.3.2.5. Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose 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 indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective.

The EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information, when they are available. 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 recommends using detailed throughput, operating schedules, and emissions information from the impacted source(s).

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. For example, where a facility has recently adopted a new federally enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS, the state may choose to model PTE rates. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations. 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, Virginia included the Chesterfield Power Station and eleven (11) other emitters of SO_2 within 20 km in the area of analysis. Virginia has chosen to model these facilities using actual emissions and actual stack parameters. The facilities in the commonwealth's

modeling analysis and their associated annual actual SO_2 emissions between 2012-14 are summarized below.

For the Chesterfield Power Station and the other eleven (11) sources included in the modeling analysis, Virginia provided annual actual SO_2 emissions between 2012 and 2014. This information is summarized in Table 4. A description of how Virginia obtained hourly emission rates is given below this table.

Table 4. Actual SO_2 Emissions Between 2012 – 2014 from Facilities in the Chesterfield Area of Analysis

Modeled Emissions			
Facility Name	**SO_2 Emissions (tpy)**		
	2012	**2013**	**2014**
Chesterfield	1,230.5	1,944.6	2,181.7
Philip Morris USA Manufacturing Center	140.1	139.7	139.7
Honeywell Resins and Chemicals LLC -Hopewell	188.2	187.7	187.7
RockTenn CP LLC – Hopewell	539.9	538.5	538.5
Chemours James River Plant	53.0	52.8	52.8
Philip Morris USA Inc - Park 500	98.3	98.0	98.0
James River Genco LLC	1,511.9	1,593.7	1,943.5
Hopewell Cogeneration Ltd Partnership	3.6	3.2	27.5
Dominion - Hopewell Power Station	8.7	13.5	13.6
Dominion - Bellemeade Power Station	3.3	1.0	41.7
Dominion - Darbytown CT Station	502.7	492.6	494.3
Spruance Genco LLC	0.6	10.0	19.5
Total Emissions from All Modeled Facilities in the State's Area of Analysis	4,280.8	5,075.5	5,738.6

EPA Clean Air Markets Division Emissions for Chesterfield Power Station			
Facility Name	**SO_2 Emissions (tpy)**		
	2012	**2013**	**2014**
Chesterfield Unit 3	27.0	32.4	41.2
Chesterfield Unit 4	101.0	180.8	279.6
Chesterfield Unit 5	453.7	496.9	649.2
Chesterfield Unit 6	641.0	1248.5	1189.0
Chesterfield Unit 8A	3.3	4.1	6.9
Total Emissions from All Facilities in the State's Area of Analysis	1,226.0	1,962.7	2,166.0

2014 NEI Emissions	
Facility Name	**2014 NEI (tpy)**
Chesterfield	2,180.9
Philip Morris USA Manufacturing Center	139.7
Honeywell Resins and Chemicals LLC -Hopewell	190.0
RockTenn CP LLC – Hopewell	539.4
Chemours James River Plant	50.6
Philip Morris USA Inc - Park 500	98.2
James River Genco LLC	1,942.8
Hopewell Cogeneration Ltd Partnership	43.5
Dominion - Hopewell Power Station	13.5
Dominion - Bellemeade Power Station	41.7
Dominion - Darbytown CT Station	19.3
Spruance Genco LLC	590.7
Total Emissions from All Facilities in the State's Area of Analysis	**5,850.4**

EGU units, including Chesterfield Power Station, James River Genco, Hopewell Cogeneration, Dominion – Hopewell Power Station, Dominion – Bellemeade Power Station, Dominion - Darbytown CT Station, and Spruance Genco LLC were modeled using hourly varying emissions based on CEM data. Other sources used fixed hourly emission rates based on state information. EPA downloaded hourly emissions from the Clean Air Markets Division (CAMD) website.[7] Hourly CAMD emissions summed for 2012-14 were nearly identical to the modeled emissions indicating the modeling analysis reflect the impacts of actual emissions. A comparison of Virginia's modeled emissions and the 2014 NEI emissions identified that emissions were

[7] https://ampd.epa.gov/ampd/

inadvertently switched in the modeling analysis between Dominion – Darbytown and Spruance Genco.

The Chesterfield Power Plant's hourly emission rates varied according to CEM collected values to reflect actual hourly emissions from the facility. Table 5 shows the difference between hourly modeled and CAMD emission rates for Chesterfield's units. The table shows modeled hourly emission rates were mostly within +/- 250 lbs/hr of the rates in CAMD. Plant stack temperatures and velocities also varied according to CEM measurements. The EPA noticed some hourly stack temperatures dropped below 273 K in the modeling analysis. This is not physically possible from a coal-fired combustion unit and brings up the possibility that there may be conversion mistakes in the stack temperature data. Given the infrequent number of hours with unusually low stack temperatures, which often occurred when emissions were zero, this issue is not expected to impact Virginia's final model concentrations.

Table 5. Table showing the difference between modeled and CAMD hourly emission rates for the Chesterfield coal-unit stacks.

Stack CH00		Stack CH06	
Bin	**Frequency**	**Bin**	**Frequency**
-500	0	-500	2
-250	0	-250	1
0	16,549	0	17,965
250	9,755	250	8,335
500	0	500	0
750	0	750	1
More	0	More	0

3.3.2.6. Modeling Parameter: Meteorology and Surface Characteristics

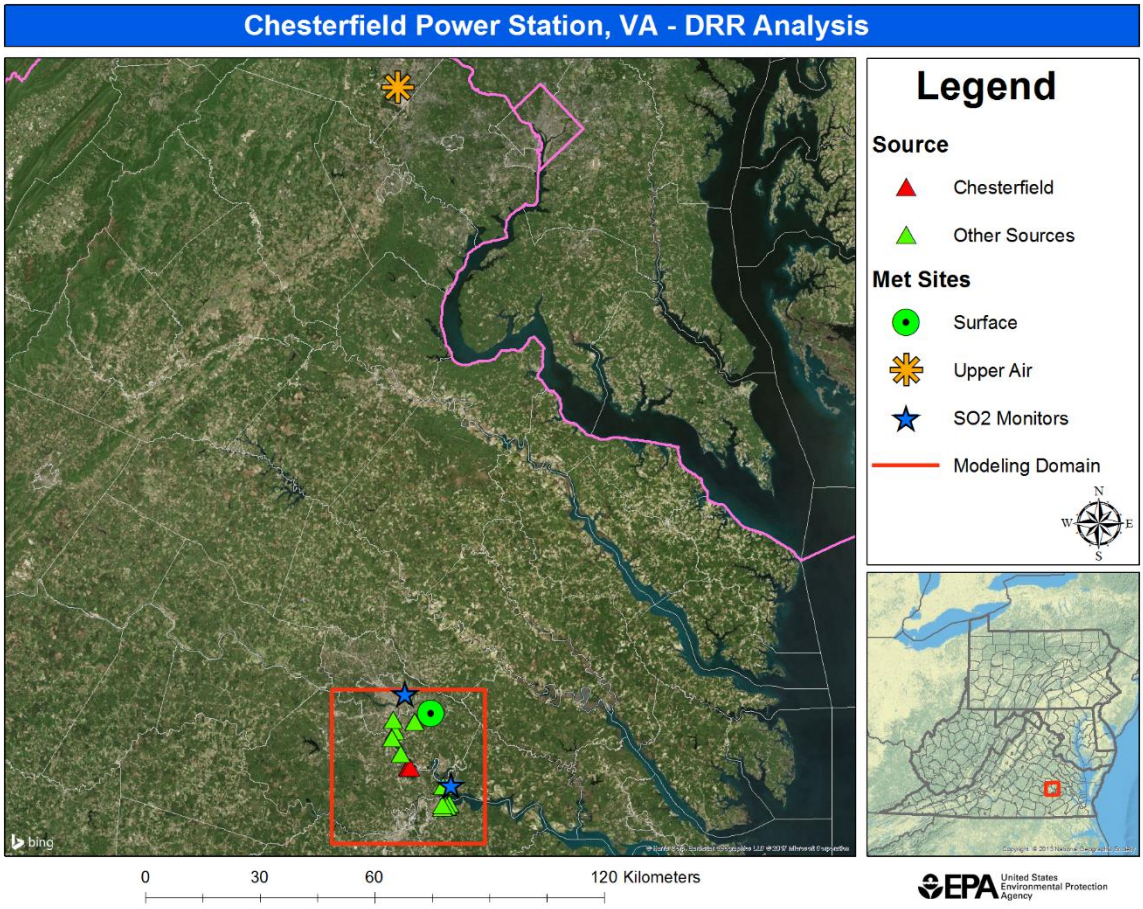
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data is determined 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 (FAA), and military stations.

For the area of analysis for the Chesterfield area, Virginia selected the surface meteorology from the Richmond International Airport in Henrico County, Virginia, for the years 2012-14. The Richmond International Airport is approximately 15 km north-northeast of the Chesterfield Power Station and resides inside the AERMOD modeling domain. Coincident upper air observations from Washington Dulles International Airport were used with the Richmond Airport's surface measurements to produce the meteorological input files used in AERMOD. These sites represent the best representative of meteorological conditions within the area of analysis.

Virginia used AERSURFACE version 13016 using data from the Richmond International Airport to estimate the surface characteristics of the area of analysis. The state estimated values for five (5) spatial sectors out to 1 km at a monthly temporal resolution and included variability in surface moisture conditions (wet, average, dry) based on comparisons with monthly precipitation data compared to a 30-year average. Seasonal categories (for each month) were altered to reflect the site's more southern latitude and no snow cover was present during any of the months processed in the analysis. Virginia 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 "z_o").

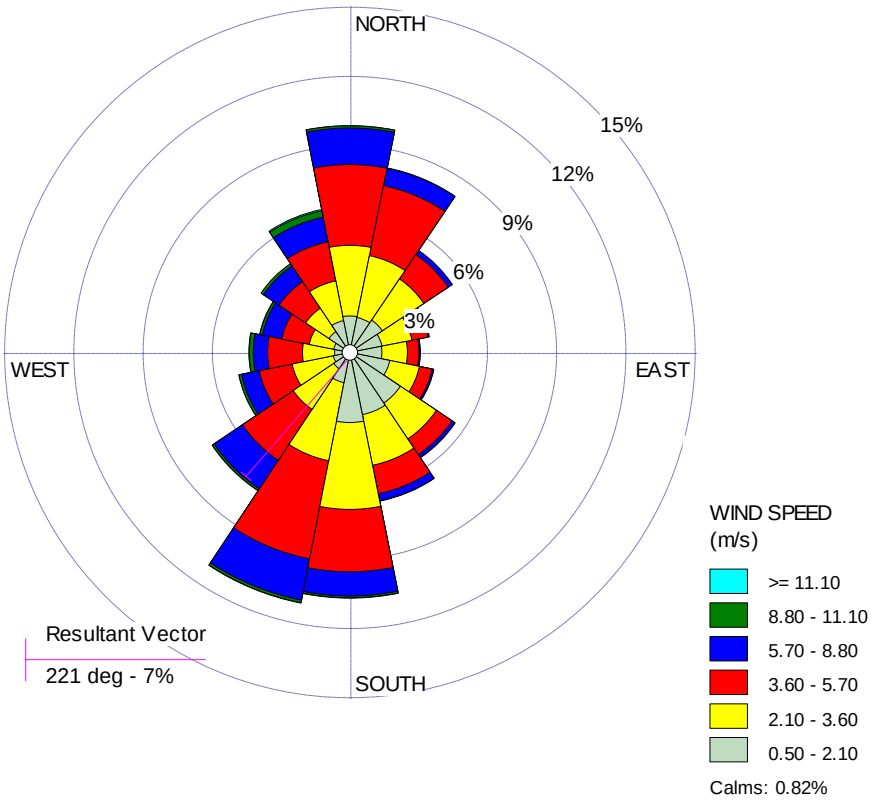
In the figure below, generated by the EPA, the location of this NWS station is shown relative to the area of analysis.

Figure 6. Area of Analysis and the NWS station in the Chesterfield Area



As part of its recommendation, Virginia provided the 3-year surface wind rose for the Richmond International Airport for 2012-14. The EPA used the final processed AERMET surface file to produce a wind rose using Lakes Environmental's AERMOD View GUI. In Figure 7, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose shows Richmond's wind primarily reside along a north-south direction though the resultant (sum) wind vector is from the southwest.

Figure 7: Chesterfield, Virginia Cumulative Annual Wind Rose for Years 2012 – 2014



Meteorological data from the above surface and upper air NWS 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. Virginia followed the methodology and settings presented in AERMET users guide and the EPA's AERMOD Implementation Guide 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 Richmond International Airport 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. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the 1-minute wind data.

After reviewing Virginia's meteorological processing, the EPA believes the meteorological data used in the Chesterfield Power Station's modeling analysis was both representative and processed in accordance with general principles contained in applicable EPA guidance.

3.3.2.7. Modeling Parameter: Geography, Topography (Mountain Ranges or Other Air Basin Boundaries) and Terrain

The Chesterfield Power Station resides in the Atlantic Coastal Plain physiographic region. Topography is generally flat with the foothills of the Piedmont/Appalachian Mountains located far to the northwest and having no impact within the AERMOD modeling domain. No large water bodies reside in the area though portions of the James River become quite wide in the southeastern portion of the modeling domain as the river approaches the Chesapeake Bay.

The terrain in the area of analysis is best described as flat or gently sloping with somewhat higher elevations in the northwest portion of the domain. 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 is from the USGS National Elevation Database (10-m resolution).

Virginia's development of its model receptor elevations and critical hill heights is consistent with current EPA guidance and adequately captures the local terrain features in the AERMOD modeling domain.

3.3.2.8. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, the state used the 2012-14 1-hr SO_2 design valued calculated at the Henrico County monitor (EPA Monitor ID 51-087-0014) on the northern side of the modeling domain. This site was chosen due to its relative proximity to the Chesterfield Power Station (~ 19 km north of the facility). The monitor, while inside the modeling domain, is also relatively far from the larger emission sources in the modeling analysis thus minimizing the risk of double counting source contributions both in the modeling analysis and added background concentration. Another monitoring site, the Charles City (EPA Monitor ID 51-036-0002), was located closer to Chesterfield Power Station (~11 km east-southeast) but this monitor appears to be impacted by nearby sources including the cluster of sources near Hopewell, Virginia. Charles City's design value was almost four (4) times higher than that of the Henrico County monitor.

The single value of the background concentration for this area of analysis was determined by Virginia to be 18.34 micrograms per cubic meter ($\mu g/m^3$), equivalent to 7 ppb,[8] and that value was incorporated into the final AERMOD results.

The EPA reviewed Virginia's analysis for estimating background concentrations near the Chesterfield Power Station and has determined that the Henrico County monitor's 2012-14 design value is a reasonable estimate to use in the modeling analysis.

3.3.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Chesterfield area of analysis are summarized below in Table 6.

[8] The SO_2 NAAQS level is expressed in ppb but AERMOD gives results in $\mu g/m^3$. The conversion factor for SO_2 (at the standard conditions applied in the ambient SO_2 reference method) is 1ppb = approximately 2.619 $\mu g/m^3$.

Table 6: Summary of AERMOD Modeling Input Parameters for the Chesterfield Area of Analysis

Input Parameter	Value
AERMOD Version	15181 (Default)
Dispersion Characteristics	Rural
Modeled Sources	12
Modeled Stacks	33
Modeled Structures	30 (Chesterfield Power Station)
Modeled Fencelines	Yes, Chesterfield Power Station
Total receptors	MainGrid: 7,388/ 100m Grid: 676/50 m Grid: 25
Emissions Type	Actual
Emissions Years	2012-14
Meteorology Years	2012-14
NWS Station for Surface Meteorology	Richmond, Virginia
NWS Station Upper Air Meteorology	Sterling, Virginia
NWS Station for Calculating Surface Characteristics	Richmond, Virginia
Methodology for Calculating Background SO_2 Concentration	Design Value
Calculated Background SO_2 Concentration	7 ppb or 18.34 µg/m3

The results presented below in Table 7 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

Table 7. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO2 Concentrations Averaged Over Three Years for the Area of Analysis for the Chesterfield Area of Analysis

		Receptor Location [UTM zone XX, if applicable]		**99th percentile daily maximum 1-hour SO_2 Concentration (µg/m^3)**	
Averaging Period	**Data Period**	**UTM/Latitude**	**UTM/Longitude**	**Modeled concentration (including background)**	**NAAQS Level**
99th Percentile 1-Hour Average	2012-14	299250	4130450	120.08629 + 18.34 = **138.42629**	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 µg/m^3 conversion factor

Virginia's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 138.42629 μg/m^3, equivalent to 52.8 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facilities included in the modeling analysis. Figure 8 below was included as part of Virginia's recommendation, and indicates that the predicted value occurred near the cluster of sources near the City of Hopewell, VA. The state's receptor grid is also shown in the figure.

Figure 8: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Chesterfield Area of Analysis

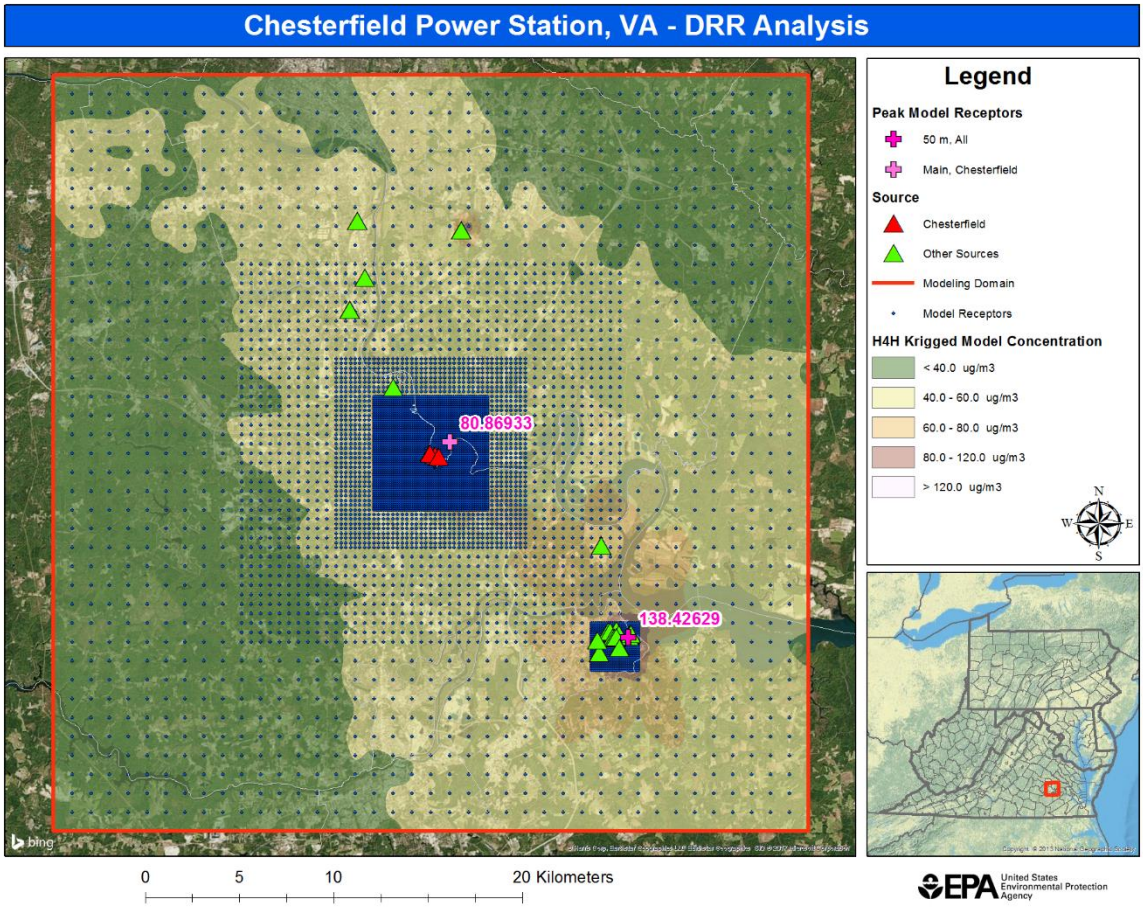
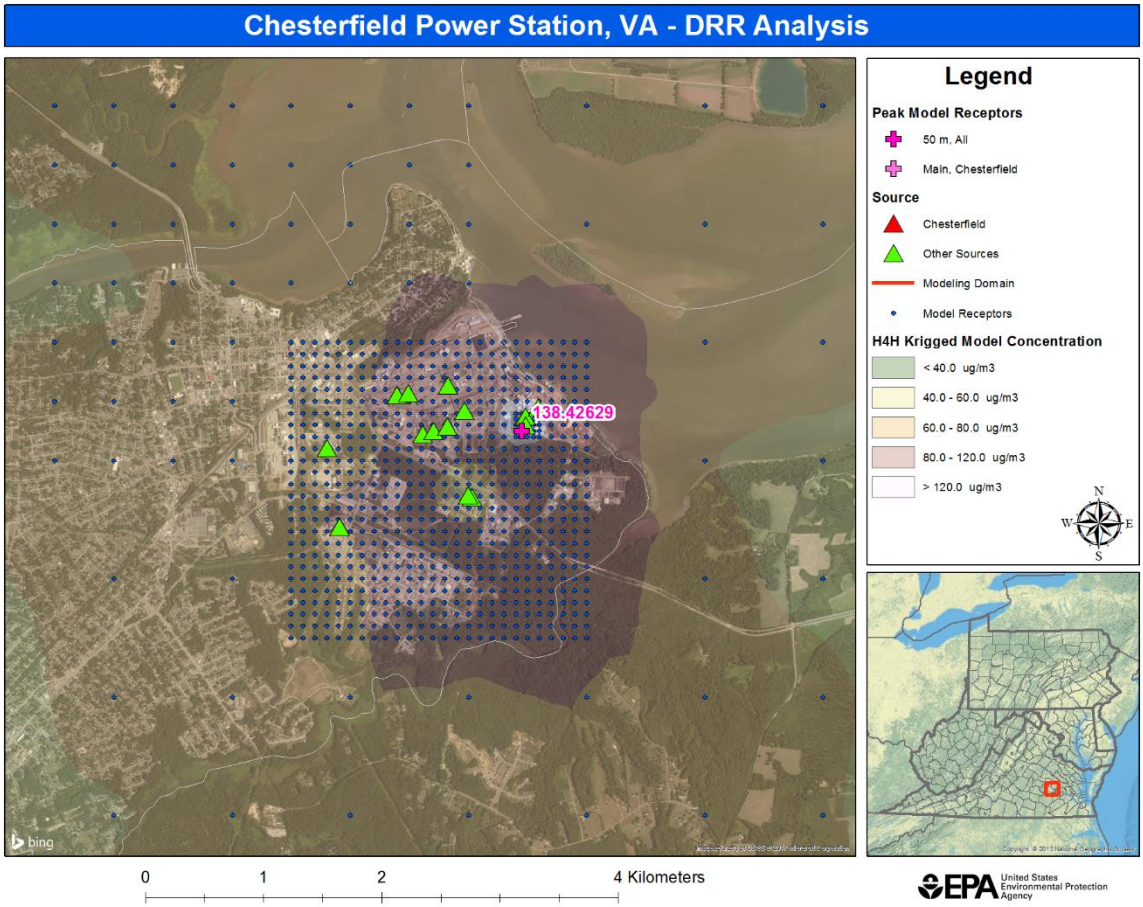


Figure 9: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the City of Hopewell Sources



Two (2) model peaks are shown on the figure with one peak showing the peak modeled concentration from sources that make up Chesterfield Power Station and another higher model peak concentration imbedded among a group of sources located in the City of Hopewell, Virginia. Virginia constructed a smaller fine-grid receptor grid near this cluster of sources to ensure the peak model concentration was captured. The cluster of modeled sources near the City of Hopewell are primarily responsible for the peak model concentration within the modeling domain; emissions from the Chesterfield Power Station are mainly impacting areas within a few kilometers of its primary stacks.

The modeling submitted by Virginia indicates that the 1-hour SO_2 NAAQS is not violated at the receptor with the highest modeled concentration.

3.3.2.10. The EPA's Assessment of the Modeling Information Provided by the State

The EPA believes the modeling for the Chesterfield Power Station was completed following the guidance outlined in EPA's Modeling TAD. Modeled concentrations are below the 1-hr SO_2 NAAQS and indicated no violation. Upon further review of the modeling it was discovered that the peak modeling concentrations are occurring over 10 km southeast of the Chesterfield Power Station near a cluster of modeled sources near the City of Hopewell, Virginia.

3.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Chesterfield Area of Analysis

These factors have been incorporated into the air quality modeling efforts and results discussed above. The EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

3.5. Jurisdictional Boundaries in the Chesterfield Area of Analysis

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for the Chesterfield area of analysis. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

Virginia recommended as attainment/unclassifiable jurisdictions in which the modeling receptor grid covered the entirety of the jurisdiction or a significant portion of the jurisdiction because the modeling analysis did not show any violations of the NAAQS in these jurisdictions. Namely, Virginia recommended that the entirety of Chesterfield County, the City of Richmond, Henrico County, Charles City County, the City of Petersburg, the City of Hopewell, and the City of Colonial Heights, be designated as attainment/unclassifiable. The modeling receptor grid also covered small portions of Dinwiddie County, Prince George County, Hanover County, and New Kent County, but Virginia did not recommend that these counties be designated as attainment/unclassifiable because it did not believe the grid extended far enough into these jurisdictions to make a determination of attainment, so instead recommended that they be designated as unclassifiable. Furthermore, Virginia has recommended that each county or city be designated as a stand-alone area and not as part of a larger multi-county, multi-city area.

3.6. Other Information Relevant to the Designations for the Chesterfield Area

There are no designated nonattainment areas or areas intended to be designated as nonattainment neighboring any of the counties or cities modeled in the Chesterfield area of analysis.

3.7. The EPA's Assessment of the Available Information for the Chesterfield Area of Analysis

The EPA finds that available air quality monitoring data alone are an unreliable representative of the area's air quality. Although design values from both air quality monitors located within this area of analysis are well below the standard of 75 ppb (29 and 8 ppb), it is unclear if these monitors are located in areas of maximum concentration, and therefore, it is unclear if the monitoring data are representative of actual air quality in the area. .

The EPA finds that available air dispersion modeling results show that the Chesterfield area of analysis is in attainment of the 1-hour SO_2 NAAQS. The modeling submitted by Virginia indicates that the 1-hour SO_2 NAAQS is not violated at the receptor with the highest modeled concentration. Virginia's modeling indicates that the highest predicted 99^{th} percentile daily maximum 1-hour concentration within the chosen modeling domain is 138.42629 $\mu g/m^3$, equivalent to 52.8 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facilities included in the modeling analysis.

Virginia recommended as attainment/unclassifiable jurisdictions in which the modeling receptor grid covered the entirety of the jurisdiction or a significant portion of the jurisdiction because the modeling analysis did not show any violations of the NAAQS in these jurisdictions. Virginia explained that it is unlikely that high SO_2 concentrations exist farther away from high emitting sources or groups of sources, so if an entire county was not included in the modeling domain but a significant portion of the county was included within the modeling domain, Virginia recommended that the entire county be designated as attainment/unclassifiable. The EPA agrees with this rationale since review of the modeling shows that SO_2 concentrations decrease substantially approaching the grid boundary, and no other sources were determined by the EPA to have the potential to cause concentration gradient impacts within the area of analysis.

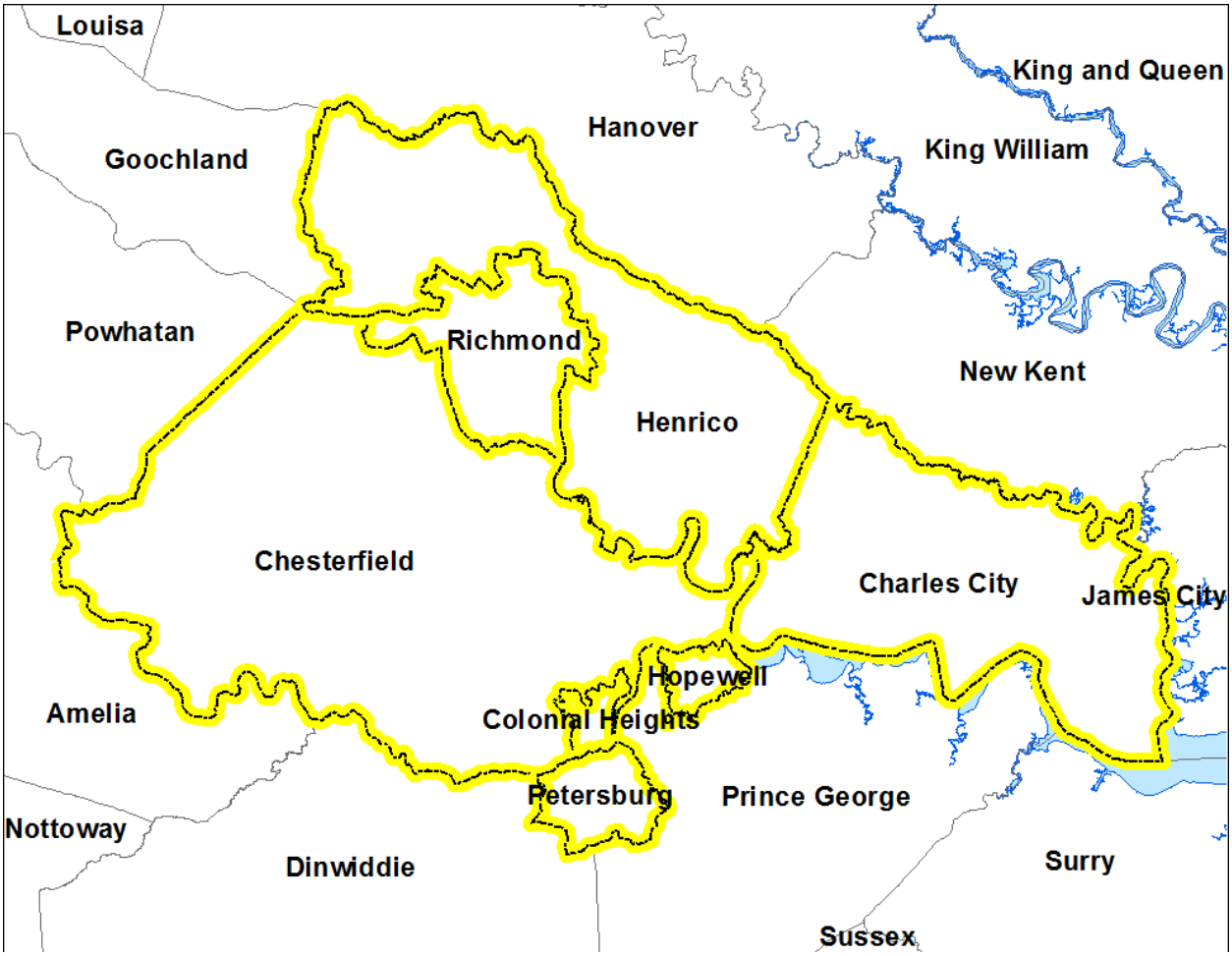
Furthermore, Virginia has recommended that each county or city be designated as a stand-alone area and not as part of a larger multi-county, multi-city area. The EPA agrees with Virginia's jurisdiction and boundary selections. The EPA believes that our intended unclassifiable/attainment areas, bounded by the county or city jurisdictional boundaries, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment areas.

3.8. Summary of Our Intended Designation for the Chesterfield Area of Analysis

After careful evaluation of Virginia's recommendations and supporting information, as well as all available relevant information, based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined the Chesterfield area (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS, and the EPA intends to designate the following as unclassifiable/attainment for the 2010 SO_2 NAAQS: Chesterfield County, the City of Richmond,

Henrico County, Charles City County, the City of Petersburg, the City of Hopewell, and the City of Colonial Heights. Specifically, the boundaries are comprised of the county or city jurisdictional boundaries for each individual county or city. Figure 10 shows the boundary of this intended designated area.

Figure 10. Boundaries of the Intended Unclassifiable/Attainment Areas in the Chesterfield Area of Analysis



4. Technical Analysis for the York, Virginia Area of Analysis

4.1. Introduction

The EPA must designate the York, Virginia, (York) area by December 31, 2017, because the area has not been previously designated and Virginia has not installed and begun timely operation of a new, approved SO_2 monitoring network to characterize air quality in the vicinity of any source in York county.

4.2. Air Quality Monitoring Data for the York, Virginia Area of Analysis

This factor considers the SO_2 air quality monitoring data in the York, Virginia, area of analysis. Virginia included monitoring data from the following monitor:

Table 8. Air Quality Monitoring Data for the York Area of Analysis

County/City	AQS Monitor ID	latitude	Longitude	2011-2013 Design Value	2012-2014 Design Value	2013-2015 Design Value	2014-2016 Design Value
Hampton City	51-650-0008	37.103733	-76.387017	37	37	36	29

Air Quality System monitor 51-650-0008 is located in Hampton City approximately 13 kilometers south-southeast of Yorktown Power Station. Data collected at this monitor meets completeness criteria and indicates that the design value has been and continues to be well below the 75 ppb standard, with the 2013-2015 design value being 36 ppb. Its 99th percentile daily maximum 1-hour concentration for 2015 was 30 ppb, well below the 75 ppb standard. Virginia intended all available data collected at this monitor to support and corroborate air dispersion modeling results; the discussion of these modeled results follows immediately below.

Additionally, the EPA also reviewed 2016 monitoring data (Table 8).
These data were available to the EPA for consideration in the designations process, however, since it is unclear if this monitor is located in the area of maximum concentration, it is unclear if the data are representative of the area's actual air quality. There are no other air quality monitors located within York County or the surrounding counties/cities. Air quality monitoring data discussed in this section can be found at https://www.epa.gov/air-trends/air-quality-design-values.

4.3. Air Quality Modeling Analysis for the York, Virginia Area of Analysis Addressing the Yorktown Power Station

4.3.1. Introduction

This section 4.3 presents all the available air quality modeling information for a portion of York County, Virginia, that includes the Yorktown Power Station. (York County and the other neighboring counties included in the analysis will collectively be referred to as "the York area" within this section 4.3). This area contains the following SO_2 sources, principally the sources around which Virginia is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tons per year:

- The Yorktown Power Station facility in York County emits 2,000 tons or more annually. Specifically, the Yorktown Power Station emitted 9,756 tons of SO_2 in the 2014 NEI.

This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and Virginia has chosen to characterize it via modeling.

- The Williamsburg Sewage Treatment Plant facility in James City is not on the SO_2 DRR Source list but was included in the modeling analysis. This source emitted approximately 131 tons of SO_2 in the 2014 NEI.

- The Hampton/NASA Steam Plant facility in Hampton City is not on the SO_2 DRR Source list but was included in the modeling analysis. This source emitted approximately 81 tons of SO_2 in the 2014 NEI.

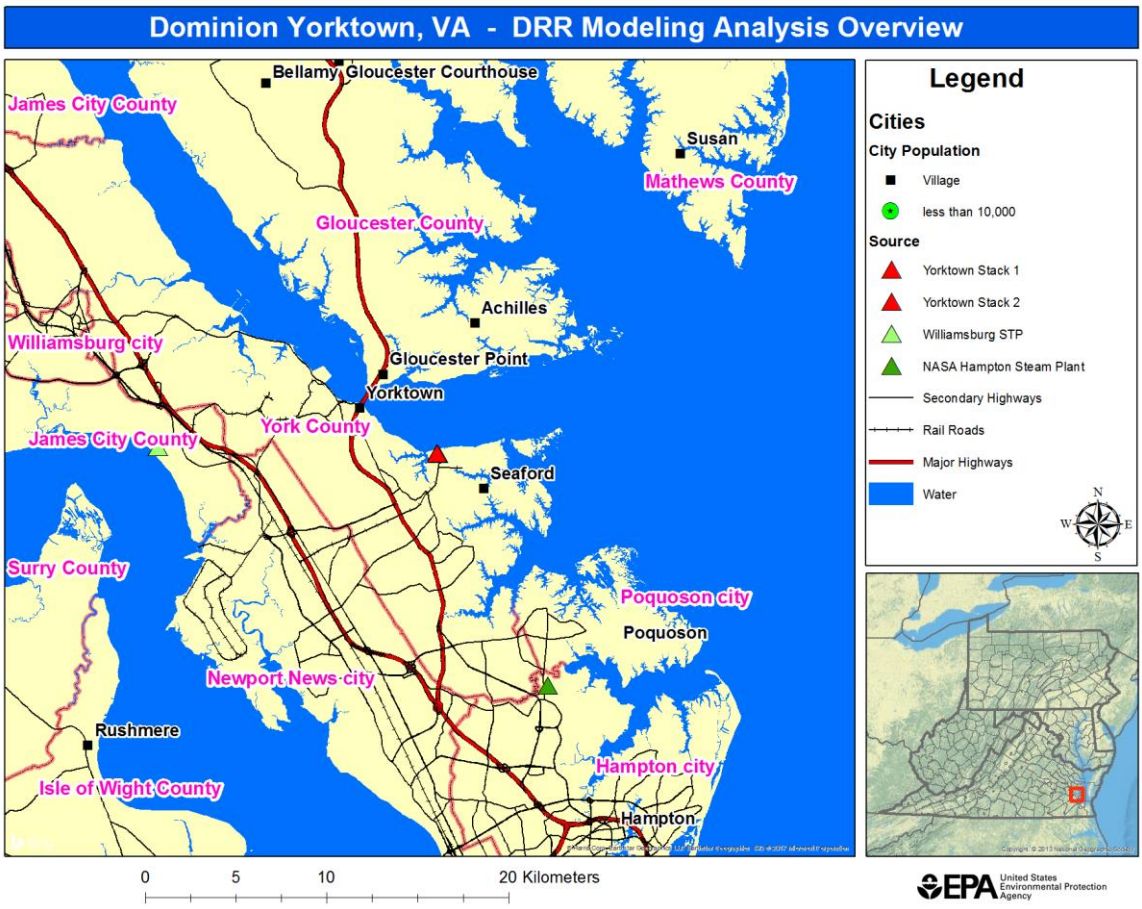
Because we have available results of air quality modeling in which these sources are modeled together, the area around this group of sources is being addressed in this section with consideration given to the impacts of all these sources.

In its submission, Virginia recommended that an area that includes the area surrounding the York Power Station, specifically the entirety of the City of Poquoson, nearly all of York County, the City of Newport News, and the City of Hampton, be designated as attainment/unclassifiable based in part on an assessment and characterization of air quality impacts from this facility and other nearby sources that may have a potential impact in the area where the 2010 SO_2 NAAQS may be exceeded. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of Virginia's assessment, supporting documentation, and all available data, the EPA agrees with Virginia's recommendation for the area, and intends to designate the area unclassifiable/attainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

The area that Virginia has assessed via air quality modeling is located in southeast Virginia and includes nearly all of York County, the City of Newport News, the city of Poquoson, the City of Hampton, and portions of Matthews County, Gloucester County, James City County, Surry County, Isle of Wight County, and the City of Williamsburg.

Figure 11 below shows the location of the Yorktown Power Station. Also included in the figure are other nearby emitters of SO_2. These are the Williamsburg Sewage Treatment Plant and the Hampton/NASA Steam Plant. All of the modeled facilities are located on the peninsula separating the York and the James rivers. The EPA's intended unclassifiable/attainment designation boundaries are not shown in this figure, but are shown in a figure in the section below that summarizes our intended designation.

Figure 11. Map of the York Area of Analysis Addressing the Yorktown Power Station



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered only one modeling assessment, that which was submitted by Virginia.

4.3.2. Modeling Analysis Provided by the State

The Commonwealth of Virginia submitted a modeling analysis for the region surrounding the Yorktown Power Station on January 11, 2017.

4.3.2.1. Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. 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
- BPIPPRM: 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

Virginia used AERMOD version 15181 with regulatory options, which was the current version at the time of submittal. On January 17, 2017, EPA published its revision to Appendix W – Guideline to Air Quality Models.[9] Since the publication of Appendix W, the currently approved AERMOD platform is version 16216 that includes updates. However, the updates made to components of AERMOD version 16216 were not utilized in the air quality modeling assessment, such as ADJ_U*. A discussion of Virginia's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

4.3.2.2. Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the "urban" or "rural" determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD details the procedures used to determine if a source is urban or rural based on land use or population density.

The application of AERMOD requires characterization of the local (within 3 kilometers) dispersion environment as either urban or rural, based on a USEPA-recommended procedure (commonly referred to as the Auer Method) that characterizes an area by prevalent land use. This land use approach classifies an area according to 12 land use types. In this scheme, areas of industrial, commercial, and compact residential land use are designated urban. According to USEPA modeling guidelines, if more than 50% of an area within a 3-km radius of the facility is classified as rural, then the urban model option in AERMOD should not be used in the dispersion modeling analysis. Conversely, if more than 50% of the area is urban, then it can be considered.

Visual inspection of the 3-km area surrounding the Yorktown Power Station (similar to Auer method) clearly shows the area is rural. Therefore, the urban model option in AERMOD was not used. For the purpose of performing the modeling for the area of analysis, the state determined that it was most appropriate to run the model in rural dispersion mode. The EPA agrees with Virginia's assessment.

4.3.2.3. Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not

[9] https://www.federalregister.gov/documents/2015/07/29/2015-18075/revision-to-the-guideline-on-air-quality-models-enhancements-to-the-aermod-dispersion-modeling

limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The Yorktown Power Station is the primary source of SO_2 emissions subject to the DRR in this area as described in the introduction to this section. For the York area, the state has included two (2) other emitters of SO_2 within 20 kilometers of Yorktown Power Station in any direction. Virginia determined that this was the appropriate distance to adequately characterize air quality through modeling to include the potential extent of any SO_2 NAAQS exceedances in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. In addition to the Yorktown Power Station, the other emitters of SO_2 included in the area of analysis are the Williamsburg Sewage Treatment Plant and the Hampton/NASA Steam Plant. No other sources beyond 20 km were determined by Virginia to have the potential to cause concentration gradient impacts within the area of analysis. EPA agrees with Virginia's conclusion.

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

- Fence line receptors spaced at 25-m intervals along the Yorktown Power Station's ambient air boundary, which is approximately 3.7 km in length
- A 100 m spaced Cartesian receptor grid extending from the fence line receptor out to 3 km from the Yorktown Power Station
- A 250 m spaced Cartesian receptor grid extending from 3 km to 5 km from the Yorktown Power Station
- A 500 m spaced Cartesian receptor grid extending from 5 km to 10 km from the Yorktown Power Station
- A 1,000 m spaced Cartesian receptor grid extending from 10 km to 20 km from the Yorktown Power Station

Receptors over open waters in the modeling domain were excluded from the analysis in accordance with EPA's Modeling TAD. Open water covers a significant portion of the modeling domain.

The receptor network contained 4,662 receptors, and the network covered portions of eleven (11) counties and cities in Virginia. Much of the modeling domain sits along the southwestern portion of the Chesapeake Bay near the terminus of the James and York rivers.

Figures 12 and 13 show the location of Yorktown Power Station and Virginia's chosen area of analysis surrounding the Yorktown Power Station, as well as the receptor grid for the area of analysis.

Consistent with the Modeling TAD, the state placed receptors for the purposes of this designation effort in locations that would be considered ambient air relative to each modeled facility, including other facilities' property with the exceptions of locations described in Section 4.2 of the Modeling TAD as not being feasible locations for placing a monitor. The Yorktown Power Station's modeled fence line was generally verified using GIS software. A significant

fraction of the modeling domain is devoid of model receptors since there are large areas in the modeling domain that are over the open waters of the James and York river systems and portions of the Chesapeake Bay. Areas over open water are excepted from placing model receptors in accordance with EPA's Modeling TAD.

Figure 12: Yorktown Power Station

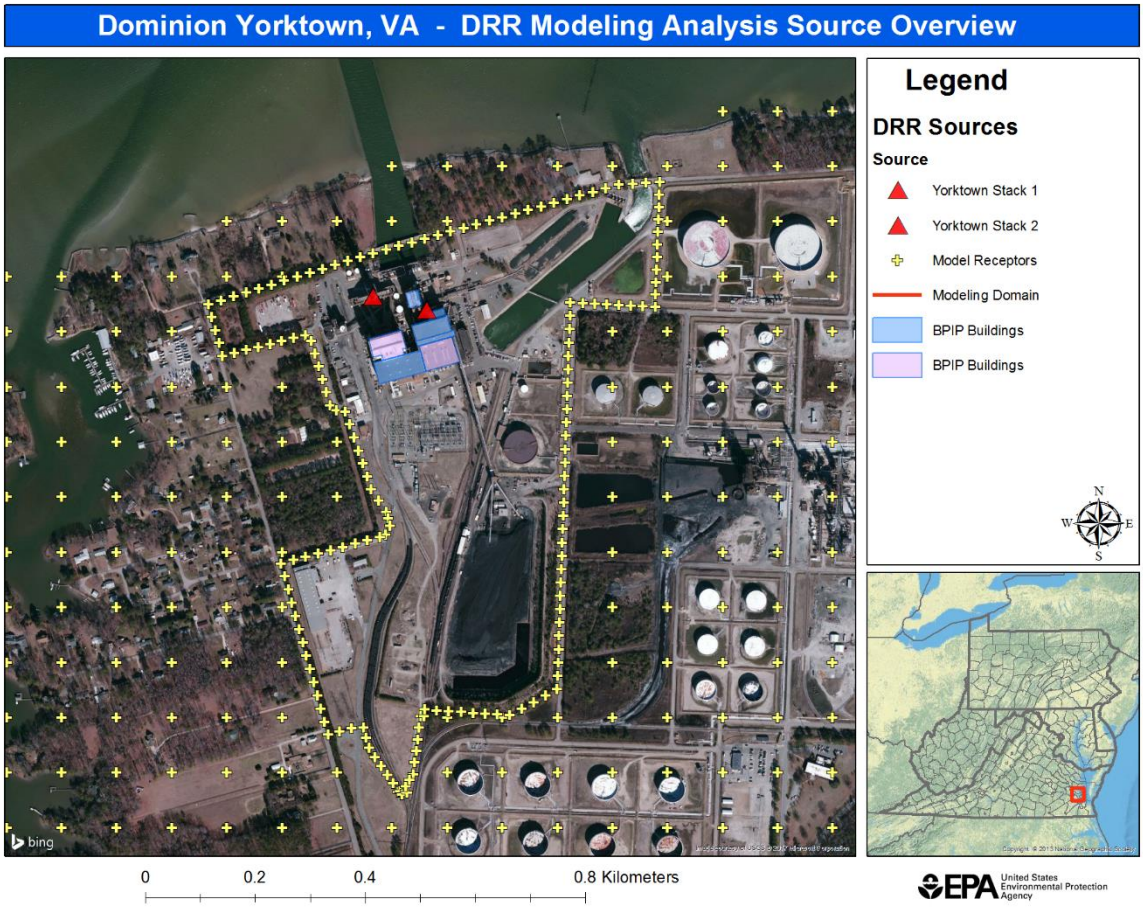
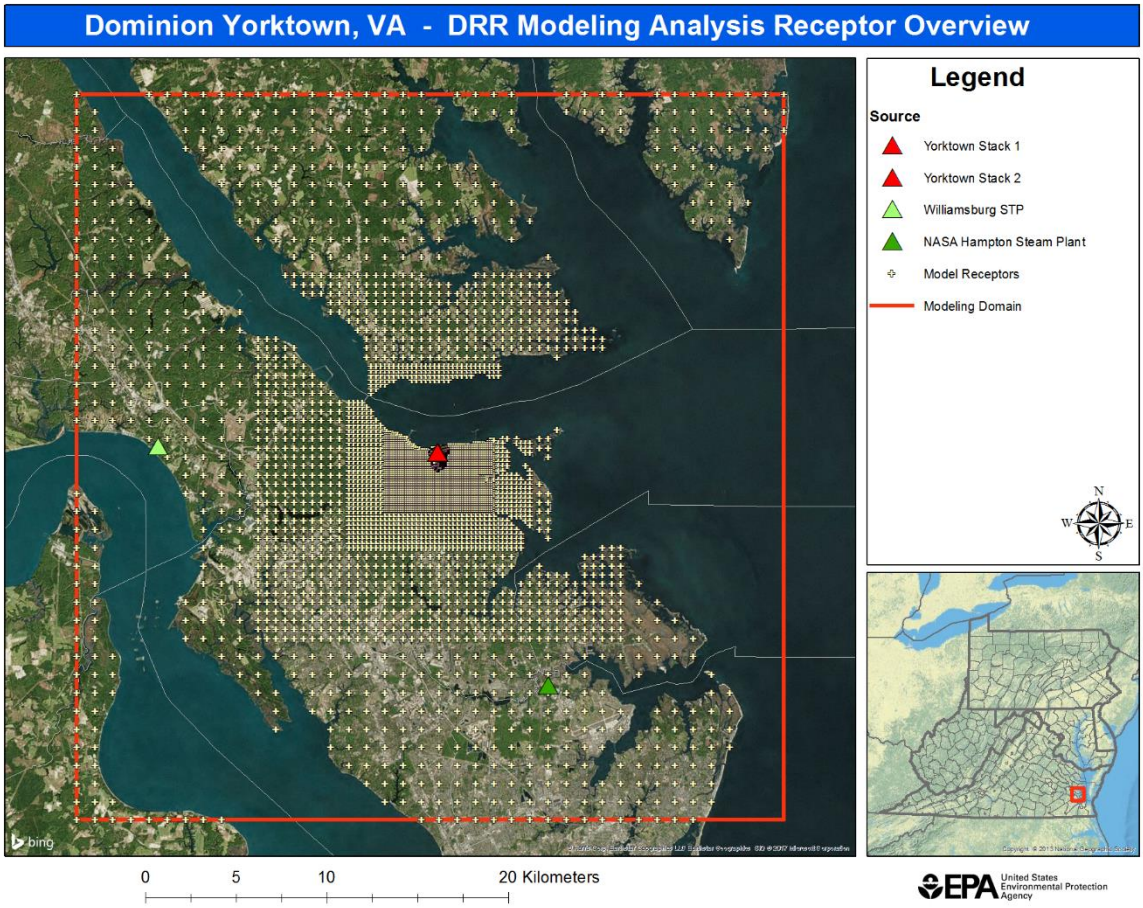


Figure 13: Receptor Grid for the York Area of Analysis



The EPA reviewed Virginia's model receptor grid and believes it accurately reflects the Yorktown Power Station's fence line boundary, areas of open water, and is of sufficient resolution to capture the maximum modeled concentration.

4.3.2.4. Modeling Parameter: Source Characterization

Section 6 of the Modeling TAD offers recommendations on source characterization including source types, use of accurate stack parameters, inclusion of building dimensions for building downwash (if warranted), and the use of actual stack heights with actual emissions or following GEP policy with allowable emissions.

The modeling analysis' primary source in the area was the Yorktown Power Station, which was the only facility in the York area of analysis having actual SO_2 emissions for the most recent calendar year in excess of 2,000 tpy. The 2014 Virginia state-wide inventory was used to determine what facilities have greater than 50 tpy of actual SO_2 emissions and are within 20 kilometers of Yorktown Power Station. The only two facilities identified were the Williamsburg

Sewage Treatment Plant located approximately 14 kilometers to the west and the Hampton/NASA Steam Plant located approximately 13 kilometers to the south-southeast in very close proximity to the Hampton City SO_2 monitor. According to Virginia's SO_2 Inventory, these facilities emitted 131 and 81 tons of SO_2 in 2014 respectively. Given the distance between these two sources and the much larger Yorktown Power station, Virginia felt that it is highly unlikely that these sources would interact on a 1-hour basis in the vicinity of the primary source. To be conservative, however, these sources were both included in the modeling. EPA agrees with Virginia's assessment of sources to include in the modeling analysis.

There are three major SO_2 emission sources at the Yorktown Power Station. Those include Units 1 and 2 (coal-fired boilers), and Unit 3 (an oil-fired boiler). Units 1 and 2 are uncontrolled units and have appeared on the PJM Deactivation List but are presently operating and operable with a federally enforceable Title V air operating permit.[10] The Yorktown Power Station has other potential small sources of SO_2 including a diesel generator and a diesel firewater pump, but these units have very low potential SO_2 emissions (2.7 tpy) and thus are not expected to have an impact on the 1-hour SO_2 modeling and were excluded. There are also two distillate oil-fired heaters listed in the facility's Title V air permit, but both have been removed from service and have therefore not been included in the modeling analysis.

Virginia characterized these sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, Virginia used actual stack heights in conjunction with actual emissions. Virginia also adequately characterized the source's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter for the primary source (building information for the two smaller sources, Williamsburg Sewage Treatment Plant and Hampton/NASA Steam Plant, were not included in the modeling analysis). Where appropriate, the AERMOD component BPIPPRMwas used to assist in addressing building downwash. Building and stack position information for the Yorktown Power Station included in the modeling analysis was verified using GIS software.

4.3.2.5. Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose 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 indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective.

The EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information, when they are available. 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 recommends using detailed throughput, operating schedules, and emissions information from the impacted source(s).

[10] http://www.pjm.com/~/media/planning/gen-retire/pending-deactivation-requests.ashx

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. For example, where a facility has recently adopted a new federally enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS, the state may choose to model PTE rates. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations. 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, Virginia included the Yorktown Power Station and two (2) other emitters of SO_2 within 20 km in the area of analysis. Virginia has chosen to model these facilities using actual emissions. The facilities in Virginia's modeling analysis and their associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.

For the Yorktown Power Station, the Williamsburg Sewage Treatment Plant and the Hampton/NASA Steam Plant, Virginia provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 9. A description of how Virginia obtained hourly emission rates is given below this table.

Table 9. Actual SO_2 Emissions Between 2013 – 2015 from Facilities in the York Area of Analysis

Modeled Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Yorktown Power Station Unit 1 & 2	8,654.6	8,851.1	2,478.4
Yorktown Power Station Unit 3	400.8	925.6	2,096.8
Yorktown Power Station Combined	9,055.4	9,776.7	4,573.8
Williamsburg Sewage Treatment Plant *	130.8	130.8	130.8
NASA/Hampton Steam Plant *	80.7	80.7	80.7
Total Emissions from All Facilities in the State's Area of Analysis	**9,266.9**	**9,988.2**	**4,785.3**

EPA Clean Air Market Division Emissions for Yorktown Power Station			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Yorktown Power Station Unit 1 ***	3,845.0	4,177.2	1,404.5
Yorktown Power Station Unit 2 ***	4,807.2	4,667.5	1,072.3
Yorktown Power Station Unit 3	398.8	908.5	2,070.5
Yorktown Power Station Combined	9,051.0	9,753.2	4,547.2
Total Emissions from All Modeled Facilities in the State's Area of Analysis	**9,051.0**	**9,964.7**	**4,547.2**

2014 NEI Emissions	
Facility	**2014 NEI SO_2 Emissions (tpy)**
Dominion Yorktown Power Station	9,755.5
HRSD Williamsburg Sewage Treatment Plant	37.2
Hampton/NASA Steam Plant	80.5

* Virginia Provided Actual Annual Emissions

For Yorktown Power Station, the actual hourly SO_2 emissions data were obtained from CEM data provided by the facility and used in the Virginia modeling analysis. In addition to this data, EPA also constructed actual hourly emissions available from EPA's Clean Air Markets Data (CAMD) website[11] and emissions from the 2014 NEI for comparison. As shown in the previous table, the annual modeled emissions for the Yorktown Power Station are very similar to totals from EPA's CAMD website and the 2014 NEI.

The Yorktown Power Station's hourly emission rates varied according to CEM collected values to reflect actual hourly emissions from the facility. Hourly modeled emissions for Units 1 & 2 (coal units) and Unit 3 (oil unit) were compared with hourly rates extracted from CAMD. Modeled hourly rates for both units were very close to the rates from CAMD. Tables showing the difference between hourly modeled and CAMD emission rates for both units are shown in Table 10. The table shows modeled hourly emission rates were mostly within +/- 250 lbs/hr of the rates in CAMD.

[11] https://ampd.epa.gov/ampd/

Table 10. Table showing the difference between modeled and CAMD hourly emission rates for the Yorktown Power Station Units 1, 2 and 3.

Yorktown Power Station Unit 1 & 2		Yorktown Power Station Unit 3	
Bin	**Frequency**	**Bin**	**Frequency**
-250	0	-250	0
0	26,054	0	25,945
250	202	250	274
500	14	500	14
1,000	6	1,000	14
1,500	2	1,500	15
2,000	0	2,000	6
More	2	More	12

Plant stack temperatures and velocities also varied according to CEM measurements. A quick survey of the modeled temperatures and velocities indicated that the coal units (1 & 2) values were within the realm of expected ranges. Unit 3, however, had stack velocities that occasionally exceeded 50 m/s. While these values are unusual, they were infrequent and likely do not alter the final modeled concentrations since emissions from the oil unit are not as high as the two (2) coal units when they are fully operational.

4.3.2.6. Modeling Parameter: Meteorology and Surface Characteristics

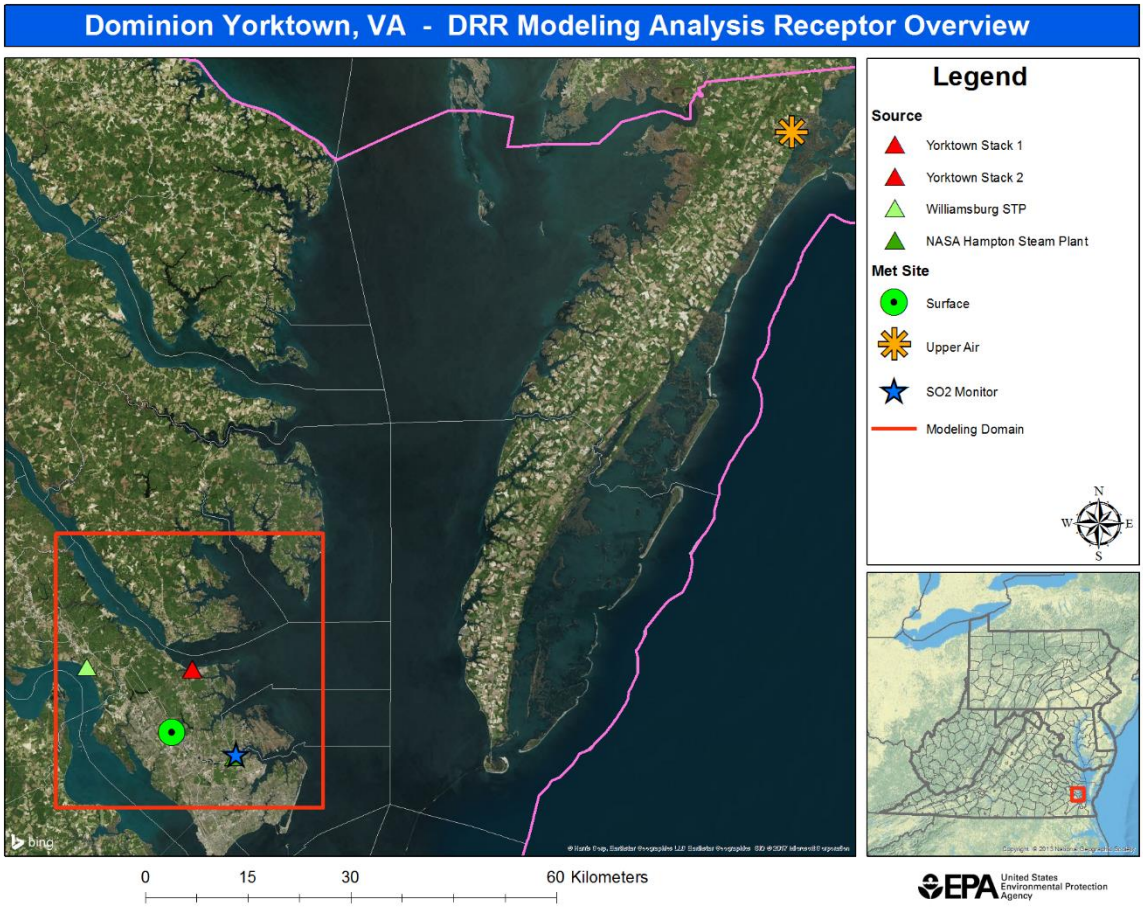
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data is determined 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 (FAA), and military stations.

For the area of analysis for the York area, Virginia selected the surface meteorology from Newport News/Williamsburg International Airport located in Newport News, Virginia, and coincident upper air observations from Wallops Island Airport located in Accomack County, Virginia as best representative of meteorological conditions within the area of analysis. The Newport News /Williamsburg International Airport and the Wallops Island Airport are located approximately 10 km south-southwest and 117 km northeast of the Yorktown Power Station respectively.

Virginia used AERSURFACE version 13016 using data from Newport News/Williamsburg International Airport to estimate the surface characteristics of the area of analysis. Virginia estimated values for three (3) spatial sectors out to 1.0 km at a monthly temporal resolution for dry, wet, average conditions based on local actual and historical rainfall rates. The state 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"). AERSURFACE was run using non-default seasonal values with no snow cover. The airport's more southerly location limits the number of autumn months, prohibits monthly snow cover, initiates an early spring and extends the growing season.

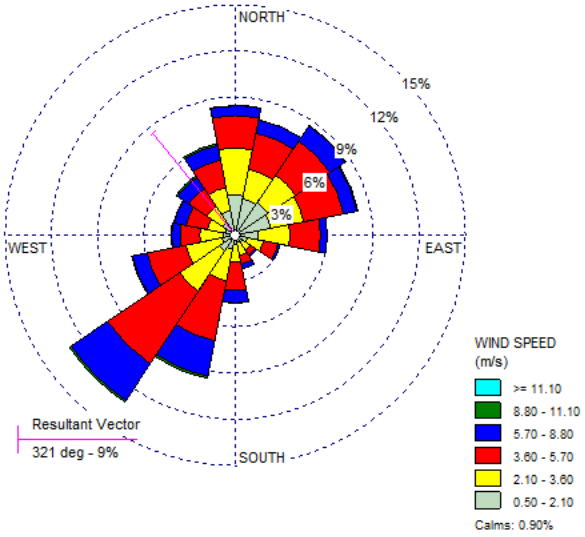
In the figure below, generated by the EPA, the location of these NWS stations are shown relative to the area of analysis.

Figure 14. Area of Analysis and the NWS stations in the York Area



As part of its recommendation, Virginia provided the 3-year surface wind rose for the Newport News/Williamsburg International Airport. In Figure 15, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose shows predominant winds from the north to northeast with a secondary southwest pattern. The resultant wind vector direction for the 10-m wind measurements appears to be from the northwest, a blending of the predominant wind patterns.

Figure 15: York Area Cumulative Annual Wind Rose for Years 2013 – 2015



Meteorological data from the above surface and upper air NWS 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. Virginia followed the methodology and settings presented in their modeling protocol, which followed guidance set forth in 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 and 5-minute duration was provided from the Newport News/Williamsburg International Airport 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. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the 1-minute and 5-minute wind data.

No major discrepancies were noted in the meteorological data processing for the Yorktown Power Station.

4.3.2.7. Modeling Parameter: Geography, Topography (Mountain Ranges or Other Air Basin Boundaries) and Terrain

The terrain in the area of analysis is best described as flat coastal plain. The Yorktown Power Station sits along the south shore the York River near its terminus point with the Chesapeake Bay. Terrain is relatively flat with no appreciable terrain located within the modeling domain. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The dataset was downloaded from the USGS website and consisted of 1/3 arc second (~10 m resolution) NED. As per the AERMAP User's Guide, the domain was sufficient to ensure all significant nodes are included such that all terrain features exceeding a 10% elevation slope from any given receptor, are considered.

EPA believes that the terrain within the modeling domain has been adequately characterized.

4.3.2.8. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, Virginia used a modified temporally varying background concentration from the air quality monitorlocated approximately 14 km south-southeast from the Yorktown Power Station. Due to this monitor's close proximity to the primary modeled source, Virginia modified the monitor values by excluding hours when winds were blowing from the Yorktown Power Station towards the SO_2 monitor (based on hourly wind data from the Newport News/Williamsburg International Airport). Observed hourly SO_2 concentrations that corresponded to a 90 degree sector (45 degrees on a side along a direct line from Yorktown Power Station towards the monitor) were removed from the background database. This approach avoided "double counting" the impacts of the Yorktown Power Station in both the modeling analysis and the background concentration. Final seasonal hourly background concentrations are provided in Table 5-2 of the final report. The background concentrations for this area of analysis were determined by Virginia to vary from 3.14 micrograms per cubic meter ($\mu g/m^3$), equivalent to 1.2 ppb when expressed in 2 significant figures,[12] to 20.69 $\mu g/m^3$ (7.9 ppb), with an average value of 8.73$\mu g/m^3$ (3.3 ppb).

The EPA believes the techniques used by Virginia are justified given the close proximity of the background monitor and the possibility of "double counting" the impacts of the Yorktown Power Station in both the modeled and the background monitoring concentration. While the background

[12] The SO_2 NAAQS level is expressed in ppb but AERMOD gives results in $\mu g/m^3$. The conversion factor for SO_2 (at the standard conditions applied in the ambient SO_2 reference method) is 1ppb = approximately 2.619 $\mu g/m^3$.

value ranges are quite low they are within the range commonly seen for isolated monitors in this region and are likely representative of the area of analysis.

4.3.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the York area of analysis are summarized below in Table 11.

Table 11: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the York Area

Input Parameter	Value
AERMOD Version	15181 (Default)
Dispersion Characteristics	Rural
Modeled Sources	3
Modeled Stacks	4
Modeled Structures	Yorktown Power Station Only (7)
Modeled Fencelines	Yorktown Power Station Ambient Boundary
Total receptors	4,662
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Newport News, VA (PHF)
NWS Station Upper Air Meteorology	Wallops Island, VA (WAL)
NWS Station for Calculating Surface Characteristics	Newport News, VA (PHF)
Methodology for Calculating Background SO_2 Concentration	Seasonally Varying; Removed Hours with Yorktown Emissions
Calculated Background SO_2 Concentration	1.2 - 7.9 ppb

The results presented below in Table 12 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

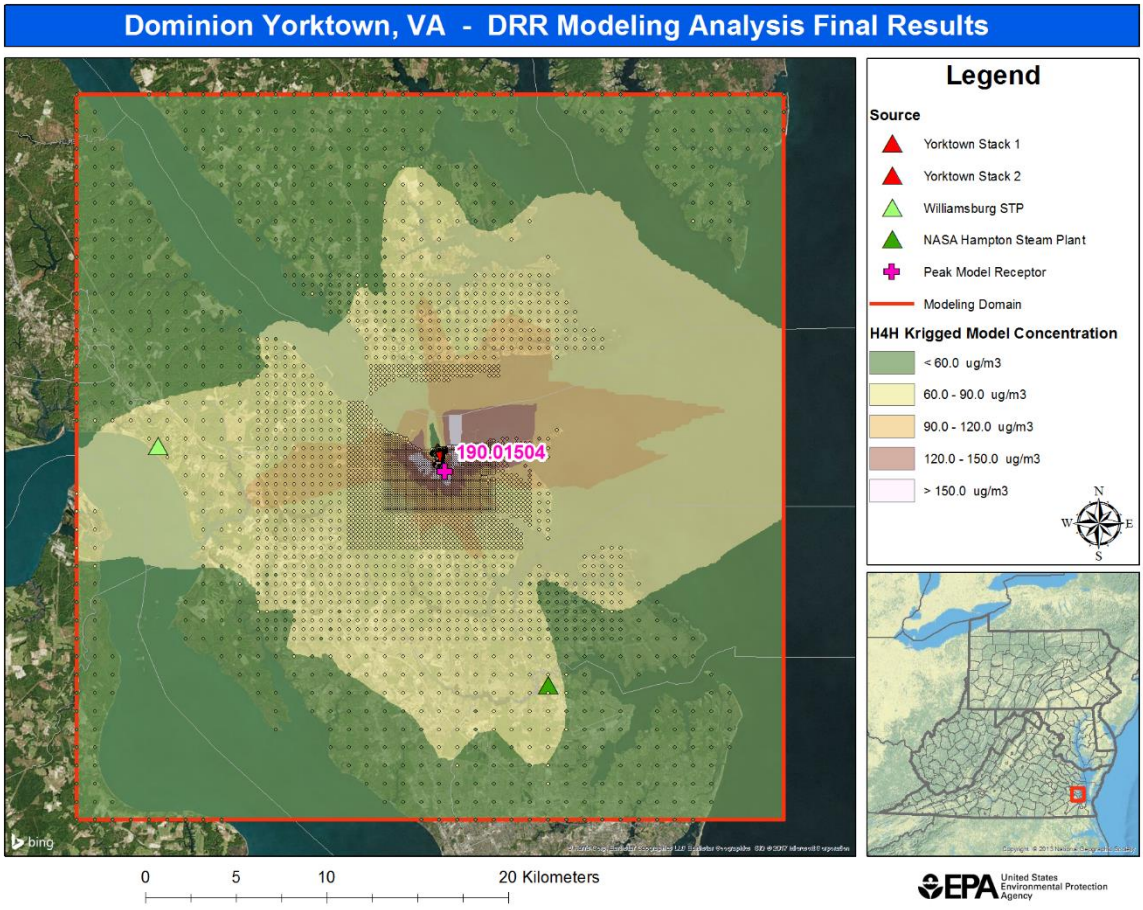
Table 12. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO2 Concentrations Averaged Over Three Years for the Area of Analysis for the York Area

Averaging Period	Data Period	Receptor Location [UTM zone XX, if applicable]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM/Latitude	UTM/Longitude	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-15	370,700	4,118,700	190.01	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor

Virginia's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 190.01 $\mu g/m^3$, equivalent to 72.6 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facilities included in the modeling. Figure 16 indicates that the predicted value occurred approximately 1.1 km south of the Yorktown Power Station's coal units stack close to the facility's projected ambient air boundary. Virginia's receptor grid is also shown in the figure.

Figure 16: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the York Area



The modeling submitted by Virginia does not indicate that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration.

4.3.2.10. The EPA's Assessment of the Modeling Information Provided by the State

Virginia submitted a modeling analysis for the Yorktown Power Station located along the southern shore of the York River in York County, Virginia. The power station sits in generally flat terrain near the confluence of the York River and the Chesapeake Bay. Virginia's modeling analysis for the York Power Station generally follows EPA's Modeling TAD and uses actual hourly emissions from 2013-2015. Stack and building position information was verified using GIS software. The modeling domain was large enough to capture peak model concentration in this area's flat terrain, which is expected to occur within 1.0 to 1.5 km of the facility's stacks (using the ten stack height rule of thumb). The peak model concentration occurs approximately 1.1 km south-southeast of the power station in York County.

4.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the York Area of Analysis

These factors have been incorporated into the air quality modeling efforts and results discussed above. The EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

4.5. Jurisdictional Boundaries in the York Area of Analysis

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for York area of analysis. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

Virginia recommended as attainment/unclassifiable jurisdictions in which the modeling receptor grid covered the entirety of the jurisdiction or a significant portion of the jurisdiction because the modeling analysis did not show any violations of the NAAQS in these jurisdictions. Namely, Virginia recommended that the all of York County, the City of Poquoson, the City of Newport News, and the City of Hampton be designated as attainment/unclassifiable. The modeling receptor grid also covered small portions of Matthews County, Gloucester County, James City County, Surry County, Isle of Wight County, and the city of Williamsburg, but Virginia did not recommend that these counties be designated as attainment/unclassifiable because it did not believe the grid extended far enough into these jurisdictions to make a determination of attainment, so instead recommended that they be designated as unclassifiable. Furthermore, Virginia has recommended that each county or city be designated as a stand-alone area and not as part of a larger multi-county, multi-city area.

4.6. Other Information Relevant to the Designations for the York Area of Analysis

There are no designated nonattainment areas or areas intended to be designated as nonattainment neighboring any of the counties or cities modeled in the York area of analysis that could be impacting the air quality in the York area of analysis.

4.7. The EPA's Assessment of the Available Information for the York Area of Analysis

The EPA reviewed all available air quality monitoring data. These data were available to the EPA for consideration in the designations process, however, since it is unclear if the monitor is located in the area of maximum concentration, it is unclear if the data are representative of the area's actual air quality.

The EPA finds that available air dispersion modeling results show that the York area of analysis is in attainment of the 1-hour SO_2 NAAQS.
The modeling submitted by Virginia indicates that the 1-hour SO_2 NAAQS is not violated at the receptor with the highest modeled concentration. Virginia's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 190.01 µg/m^3, equivalent to 72.6 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facilities.

Virginia recommended as attainment/unclassifiable jurisdictions in which the modeling receptor grid covered the entirety of the jurisdiction or a significant portion of the jurisdiction because the modeling analysis did not show any violations of the NAAQS in these jurisdictions. Virginia explained that it is unlikely that high SO_2 concentrations exist farther away from high emitting sources or groups of sources, so if an entire county was not included in the modeling domain but a significant portion of the county was included within the modeling domain, Virginia recommended that the entire county be designated as attainment/unclassifiable. The EPA agrees with this rationale since review of the modeling shows that SO_2 concentrations decrease substantially approaching the grid boundary. No other sources were determined to have the potential to cause concentration gradient impacts within the area of analysis.

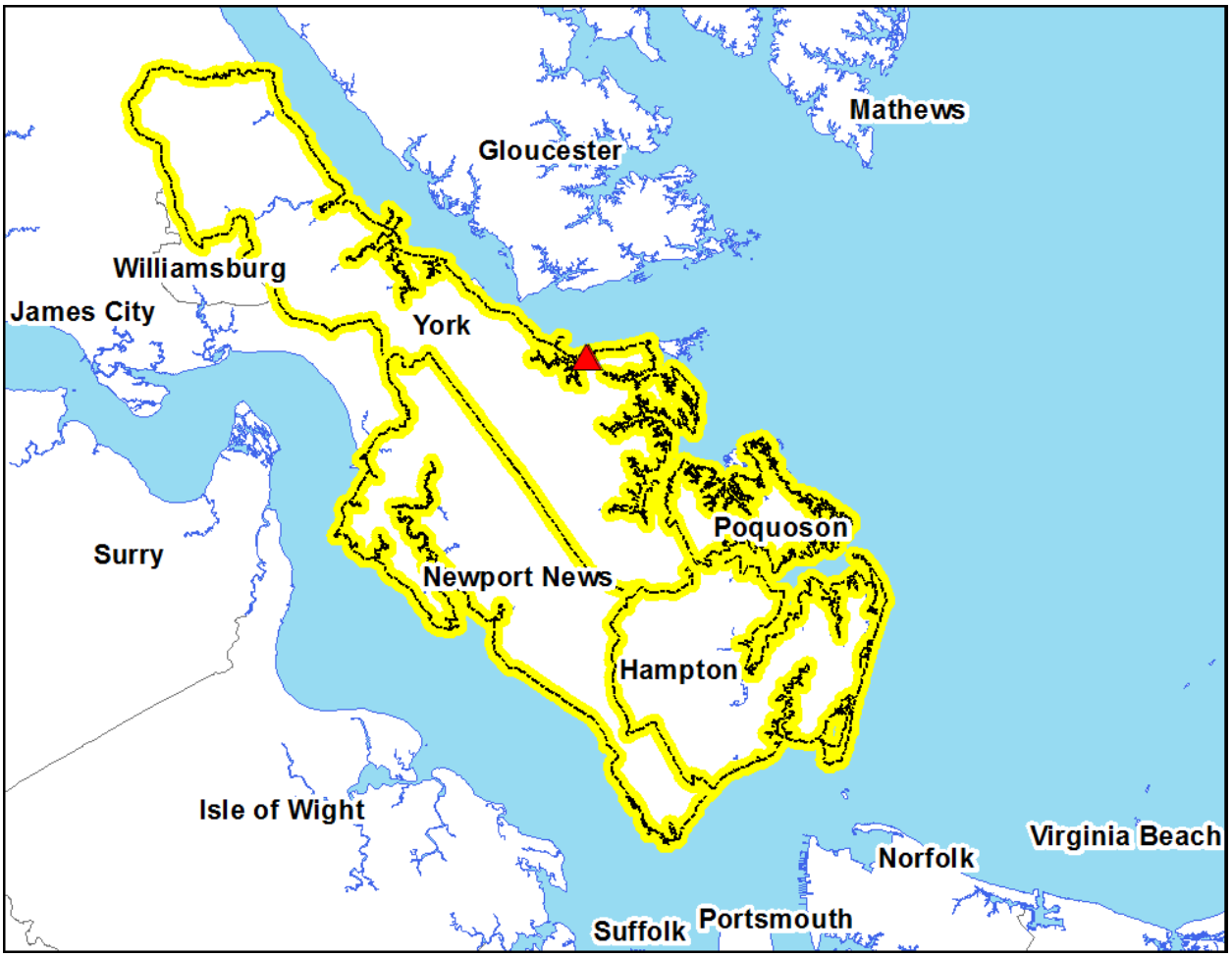
Furthermore, Virginia has recommended that each county or city be designated as a stand-alone area and not as part of a larger multi-county, multi-city area. The EPA agrees with Virginia's jurisdiction and boundary selections. The EPA believes that our intended unclassifiable/attainment area, bounded by the county jurisdictional boundaries, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area.

4.8. Summary of Our Intended Designation for the York Area of Analysis

After careful evaluation of Virginia's recommendation and supporting information, as well as all available relevant information, based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined the York area (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS, and the EPA intends to designate the following as unclassifiable/attainment for the 2010 SO_2 NAAQ: York County, the City of Poquoson, the City of Newport News, and the City of Hampton. Specifically, the boundaries are comprised of the

county or city jurisdictional boundaries for each individual county or city. Figure 17 shows the boundary of this intended designated area.

Figure 17. Boundary of the Intended Unclassifiable/Attainment Areas in the York Area of Analysis



5. Technical Analysis for the Halifax, Virginia Area of Analysis

5.1. Introduction

The EPA must designate the Halifax, Virginia, (Halifax) area by December 31, 2017 because the area has not been previously designated and Virginia has not installed and begun timely operation of a new, approved SO_2 monitoring network to characterize air quality in the vicinity of any source in Halifax county.

5.2. Air Quality Monitoring Data for the Halifax, Virginia Area of Analysis

There are no air quality monitors located in the Halifax, Virginia, area of analysis.

5.3. Air Quality Modeling Analysis for the Halifax, Virginia Area of Analysis Addressing the Clover Power Station

5.3.1. Introduction

This section 5.3 presents all the available air quality modeling information for the Clover Power Station in Halifax County, Virginia and several surrounding counties, and will be referred to as "the Halifax area" within this section 5.3. A survey of the area surrounding the Clover Power Station indicated no other sources within 10 km. Thus this area contains only one facility, Clover Power Station, which Virginia is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tons per year:

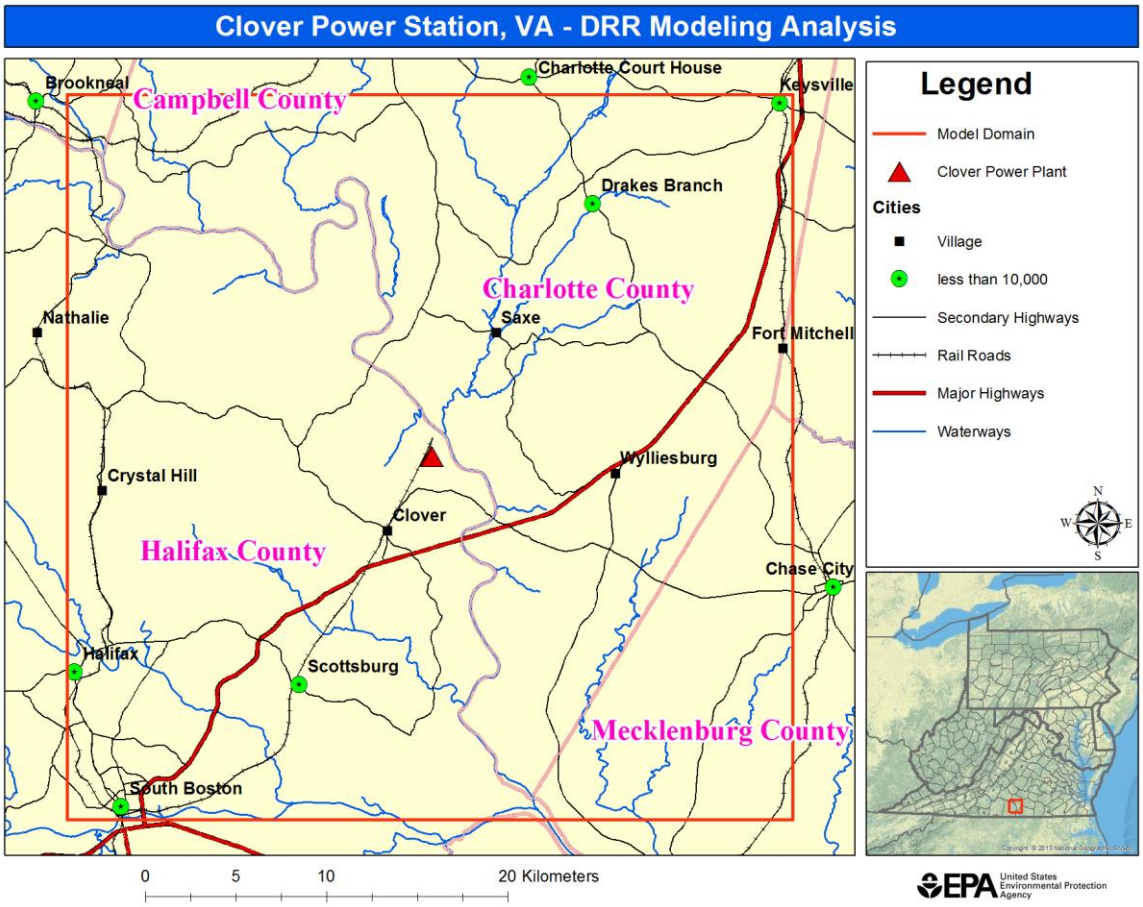
- The Clover Power Station facility emits 2,000 tons or more annually. Specifically, the Clover Power Station emitted 2,084 tons of SO_2 according to the 2014 NEI. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and Virginia has chosen to characterize it via modeling.

In its submission, Virginia recommended that an area that includes the area surrounding the Clover Power Station, specifically Halifax County, Charlotte County, and Mecklenburg County, be designated as attainment/unclassifiable based in part on an assessment and characterization of air quality impacts from this source. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the state's assessment, supporting documentation, and all available data, the EPA agrees with Virginia's recommendation for the area, and intends to designate the area as unclassifiable/attainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

The area that Virginia has assessed via air quality modeling is located in south-central Virginia and includes significant portions of Halifax County, Charlotte County, and Mecklenburg County. It also covers small portions of Lunenburg County and Campbell County.

As seen in Figure 18 below, the Clover Power Station is located within three miles of Clover, Virginia. The EPA's intended unclassifiable/attainment designation boundary for the Halifax area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

Figure 18. Map of the Halifax, Virginia Area Addressing the Clover Power Station



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered only one modeling assessment, that which was submitted by Virginia.

5.3.2. Modeling Analysis Provided by Virginia

5.3.2.1. Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. 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
- BPIPPRM: 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

Virginia used AERMOD version 15181 in regulatory default mode for this analysis. This was the regulatory version of the model prior to the recent publication of EPA revisions to the Guideline on Air Quality Models, which was published in the Federal Register on January 17, 2017.[13] The currently approved AERMOD platform is version 16216 that includes updates. However, the updates made to components of AERMOD version 16216 were not utilized in the air quality modeling assessment, such as ADJ_U*. A discussion of Virginia's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

5.3.2.2. Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the "urban" or "rural" determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD details the procedures used to determine if a source is urban or rural based on land use or population density.

The application of AERMOD requires characterization of the local (within 3 kilometers) dispersion environment as either urban or rural, based on a USEPA-recommended procedure (commonly referred to as the Auer Method) that characterizes an area by prevalent land use. This land use approach classifies an area according to 12 land use types. In this scheme, areas of industrial, commercial, and compact residential land use are designated urban. According to USEPA modeling guidelines, if more than 50% of an area within a 3-km radius of the facility is classified as rural, then the urban model option in AERMOD should not be used in the dispersion modeling analysis. Conversely, if more than 50% of the area is urban, then it can be considered.

Visual inspection of the 3-km area surrounding the Clover Power Station following the Auer method clearly shows the area is rural. Therefore, the urban model option in AERMOD was not used. For the purpose of performing the modeling for the area of analysis, Virginia determined that it was most appropriate to run the model in rural dispersion mode. The EPA agrees with Virginia's assessment.

5.3.2.3. Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and

[13] https://www3.epa.gov/ttn/scram/appendix_w/2016/AppendixW_2017.pdf

sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The Clover Power Station is the primary source of SO_2 emissions subject to the DRR in this area as described in the introduction to this section. For the Clover Power Station area, Virginia examined the region within 20 km of the facility and found no other emitters above 100 tpy of SO_2 that are expected to cause a concentration gradient impacts in the vicinity of the primary source. Virginia determined that this was the appropriate distance to adequately characterize air quality through modeling to include the potential extent of any SO_2 NAAQS exceedances in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. No other sources beyond 20 km were determined by Virginia to have the potential to cause concentration gradient impacts within the area of analysis.

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

- Fence line receptors spaced at 25-m intervals along the Clover Power Station's ambient air boundary, which is approximately 3.3 kilometers in length
- a 100 m Cartesian receptor grid extending from the Clover Power Station's ambient air boundary out to 3 km
- a 250 m Cartesian receptor grid extending from 3 to 5 km from the Clover Power Station
- a 500 m Cartesian receptor grid extending from 5 to 10 km from the Clover Power Station
- a 1,000 m Cartesian receptor grid extending from 10 to 20 km from the Clover Power Station
- a five by five 50 m Cartesian receptor grid centered on the peak model concentration from the main grid

The receptor network contained 7,360 receptors, and the network covered a 20 km by 20 km area centered around the Clover Power Station.

Figures 19 and 20 show the location of the Clover Power Station and Virginia's, as well as the receptor grid for the area of analysis.

Consistent with the Modeling TAD, the state placed receptors for the purposes of this designation effort in locations that would be considered ambient air relative to each modeled facility, including other facilities' property with the exceptions of locations described in Section 4.2 of the Modeling TAD as not being feasible locations for placing a monitor. Model receptors covered portions of Halifax and Charlotte counties along the Staunton River, which roughly runs from the southeast to northwest corners of the modeling domain. Virginia did not remove any receptors outside of what the state asserted was the Clover Power Station's ambient air boundary from the modeling domain since terrain was relatively flat and large water bodies were not present. The projected ambient air boundary was examined via GIS aerial imagery. As noted in the model receptor summary, a 25-m fence line receptor spacing was placed along the Clover Power Station's ambient air boundary.

Figure 19: Area of Analysis for the Halifax Area of Analysis

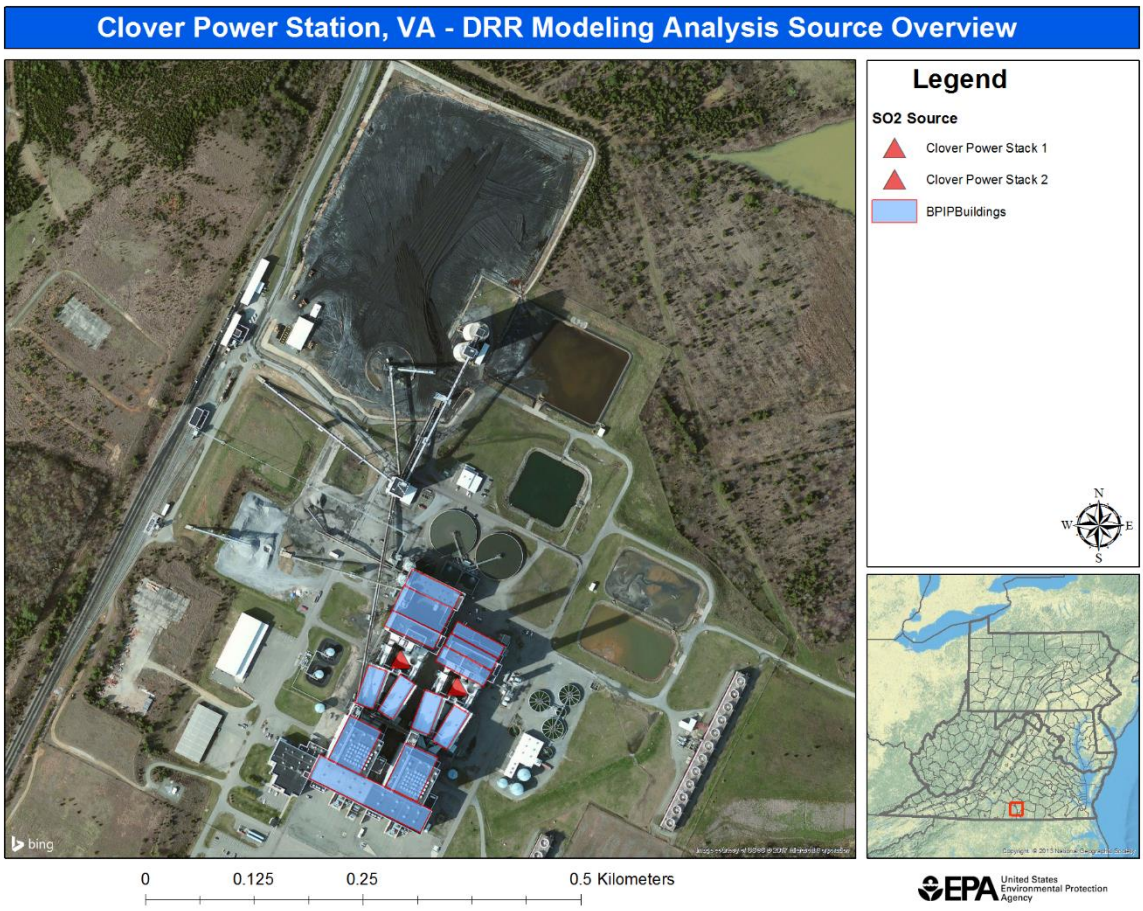
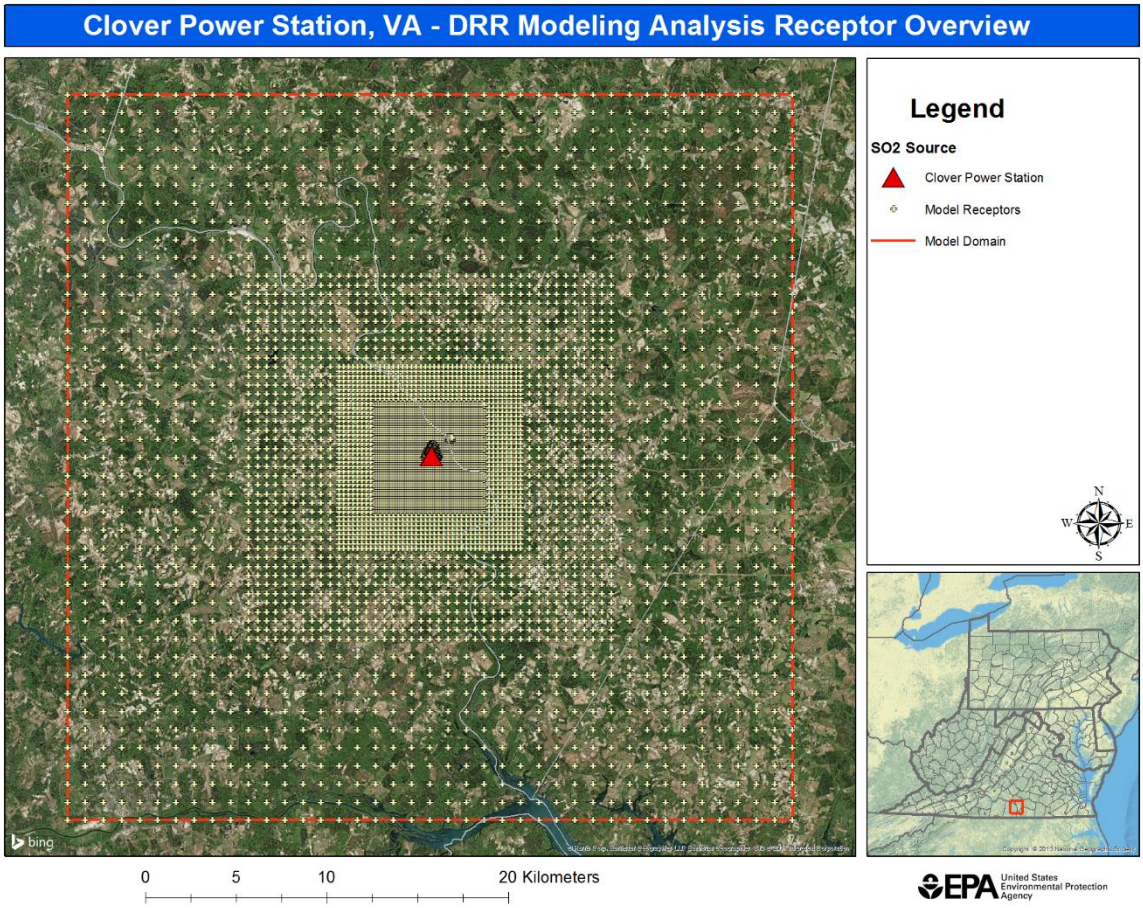


Figure 20: Receptor Grid for the Halifax Area of Analysis



The EPA reviewed Virginia's model receptor grid and believes it accurately reflects the Clover Power Station's ambient air boundary and is of sufficient resolution to capture the maximum modeled concentration.

5.3.2.4. Modeling Parameter: Source Characterization

Section 6 of the Modeling TAD offers recommendations on source characterization including source types, use of accurate stack parameters, inclusion of building dimensions for building downwash (if warranted), and the use of actual stack heights with actual emissions or following GEP policy with allowable emissions.

There are two major SO_2 emission sources at the Clover Power Station that were included in the 1-hour SO_2 modeling analysis. Those sources include Unit 1 and Unit 2, which are both pulverized coal-fired boilers. SO_2 emissions from Units 1 and 2 are all currently controlled with wet limestone flue gas desulfurization (FGD) systems. There are other potential small sources of SO_2 at the Clover Power Station that include two emergency generators and an auxiliary boiler.

Both generators are emergency in nature and, do not operate routinely, and thus have very low actual SO_2 emissions (< 0.25 tons of SO_2 from 2012-14). In addition, the auxiliary boiler has been decommissioned, but has yet to be removed from the site. Consequently, these potential small sources of SO_2 were not included in the 1-hour SO_2 modeling.

Units 1 and 2 each exhaust through separate 446-ft stacks. The modeling analysis was performed with the actual stack heights in accordance with recommendations in the DRR and TAD. Hourly exhaust flow rates, temperatures, and emission rates were based on the actual data available from the continuous emission monitor (CEM) systems. The data capture on Clover Units 1-2 CEMs data exceeded 99%. Missing data was replaced following Part 75 data substitution requirements. The emissions for modeling consisted of actual hourly data for calendar years 2012-2014.

Virginia characterized this source within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, Virginia used actual stack heights in conjunction with actual emissions. Virginia also adequately characterized the source's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRM was used to assist in addressing building downwash. Building and stack position information that the Clover Power Station included in the modeling analysis was verified using GIS software. Plant stack temperatures and velocities also varied according to CEM measurements. A quick survey of the modeled temperatures and velocities indicated they were within the realm of expected values.

5.3.2.5. Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose 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 indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective.

The EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information, when they are available. 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 recommends using detailed throughput, operating schedules, and emissions information from the impacted source.

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. For example, where a facility has recently adopted a new federally enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS, the state may choose to model PTE rates. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2

emissions inventories used for permitting or SIP planning demonstrations. 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, the state included emissions from Units 1 and 2 of the Clover Power Station as emitters of SO_2 within 20 km in the area of analysis. Virginia has chosen to model this facility using actual emissions. The facilities in Virginia's modeling analysis and their associated annual actual SO_2 emissions between 2012 and 2014 are summarized below.

For the Clover Power Station, Virginia provided annual actual SO_2 emissions between 2012 and 2014. This information is summarized in Table 13. A description of how the state obtained hourly emission rates is given below this table.

Table 13. Actual SO_2 Emissions Between 2012 – 2014 from Facilities in the Halifax Area of Analysis

Modeled Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2012**	**2013**	**2014**
Clover Power Station Unit 1	879.1	1,203.0	1,180.1
Clover Power Station Unit 2	1,009.5	1,066.4	915.8
Total Emissions from All Modeled Facilities in the State's Area of Analysis	1,888.6	2,269.4	2,095.9
EPA Clean Air Market Division Emissions for Clover Power Station			
	SO_2 Emissions (tpy)		
Facility Name	**2012**	**2013**	**2014**
Clover Power Station Unit 1	871.5	1,200.1	1,176.4
Clover Power Station Unit 2	1,003.7	1,062.0	906.9
Total Emissions from All Modeled Facilities in the State's Area of Analysis	1,875.2	2,262.1	2,083.3

2014 NEI Emissions	
Facility	**2014 NEI SO_2 Emissions (tpy)**
Dominion Clover Power Station	2,083.5

For Clover Power Station, the actual hourly SO_2 emissions data were obtained from CEM data provided by the facility and used in the Virginia modeling analysis. In addition to this data, the EPA also constructed actual hourly emissions available from EPA's Clean Air Markets Data (CAMD) website[14] and emissions from the 2014 NEI for comparison. As shown in the previous tables, the annual modeled emissions for the Clover Power Station are very similar to totals from EPA's CAMD website and the 2014 NEI.

The Clover Power Station's hourly emission rates varied according to CEM collected values to reflect actual hourly emissions from the facility. Hourly modeled emissions for both units were compared with hourly rates extracted from CAMD. Modeled hourly rates for both units were very close to the rates from CAMD. Tables showing the difference between hourly modeled and CAMD emission rates for both units are shown in Table 14. The table shows modeled hourly emission rates were mostly within +/- 250 lbs/hr of the rates in CAMD.

Table 14. Table showing the difference between modeled and CAMD hourly emission rates for the Clover Power Station Units 1 and 2.

Clover Power Station Unit 1		Clover Power Station Unit 2	
Bin	**Frequency**	**Bin**	**Frequency**
-500	1	-500	2
-250	26	-250	31
0	12,754	0	14,169
250	13,468	250	12,038
500	38	500	46
750	8	750	10
1,000	3	1,000	3
More	6	More	5

[14] https://ampd.epa.gov/ampd/

5.3.2.6. Modeling Parameter: Meteorology and Surface Characteristics

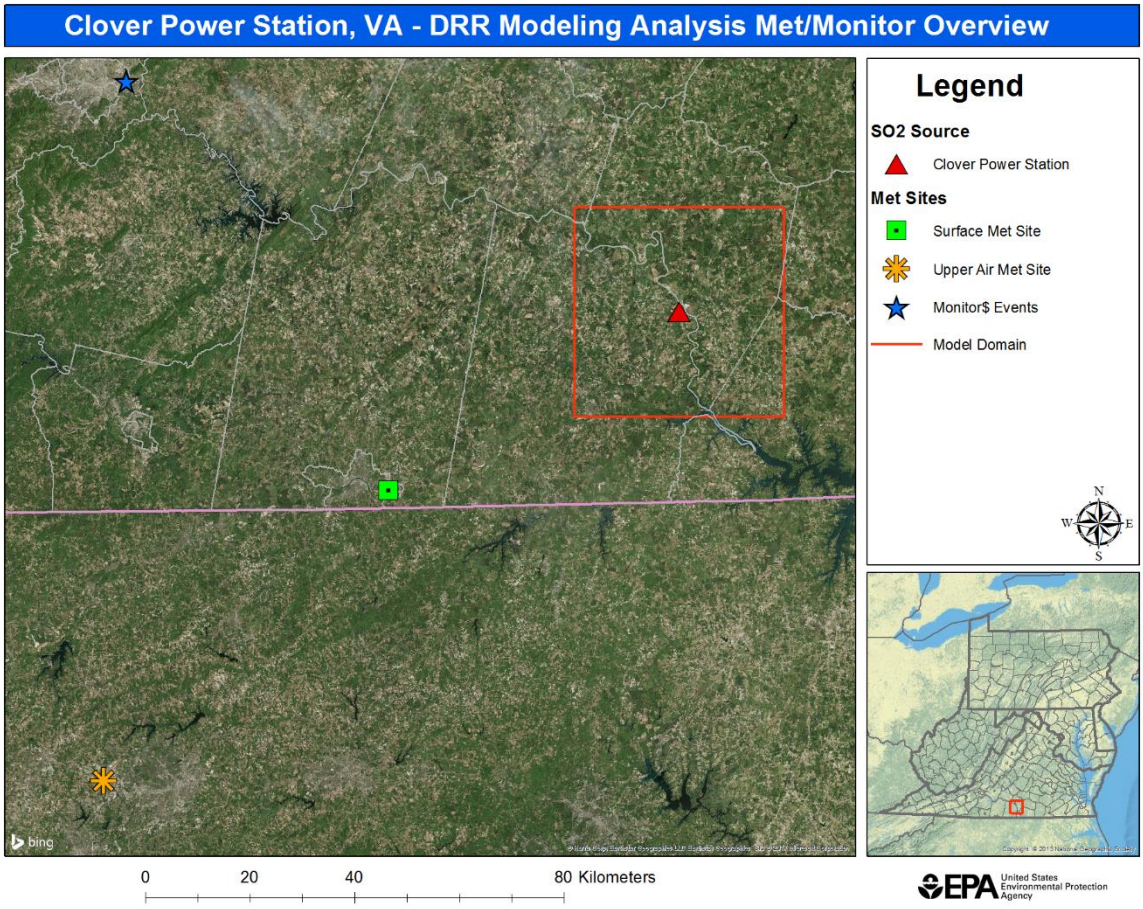
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data is determined 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 (FAA), and military stations.

For the area of analysis for the Clover Power Station area, Virginia selected the surface meteorology from the Danville International Airport located in Pittsylvania County, Virginia and coincident upper air observations from Piedmont Triad International Airport in Guilford County, NC as best representative of meteorological conditions within the area of analysis. The Danville International Airport and Piedmont Triad International Airports are located approximately 65 kilometers and 142 kilometers, respectively, southwest of the Clover Power Station.

Virginia used AERSURFACE version 13016 using data from the Danville International Airport to estimate the surface characteristics of the area of analysis. The state estimated values for twelve (12) spatial sectors out to 1.0 km at a monthly temporal resolution for dry, wet, average conditions based on local actual and historical rainfall rates. Virginia 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"). AERSURFACE was run using non-default seasonal values with no snow cover. The airport's more southerly location limits the number of autumn months, prevents monthly snow cover, initiates an early spring and extends the growing season.

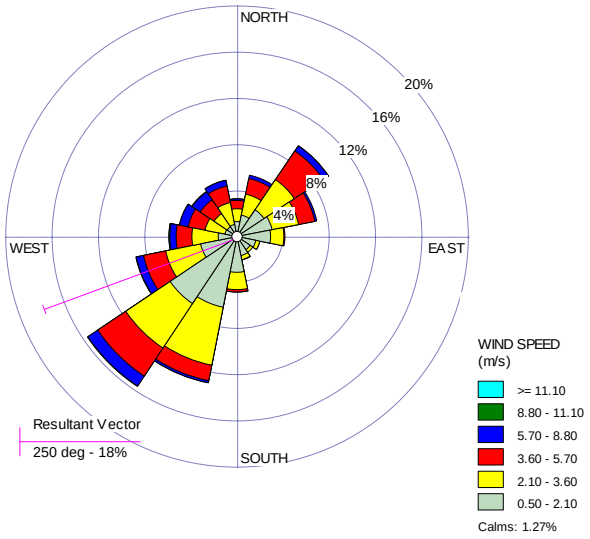
In the figure below, generated by the EPA, the locations of these NWS stations are shown relative to the area of analysis.

Figure 21. Area of Analysis and the NWS stations in the Halifax Area of Analysis



As part of its recommendation, Virginia provided the 3-year surface wind rose for the Danville International Airport located in Pittsylvania County, VA. In Figure 22, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose shows predominant winds from the southwest and northeast along with the resultant wind vector direction for the 10-m wind measurements, which shows winds out of the west-southwest.

Figure 22: Halifax, Virginia Cumulative Annual Wind Rose for Years 2012 – 2014



Meteorological data from the above surface and upper air NWS 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. Virginia followed the methodology and settings presented in their modeling protocol, which followed guidance set forth in 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 Danville International Airport located in Pittsylvania County, VA, 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. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, Virginia set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the 1-minute wind data.

Virginia's modeling archive noted the Danville International Airport's elevation input into AERMET did not match the elevation in the ISHD file (see Stage 1 reports). This appeared to be a minor discrepancy with Virginia using an airport elevation of 180 meters and the ISHD listing the airport elevation at 174 meters. Elevation differences of this size should have little impact on final model concentrations.

Additionally, Virginia's AERMINUTE log file for 2012 noted a fair amount of missing data for the month of June. The AERMINUTE log file indicates the missing hours led to 2nd quarter completeness of around 90%.

Though minor discrepancies were noted in the meteorological data processing, they are not expected to significantly impact final modeling concentrations for the Clover Power Station.

5.3.2.7. Modeling Parameter: Geography, Topography (Mountain Ranges or Other Air Basin Boundaries) and Terrain

The terrain in the area is best described as gently rolling to flat in elevation. The Clover Power Station sits along the Staunton River with no appreciable terrain within five to ten kilometers of the facility. All terrain within the modeling domain is below stack top (the nearest complex terrain is over 50 km from the facility). 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 is from the AERMAP (version 11103), the AERMOD terrain preprocessor program, was used to calculate terrain elevations and critical hill heights for the modeled receptors (NAD83 datum and zone 17) using National Elevation Data (NED). Virginia downloaded from the USGS website and consisted of 1/3 arc second (~10 m resolution) NED. As per the AERMAP User's Guide, the domain was sufficient to ensure all significant nodes are included such that all terrain features exceeding a 10% elevation slope from any given receptor, are considered.

EPA believes that the terrain within the modeling domain has been adequately characterized.

5.3.2.8. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, Virginia chose the East Vinton Elementary School (Site ID: 51-161-1004) SO_2 monitoring site in Roanoke County, VA, as a representative regional background site. The monitor is roughly 114 km west-northwest of the Clover Power Station and is located in the eastern portion of the Appalachian Mountains.

Virginia used the monitor's 2012-14 design value as its background concentration for its modeling analysis. Monitor information from EPA's Air Trends[15] website indicated that this monitor did not have complete data in 2013. Information provided in the final modeling analysis report indicates over 80% data capture for 2013. The single value of the background concentration for this area of analysis was determined by Virginia to be 14.06 micrograms per cubic meter ($\mu g/m^3$), equivalent to 5.37 ppb,[16] and that value was incorporated into the final AERMOD results.

While the monitor is located well away from the Clover Power Station, it should provide a reasonable estimate of regional SO_2 concentrations. The monitor appears to have adequate data capture though it misses the completeness requirements to establish a valid design value. The monitor's design value is within the range of background concentrations used to establish background for other modeling demonstrations in Region 3.

5.3.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Halifax area of analysis are summarized below in Table 15

[15] https://www.epa.gov/air-trends/air-quality-design-values

[16] The SO_2 NAAQS level is expressed in ppb but AERMOD gives results in $\mu g/m^3$. The conversion factor for SO_2 (at the standard conditions applied in the ambient SO_2 reference method) is 1ppb = approximately 2.619 $\mu g/m^3$.

Table 15: Summary of AERMOD Modeling Input Parameters for the Halifax Area of Analysis

Input Parameter	Value
AERMOD Version	15181 Default
Dispersion Characteristics	Rural
Modeled Sources	1
Modeled Stacks	2
Modeled Structures	9
Modeled Fencelines	1
Total receptors	7,365
Emissions Type	Actual
Emissions Years	2012-14
Meteorology Years	2012-14
NWS Station for Surface Meteorology	Danville Airport, VA
NWS Station Upper Air Meteorology	Greensboro, NC
NWS Station for Calculating Surface Characteristics	Danville Airport, VA
Methodology for Calculating Background SO_2 Concentration	Tier I: Design Value (Incomplete)
Calculated Background SO_2 Concentration	5.37 ppb

The results presented below in Table 16 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

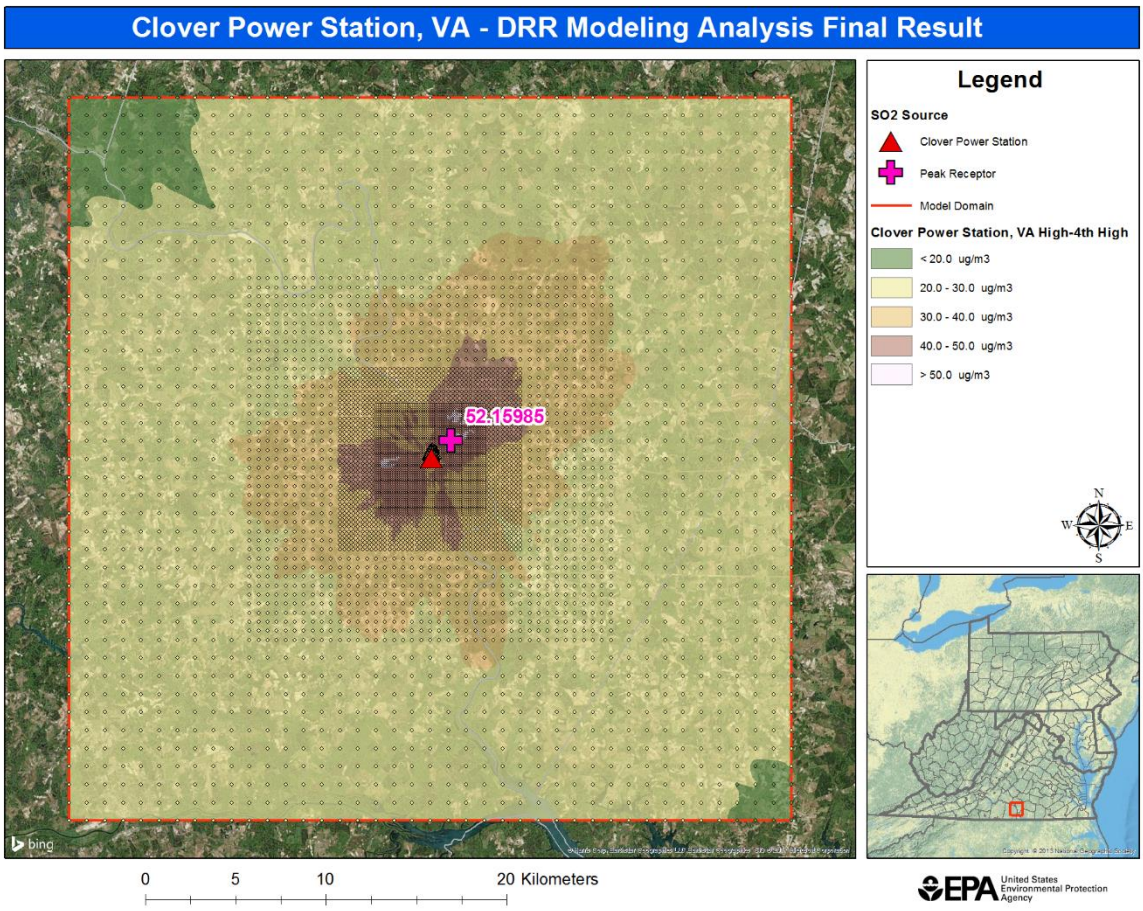
Table 16. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Halifax Area of Analysis

Averaging Period	Data Period	Receptor Location [UTM zone XX, if applicable]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM/Latitude	UTM/Longitude	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2012-14	705650	4083850	38.08985 + 14.07 = **52.159885**	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor

Virginia's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 52.16 µg/m^3, equivalent to 19.92 ppb. This modeled concentration included the background concentration of SO_2, and is based actual emissions from the facility. Figure 23 below was included as part of Virginia's recommendation, and indicates where the predicted value occurred. Virginia's receptor grid is also shown in the figure.

Figure 23: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Halifax Area of Analysis



The modeling submitted by Virginia does not indicate that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration.

5.3.2.10. The EPA's Assessment of the Modeling Information Provided by the State

Virginia submitted a modeling analysis for the Clover Power Station in Halifax County, VA. The power station sits along Staunton River in generally flat terrain. Virginia's modeling analysis for the Clover Power Station generally follows EPA's Modeling TAD and uses actual hourly emissions. Stack and building position information was verified using GIS software. The modeling domain was large enough to capture peak model concentration in this relatively flat terrain, which are expected to occur within 1.5 km of the facility's stacks (using the ten stack height rule of thumb). The peak model concentration occurs approximately 1.4 km northeast of the power station in Charlotte County, downwind of the plant according to the predominant wind direction from the Danville International Airport.

5.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Halifax Area of Analysis

These factors have been incorporated into the air quality modeling efforts and results discussed above. The EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

5.5. Jurisdictional Boundaries in the Halifax Area of Analysis

Virginia recommended as attainment/unclassifiable jurisdictions in which the modeling receptor grid covered the entirety of the jurisdiction or a significant portion of the jurisdiction because the modeling analysis did not show any violations of the NAAQS in these jurisdictions. Namely, Virginia recommended that the entirety of Halifax County, Charlotte County, and Mecklenburg County be designated as attainment/unclassifiable. The modeling receptor grid also covered small portions of Lunenburg County and Campbell County, but Virginia did not recommend that these counties be designated as attainment/unclassifiable because it did not believe the grid extended far enough into these jurisdictions to make a determination of attainment, so instead recommended that they be designated as unclassifiable. Furthermore, Virginia has recommended that each county be designated as a stand-alone area and not as part of a larger multi-county, multi-city area.

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for the Halifax area of analysis. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

5.6. The EPA's Assessment of the Available Information for the Halifax Area of Analysis

The EPA finds that available air dispersion modeling results show that the Halifax area of analysis is in attainment of the 1-hour SO_2 NAAQS. The modeling submitted by Virginia indicates that the 1-hour SO_2 NAAQS is not violated at the receptor with the highest modeled concentration. Virginia's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 52.16 $\mu g/m^3$, equivalent to 19.92 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facility.

Virginia recommended as attainment/unclassifiable jurisdictions in which the modeling receptor grid covered a significant portion of the jurisdiction because the modeling analysis did not show any violations of the NAAQS in these jurisdictions. Virginia explained that it is unlikely that high SO_2 concentrations exist farther away from high emitting sources or groups of sources, so if an entire county was not included in the modeling domain but a significant portion of the county was included within the modeling domain, Virginia recommended that the entire county be designated as attainment/unclassifiable. The EPA agrees with this rationale since review of the modeling shows that SO_2 concentrations decrease substantially approaching the grid boundary, so it is likely that SO_2 concentrations decrease even further beyond the grid boundary in the portions of the counties that were not entirely included within the grid.

In addition, neighboring counties in Virginia (Pittsylvania, Campbell, Appomattox, Prince Edward, Lunenburg, and Brunswick) generally have total annual SO_2 emissions ranging from 18-86 tpy with one county having a total of 222 tpy SO_2 emissions and no nearby nonattainment areas. Therefore, these counties are likely not impacting the air quality of Halifax County, Charlotte County, or Mecklenburg County, and vice versa.[17]

Furthermore, the EPA is proposing to designate the neighboring counties in North Carolina as unclassifiable/attainment, so these counties are likely not impacting the air quality of Halifax County or Mecklenburg County in Virginia and vice versa. See the TSD for North Carolina.

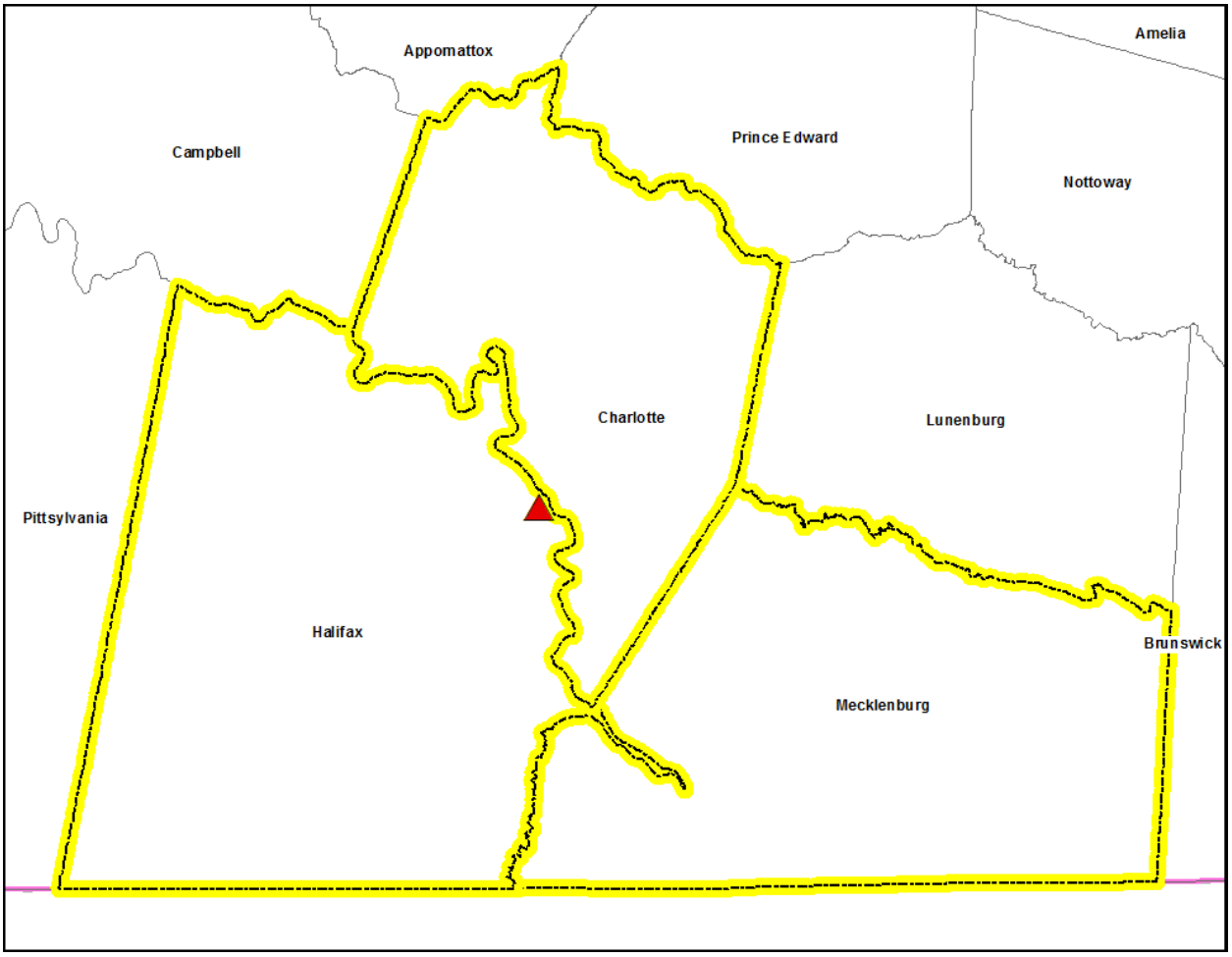
Finally, Virginia has recommended that each county or city be designated as a stand-alone area and not as part of a larger multi-county, multi-city area. The EPA agrees with Virginia's jurisdiction and boundary selections. The EPA believes that our intended unclassifiable/attainment area, bounded by the county jurisdictional boundaries, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area.

[17] Mecklenburg County contains one facility, Dominion – Mecklenburg Power Station, with 2014 SO_2 emissions of 371 tpy, and 2015 emissions of 290 tpy, however, the EPA finds that it is unlikely that its emissions cause or contribute to any NAAQS violations.

5.7. Summary of Our Intended Designation for the Halifax Area of Analysis

After careful evaluation of Virginia's recommendation and supporting information, as well as all available relevant information, based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined the Halifax area (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS, and the EPA intends to designate the following as unclassifiable/attainment for the 2010 SO_2 NAAQS: Halifax County, Charlotte County, and Mecklenburg County. Specifically, the boundaries are comprised of the county jurisdictional boundary for each individual county. Figure 24 shows the boundary of this intended designated area.

Figure 24. Boundaries of the Intended Unclassifiable/Attainment Areas in the Halifax Area of Analysis



6. Technical Analysis for the Buchanan, Virginia Area of Analysis

6.1. Introduction

The EPA must designate the Buchanan, Virginia, (Buchanan) area by December 31, 2017, because the area has not been previously designated and Virginia has not installed and begun timely operation of a new, approved SO_2 monitoring network to characterize air quality in the vicinity of any source in Buchanan county.

6.2. Air Quality Monitoring Data for the Buchanan, Virginia Area of Analysis

There are no air quality monitors located in the Buchanan, Virginia, area of analysis.

6.2.1. Introduction

This section 6.2 presents all the available air quality modeling information for a portion of Buchanan County, Virginia, that includes the Jewell Coke Company. A survey of the area surrounding the Jewell Coke Company indicated no other sources within 10 km.[18] Thus this area contains only one facility, the Jewel Coke Company, which Virginia is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tons per year:

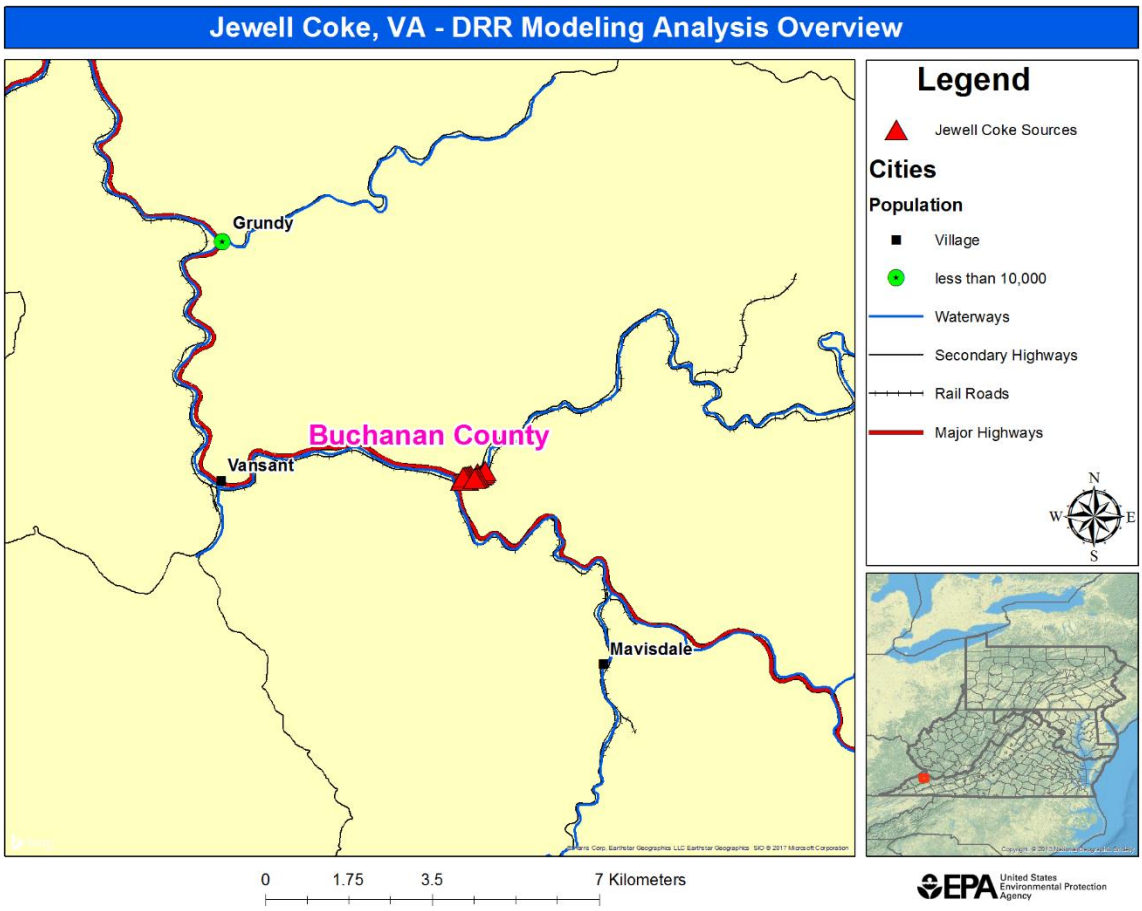
- The Jewell Coke Company facility emits 2,000 tons or more annually. Specifically, the Jewell Coke Company emitted 4,964.5 tons of SO_2 according to the 2014 NEI. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and Virginia has chosen to characterize it via modeling.

In its submission, Virginia recommended that an area that includes the area surrounding the Jewell Coke Company, specifically Buchanan County, be designated as attainment/unclassifiable based in part on an assessment and characterization of air quality impacts from this facility. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of Virginia's assessment, supporting documentation, and all available data, the EPA does not agree with Virginia's recommendation for the area, and intends to designate the area as unclassifiable. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

The area that Virginia has assessed via air quality modeling is located in Buchanan County. Figure 25 below shows the location of the Jewell Coke Company. There are no other SO_2 sources in the area. The EPA's intended unclassifiable designation boundary for the Buchanan area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

[18] There are no point sources in Buchanan County according to the 2014 NEI with SO_2 emissions above 0.5 tpy

Figure 25. Map of the Buchanan, Virginia Area Addressing the Jewell Coke Company



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered only one modeling assessment, that which was submitted by Virginia.

6.2.2. Modeling Analysis Provided by the State

The Commonwealth of Virginia submitted a modeling analysis for the regions surrounding the Jewell Coke Company on January 11, 2017.

6.2.2.1. Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. 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
- BPIPPRM: 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

Virginia used AERMOD version 15181 with the Adjust u* option. This option is/was considered a Beta (non-regulatory) option that required approval under Section 3.2.2 of Appendix W – Guideline on Air Quality Models and Concurrence from EPA's Model Clearinghouse[19]. Virginia included a formal request to use the Adjust u* Beta option with their January 13, 2017, submittal of their DRR modeling analysis for the Jewell Coke Company. On January 17, 2017, EPA published its revision to Appendix W – Guideline to Air Quality Models[20]. Since the publication of Appendix W the current version of AERMOD is version 16216r. On March 14, 2017, the effective date for implementation of Appendix W was extended until May 22, 2017. Additionally, on March 8, 2017, EPA issued another Clarification Memo regarding using the Adjust u* Beta option with AERMOD version 15181[21]. In this memo EPA stated:

> *"[F]or state, local, and tribal air agencies, with or without alternative model approval, that submitted SO_2 DRR modeling based on AERMOD version 15181 that included AERMET version 15181 meteorological data processed with the ADJ_U* beta option, the SO_2 DRR modeling results would be affected by the formulation bug and, consequently, would not be considered sufficiently representative to inform the Round 3 – SO_2 designations.*"

Due to the formulation bug discovered in the Beta Adjust u* option within AERMOD version 15181, any modeling analysis using this option is considered not representative of true model concentration. This point was communicated to Virginia by the EPA in early 2017 and through the Clarification Memo. A discussion of the Virginia's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

6.2.2.2. Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the "urban" or "rural" determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD details the procedures used to determine if a source is urban or rural based on land use or population density.

[19] https://www3.epa.gov/ttn/scram/guidance/clarification/AERMOD_Beta_Options_Memo-20151210.pdf
[20] https://www.federalregister.gov/documents/2015/07/29/2015-18075/revision-to-the-guideline-on-air-quality-models-enhancements-to-the-aermod-dispersion-modeling
[21] https://www3.epa.gov/ttn/scram/guidance/clarification/SO2_DRR_Designation_Modeling_Clarificaiton_Memo-03082017.pdf

The application of AERMOD requires characterization of the local (within 3 kilometers) dispersion environment as either urban or rural, based on a USEPA-recommended procedure (commonly referred to as the Auer Method) that characterizes an area by prevalent land use. This land use approach classifies an area according to 12 land use types. In this scheme, areas of industrial, commercial, and compact residential land use are designated urban. According to USEPA modeling guidelines, if more than 50% of an area within a 3-km radius of the facility is classified as rural, then the urban model option in AERMOD should not be used in the dispersion modeling analysis. Conversely, if more than 50% of the area is urban, then it can be considered.

Visual inspection of the 3-km area surrounding the Jewell Coke Company following the Auer method clearly shows the area is rural. Therefore, the urban model option in AERMOD was not used. For the purpose of performing the modeling for the area of analysis, the state determined that it was most appropriate to run the model in rural dispersion mode. EPA agrees with the state's assessment.

6.2.2.3. Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The Jewel Coke Company is the primary source of SO_2 emissions subject to the DRR in this area as described in the introduction to this section. For the Buchanan area, Virginia has determined that there are no other emitters of SO_2 greater than 0.5 tpy within 10 km of Jewell Coke Company in any direction. Virginia determined that this was the appropriate distance to adequately characterize air quality through modeling to include the potential extent of any SO_2 NAAQS exceedances in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas.

The EPA reviewed the model receptor grid proposed in Jewell Coke Company modeling protocol and found it generally too limited in extent. In an attempt to revise and expand the model receptor grid, the Jewell Coke Company reviewed several other EPA guidance documents including *Optimum Site Exposure Criteria for SO_2 Monitoring* (1977) and *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (1987).* Additionally, Jewell Coke Company also examined DOT documents to try to determine how to account for the steep terrain in the vicinity of its facility.

Based on EPA guidance and given the ruggedness of the terrain in the vicinity of the Jewell Coke Company, as well as the need to extend the modeling receptor grid out to 10 km from the modeled sources, the receptor grid for modeling SO_2 emissions from the Jewell Coke Company consists of the following:

- Include receptors at a 100 m spacing outward from the Jewell Coke Company to 10 km
- Exclude receptors that are located on land owned or controlled by Jewell Coke Company

- Exclude receptors that are located within rugged terrain areas that have terrain slopes of equal to or greater than 30 percent
- Exclude receptors that are located within the immediate industrial, transportation, and river areas around Jewell Coke Company operations

The model receptor network contained 13,498 receptors, and the network covered portions of the modeling domain that extended 10 km from the Jewell Coke Company.

Figures 26 and 27 show Virginia's chosen area of analysis surrounding the Jewell Coke Company, as well as the receptor grid for the area of analysis.

Figure 26: Area of Analysis for the Buchanan Area

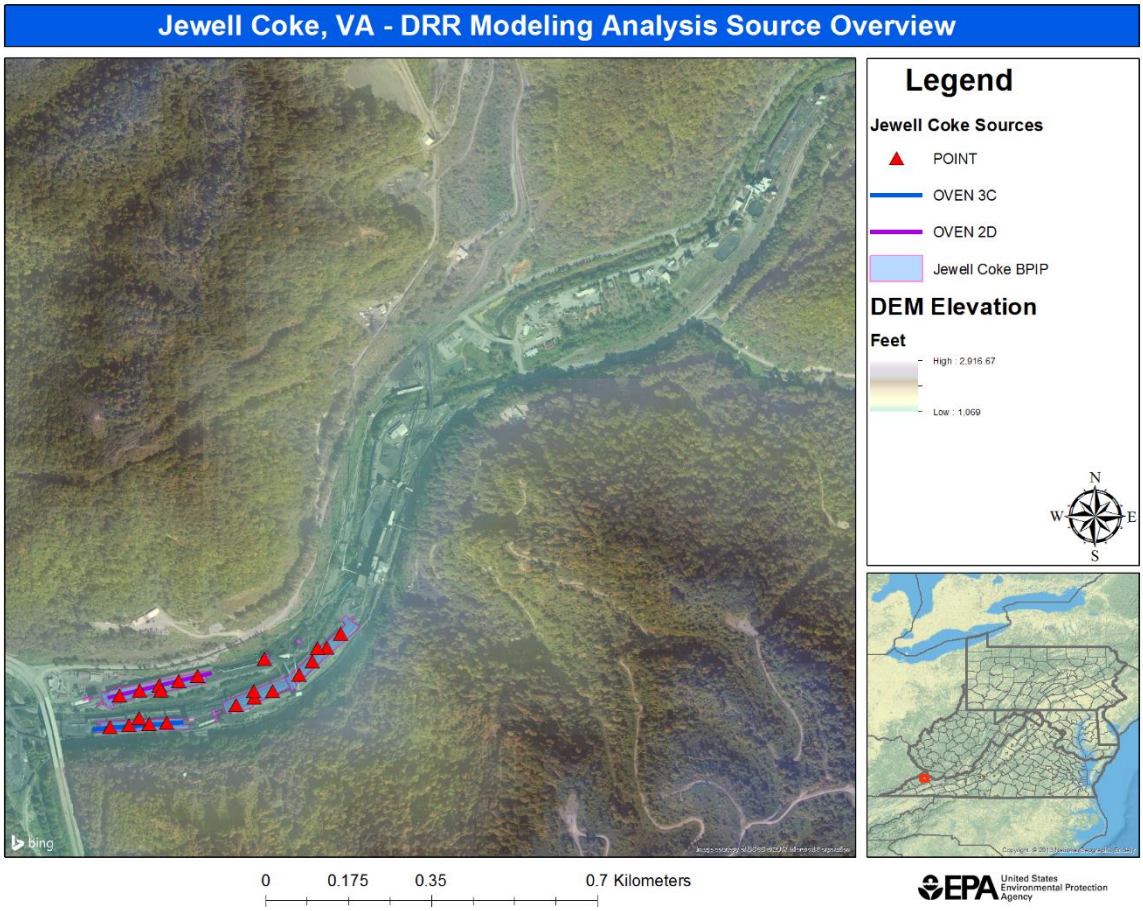
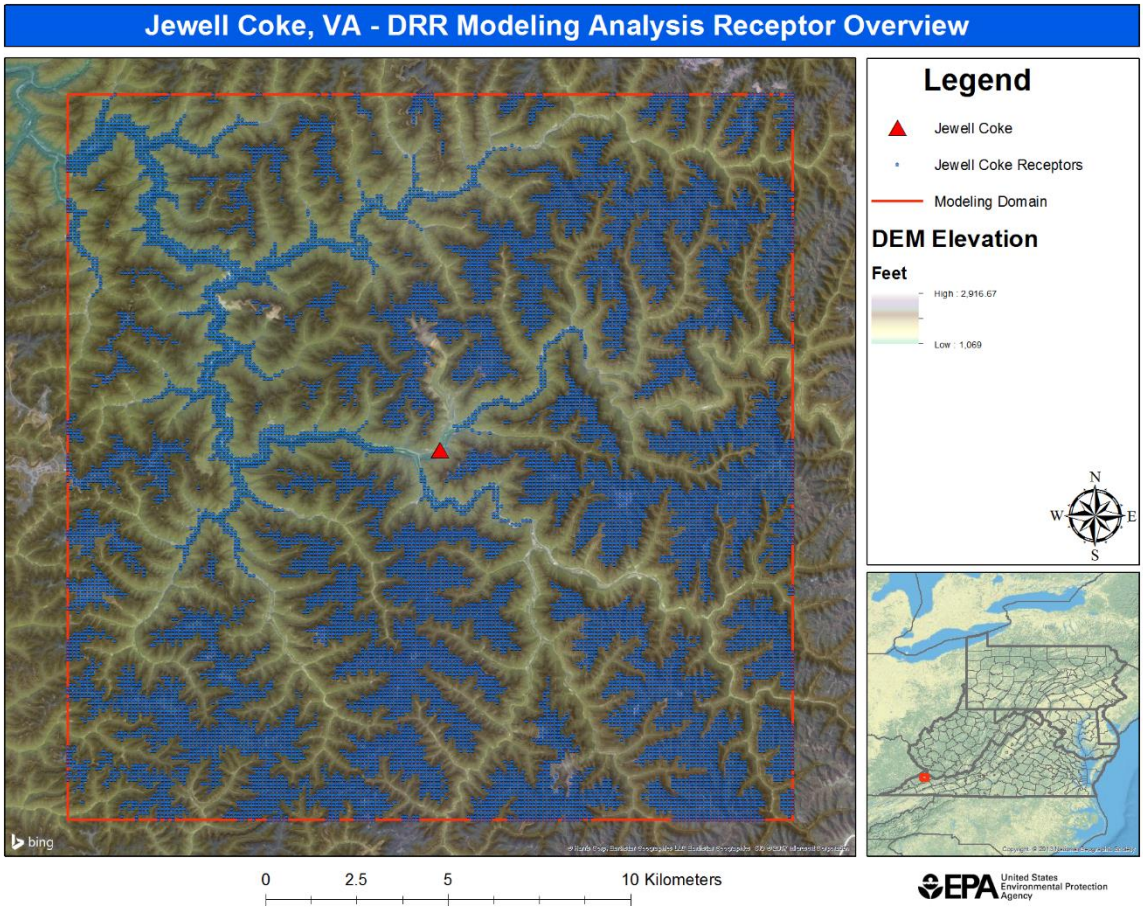


Figure 27: Receptor Grid for the Buchanan Area



While Jewell Coke Company's expanded model receptor grid was more extensive than the grid in its original modeling protocol, it is still rather limited. Using a restriction of including receptors only in areas with elevation grades less than 30% is too restrictive. Using this restriction limits model receptor locations to the valleys and to the tops of the adjacent ridges. This leads to receptor clumping within limited elevations and hill height scales in AERMOD. Table 17 shows Jewell Coke Company's receptor grid elevations and hill height scale values. Receptor elevation values tend to be clustered between 300 to 400 meters and above 650 meters. Hill height scales are limited to ranges above 650 meters. The current design of Jewell Coke Company's receptor grid restricts the levels in which AERMOD samples Jewell Coke Company's emissions creating gaps in receptor elevations that could allow model plumes to escape detection in the model.

Table 17. Table Showing Jewell Coke Company's Model Receptor Grid Elevation and hill scale heights

Receptor Elevation (m)		Hill Height Scale (m)	
Bin	**Frequency**	**Bin**	**Frequency**
250	0	250	0
300	37	300	0
350	552	350	0
400	1,158	400	0
450	0	450	0
500	0	500	0
550	0	550	0
600	0	600	0
650	1,669	650	25
700	7,127	700	1,627
750	2,630	750	6,512
800	311	800	4,516
More	14	More	818

6.2.2.4. Modeling Parameter: Source Characterization

Section 6 of the Modeling TAD offers recommendations on source characterization including source types, use of accurate stack parameters, inclusion of building dimensions for building downwash (if warranted), and the use of actual stack heights with actual emissions or following GEP policy with allowable emissions.

Jewell Coke Company uses SunCoke Energy's Jewell-Thompson non-recovery type of coke oven. In coke production from both non-recovery and byproduct ovens, the volatile fraction of the coal is driven off in a reducing atmosphere. Coke is essentially the remaining carbon and ash. For Jewell Coke Company's non-recovery ovens, all coal volatiles are oxidized within the ovens. No coke oven gas is produced and there is no flaring of gases with the non-recovery coke oven design. Because there is no recovery of the volatile fraction of the coal, non-recovery ovens do not have many of the emissions sources that byproduct facilities have such as offtakes, lids, and piping. Fugitive emissions from a non-recovery oven are limited to the pushing and charging processes and material handling.

Virtually all of the SO_2 emissions from Jewell are emitted from the vent and coal dryer stacks. Fugitive emissions from pushing, charging and material handling operations make up a much smaller fraction of Jewell Coke Company's total SO_2 emissions. The actual modeled stack emissions from the Jewell Coke Company facility were based upon emission testing that was performed at the facility on a representative vent (or coking) stack and the coal dryer stack. Emission testing at Jewell was performed recently on February 23-25, 2016 and previously on August 20-21, 2009, in accordance with Jewell's Title V permit. Actual emission rates and stack parameters were used for the modeling. Use of the compliance-based stack test data has the advantages of being actual emissions data from tests that were performed under a Virginia DEQ-approved test protocol and observed by representatives of the Virginia DEQ.

Virginia characterized this source within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, Virginia used actual stack heights in conjunction with actual emissions. Virginia also adequately characterized the source's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRM was used to assist in addressing building downwash. Building and stack position information that the Jewell Coke Company included in the modeling analysis was verified using GIS software. Plant emissions, stack temperatures and velocities were kept constant throughout the simulation. This is probably reflective of actual coking operations where shutdowns and down times are typically very infrequent. A survey of the modeled temperatures and velocities indicated they were within the realm of expected values.

6.2.2.5. Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose 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 indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective.

The EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information, when they are available. 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 recommends using detailed throughput, operating schedules, and emissions information from the impacted source(s).

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. For example, where a facility has recently adopted a new federally enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS, the state may choose to model PTE rates. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations. 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, Virginia included only the Jewell Coke Company in the area of analysis; no other emitters of SO_2 over 0.5 tpy are within 10 km. Virginia has chosen to model this facility using actual emissions. The facility in Virginia's modeling analysis and their associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.

For Jewel Coke Company, emissions were based on source testing information discussed earlier. This information is summarized in Table 18. A description of how Virginia obtained hourly emission rates is given below this table.

Table 18. Actual SO_2 Emissions Between 2013 – 2015 from Facilities in the Buchanan Area

Modeled Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Jewell Coke Company - Vent Stacks	4,441.4	4,441.4	4,441.4
Jewell Coke Company - Thermal Dryer	2.2	2.2	2.2
Jewell Coke Company - Oven Charging	1.3	1.3	1.3
Jewell Coke Company - Pushing	63.5	63.5	63.5
Total Emissions from All Modeled Facilities in the State's Area of Analysis	**4,508.4**	**4,508.4**	**4,508.4**

2014 NEI Emissions	
Facility	**2014 NEI SO_2 Emissions (tpy)**
Jewell Coke Company LLP	4,964.5

Virginia Emissions Inventory[22]			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Jewell Coke Company - Vent Stacks	4,752.43	4,964.48	4,844.646

For the Jewell Coke Company actual hourly emissions data were based on recent stack testing information as described in the previous section. The modeled emissions appear to be about 10% lower than what is in EPA's 2014 NEI. Emissions tabulated by Virginia also show modeled emissions are generally lower throughout the simulation period. Charging emissions from AP-42, pushing from stack test, quenching emissions were ignored, however, since this is a non-recovery coking operation, these emissions are somewhat negligible when compared to the COG combustion numbers.

[22] http://www.deq.virginia.gov/Programs/Air/AirQualityPlanningEmissions/EmissionInventory.aspx

6.2.2.6. Modeling Parameter: Meteorology and Surface Characteristics

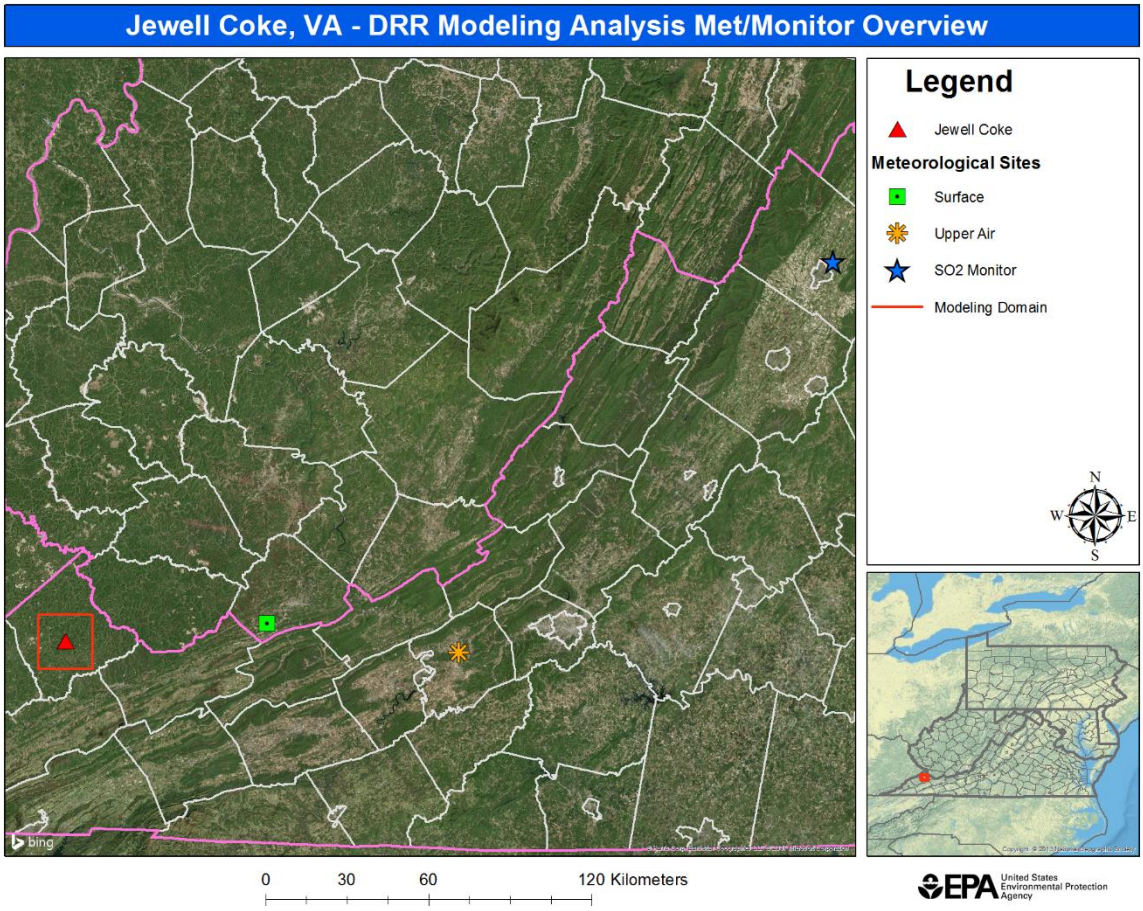
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data is determined 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 (FAA), and military stations.

For the area of analysis for the Buchanan area, Virginia selected the surface meteorology from Bluefield/Mercer County Airport in Mercer County, WV, and coincident upper air observations from Roanoke–Blacksburg Regional Airport in Montgomery County, VA, as best representative of meteorological conditions within the area of analysis. Both airports are located to the east of the Jewell Coke Company with Bluefield/Mercer County Airport roughly 74 km away and Roanoke–Blacksburg Regional Airport roughly 144 km away.

Virginia used AERSURFACE version 13016 using data from Bluefield/Mercer County Airport to estimate the surface characteristics of the area of analysis. Virginia estimated values for five (5) spatial sectors out to 1.0 km at a monthly temporal resolution for dry, wet, average conditions based on local actual and historical rainfall rates. Virginia 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"). AERSURFACE was run using non-default seasonal values with no snow cover. The lack of continuous monthly snow cover given the location of Jewell Coke Company seems unusual and should be verified.

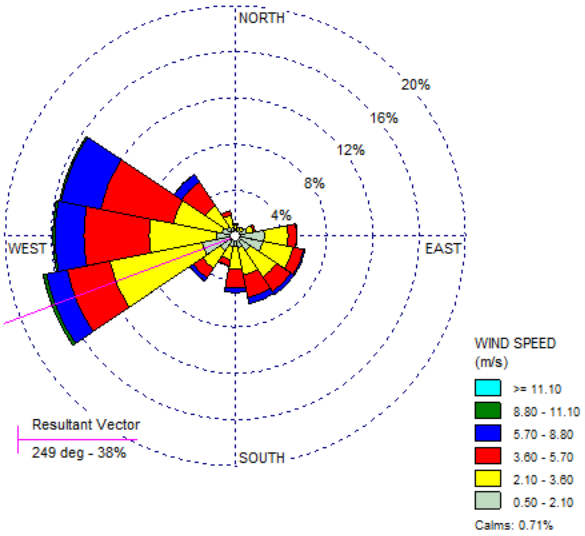
In the figure below, generated by the EPA, the locations of these NWS stations are shown relative to the area of analysis.

Figure 28. Area of Analysis and the NWS stations in the Buchanan Area



As part of its recommendation, Virginia provided the 3-year surface wind rose for Bluefield/Mercer County Airport. In Figure 29, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose shows predominant winds from the west with the resultant wind vector direction for the 10-m wind measurements, which shows winds out of the west-southwest.

Figure 29: Bluefield/Mercer County Airport Cumulative Annual Wind Rose for Years 2013 – 2015



Meteorological data from the above surface and upper air NWS 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. Virginia followed the methodology and settings presented in their modeling protocol, which followed guidance set forth in 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 and 5-minute duration was provided from Bluefield/Mercer County Airport, 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. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the 1-minute and 5-minute wind data.

The Jewell Coke Company is located in a narrow valley incised by the Dismal River. Terrain rises quickly from where the plant is located, as noted in the final report, creating very steep grades. Elevations differences between the valley floor and the nearest terrain are on the order of 200 m. Conditions in these narrow valleys could create valley induced flows that may not be captured in the meteorological data used in this analysis. Similar valley flows have been documented in the Allegheny, PA, SO_2 SIP draft[23] for a similar coke facility. Jewell Coke Company emission temperatures are quite high, which could lead to buoyant plumes that at least have a possibility of lofting emissions out of the narrow valley and into the regional atmospheric flow, which is probably captured at the higher elevation collection points such as the Bluefield/Mercer County Airport. Due to the airport's high elevation, its winds are probably reflecting the regional wind flow. The valley in which the coke plant is located likely has different wind patterns than the surrounding elevated terrain. Given the buoyant nature of the coke oven emissions, the plumes probably loft out of the valley and are therefore subject to the regional winds measured at Bluefield.

6.2.2.7. Modeling Parameter: Geography, Topography (Mountain Ranges or Other Air Basin Boundaries) and Terrain

The terrain in the area of analysis is best described as complex with narrow valleys incised by small creeks and rivers with elevations along the surrounding hill tops relatively uniform. Higher terrain lies well to the east of the Jewell Coke Company. 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 is from the using 1/3 arc second National Elevation Data (NED) files obtained from the USGS.

EPA believes that the terrain within the modeling domain has been adequately characterized.

[23] http://www.achd.net/air/publichearing2017/SO2_2010_NAAQS_SIP_DRAFT_Mar-2-2017.pdf

6.2.2.8. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, Virginia used the Harrisonburg SO_2 monitoring site (Site ID 51-165-0003) in Rockingham County, VA. This monitor is roughly 314 km northeast of the Jewell Coke Company. The single value of the background concentration for this area of analysis was determined by Virginia to be 13.1 micrograms per cubic meter ($\mu g/m^3$), equivalent to 5 ppb when expressed in one significant figure,[24] and that value was incorporated into the final AERMOD results.

Given the isolation of Jewell Coke Company it is probably acceptable to use Harrisonburg as a regional representative background site in accordance with section 8.3.2 (b) of Appendix W.

6.2.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Buchanan area of analysis are summarized below in Table 19.

[24] The SO_2 NAAQS level is expressed in ppb but AERMOD gives results in $\mu g/m^3$. The conversion factor for SO_2 (at the standard conditions applied in the ambient SO_2 reference method) is 1ppb = approximately 2.619 $\mu g/m^3$.

Table 19: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Buchanan Area

Input Parameter	Value
AERMOD Version	15181 Beta Adjust u*
Dispersion Characteristics	Rural
Modeled Sources	23
Modeled Stacks	21
Modeled Structures	12
Modeled Fencelines	0
Total receptors	13,498
Emissions Type	Actual (based on extrapolation of stack test information)
Emissions Years	2013-2015
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Bluefield, WV
NWS Station Upper Air Meteorology	Roanoke, VA
NWS Station for Calculating Surface Characteristics	Bluefield, WV
Methodology for Calculating Background SO_2 Concentration	Tier 1 Design Value 2013-15
Calculated Background SO_2 Concentration	5 ppb or 13.1 ug/m^3

The results presented below in Table 20 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

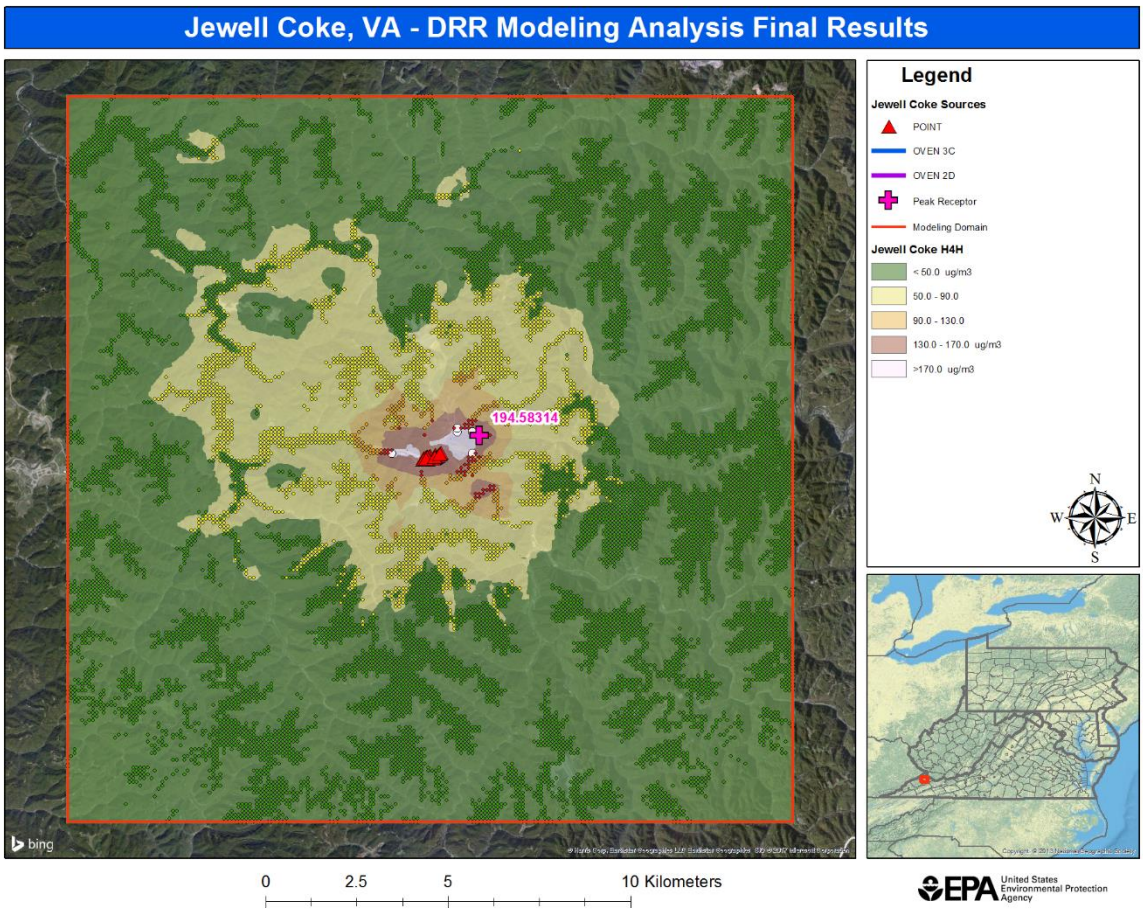
Table 20. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Buchanan Area

Averaging Period	Data Period	Receptor Location [UTM zone XX, if applicable]		99th percentile daily maximum 1-hour SO_2 Concentration (µg/m^3)	
		UTM/Latitude	UTM/Longitude	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-15	409130	4121930	181.5 + 13.1 = 194.6	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 µg/m^3 conversion factor

Virginia's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 194.6 µg/m^3, equivalent to 74.3 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual calculated emissions from the facility. Figure 30 below indicates that the predicted value approximately 1.1 km northeast of Battery 3. Virginia's receptor grid is also shown in the figure.

Figure 30: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Buchanan Area



The modeling submitted by Virginia does not indicate that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration. Peak model concentrations are shown in Table 21 and occurred during the overnight hours during the AERMOD simulation. This is important since Jewell Coke Company utilized the Adjust_U* option in its AERMOD simulation. This option will enhance the u* values during overnight stable conditions. Increasing u* values will tend to generally lower model concentrations. The EPA has previously noted in its March 8, 2017, Clarification Memo that AERMOD version 15181, used in this analysis, has a known formulation bug that inadvertently overly enhances the u* factor leading to unrepresentative model concentrations.

Table 21. Peak Receptor Concentrations (without background) for Jewell Coke Company Showing Peak Concentrations Occur During the Overnight Hours

X	Y	AvgHigh-4th High	2013 H4H	Date	Hour	2014 H4H	Date	Hour	2015 H4H	Date	Hour
409130	4121930	181.48314	167.71447	13/01/20	03	194.66675	14/01/19	02	182.06818	15/03/07	20

6.2.2.10. The EPA's Assessment of the Modeling Information Provided by the State

Jewell Coke Company submitted a modeling analysis with peak concentrations that are 99% of the 1-hour SO_2 NAAQS. While this result appears to show compliance there are a number of factors that indicate this modeled compliance demonstration is likely flawed. These model shortcomings are outlined below.

Model Receptor Grid: Jewell Coke Company's model receptor grid is insufficient and may not pick up the maximum modeled concentration. Jewell Coke Company's receptor placement methodology limits receptor sampling and could allow its emission plumes to bypass the model receptor grid due to receptor clustering at certain elevations and hill height scales.

Use of Adjust u* in AERMOD version 15181: EPA issued a Clarification Memo on March 8, 2017 noting a known formulation bug that would lead to unrepresentative model concentrations. Jewell Coke Company's modeling simulation used this version of AERMOD. Furthermore, peak model concentrations occur during overnight stable conditions when this formulation bug would have been activated.

Modeled Emission Rates Are 10% Below 2014 NEI Values: Jewell Coke Company based its modeled emission rates on stack testing values. The facility's total modeled emission rates were approximately 10% less than the annual reported emissions to the 2014 NEI. AERMOD concentrations could, therefore, be under predicted by as much as 10%. Modeled annual emissions for the simulation period should also be compared to those reported to the Commonwealth of Virginia to determine accuracy.

Region 3 has two other coke ovens involved in submitting state implementation plans (SIP) to demonstrate modeled compliance with the SO_2 NAAQS. Both of these facilities, Mountain State Carbon in Follansbee, WV, and the US Steel Clairton Coke Works in Clairton, PA, are byproduct coke facilities; volatiles driven off during the coking process are desulfurized prior to consumption. Both facilities have demonstrated compliance with design values within 1% or so of the standard, similar to Jewell Coke Company's modeling demonstration. For comparison, final modeled SO_2 emission rates are presented in Table 22. All three (3) facilities are located in similar terrain but SO_2 emissions from Jewell Coke Company are substantially higher. This suggests that if the modeling analysis did not have the problems discussed above, it is unlikely that Jewell Coke Company's modeling would demonstrate attainment with the 1-hr SO_2 NAAQS.

Table 22. Comparison of Model Results for Jewell Coke Company, US Steel Clairton Coke Woks and Mountain State Carbon

Facility	Model Peak (ug/m3)	NAAQS (ug/m3)	2014 NEI SO2 Emissions (tpy)	Coal Production (tpy)
Jewell Coke Company	194.6	196.5	4,964.5	1,041,500
US Steel Clairton	195.34	196.5	1,511.7	est 4,700,000
Mountain State Carbon	195.9	196.5	366.7	max 1,535,000

6.3. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Buchanan Area

These factors have been incorporated into the air quality modeling efforts and results discussed above. The EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

6.4. Jurisdictional Boundaries in the Buchanan Area

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for Buchanan County. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

Virginia recommended Buchanan County as attainment/unclassifiable because Virginia's modeling analysis did not show any violations of the NAAQS in this jurisdiction.

6.5. Other Information Relevant to the Designations for the Buchanan Area

There are no designated nonattainment areas or areas intended to be designated as nonattainment neighboring any of the counties or cities modeled in the Buchanan area of analysis.

6.6. The EPA's Assessment of the Available Information for the Buchanan Area

The modeling submitted by Virginia indicates that the 1-hour SO_2 NAAQS is not in violation at the receptor with the highest modeled concentration. Virginia's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 194.6 μg/m^3, equivalent to 74.3 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual calculated emissions from the facility. While this result appears to show compliance there are a number of factors that indicate this modeled attainment demonstration is likely flawed. These model shortcomings are as follows: (1) Jewell Coke Company's model receptor grid is not in accordance with current model guidance outlined in EPA's Modeling TAD, and therefore, may not pick up the maximum modeled concentration; (2) the modeling analysis used Adjust u* in AERMOD version 15181**,** which has a known formulation bug that would lead to unrepresentative model concentrations; and (3) AERMOD concentrations could be under-predicted by as much as 10% since the modeled emission rates were based on stack testing values.

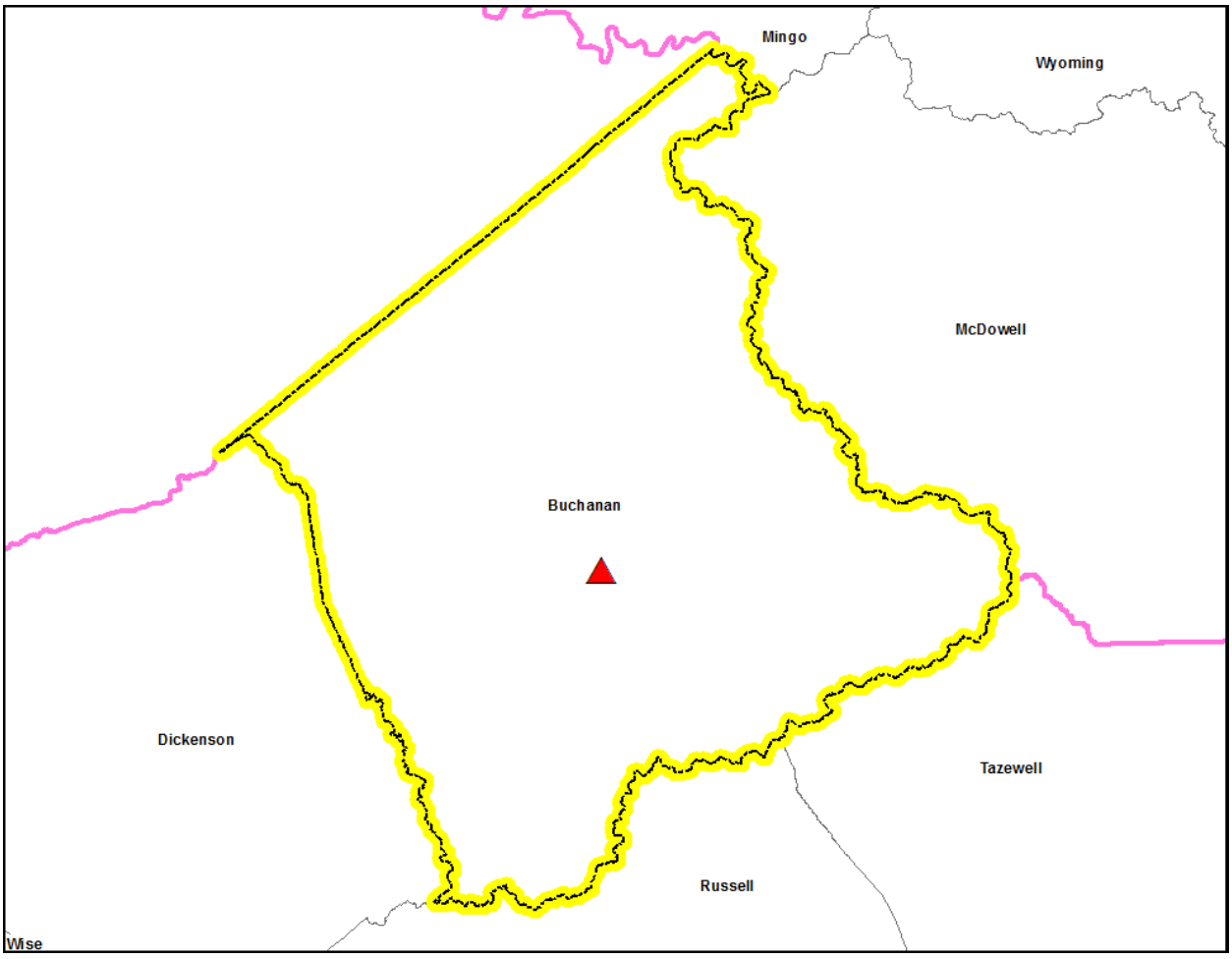
For the reasons outlined above as well as because Jewell's actual emissions are substantially higher than that of Mountain State Carbon, the EPA does not agree that the modeling analysis for the Buchanan area is representative of actual air quality in that area, and does not agree that the Buchanan County is in attainment with the 1-hour SO_2 NAAQS. Although Virginia recommended that Buchanan County be designated as attainment/unclassifiable based on the modeling analysis for Jewell Coke Company described in this document, without having a modeling analysis conducted in accordance with EPA's modeling TAD, and other issued guidance, or that is otherwise technically reliable and representative of the area, the EPA has insufficient information to designate the Buchanan area as unclassifiable/attainment. Therefore, the EPA believes the most appropriate designation for Buchanan County is unclassifiable. The EPA finds that our intended unclassifiable area, bounded by Buchanan County's jurisdictional boundary, will have a clearly defined legal boundary, and we intend to find this boundary to be a suitable basis for defining our intended unclassifiable area.

Furthermore, given the mountainous terrain in the area, the EPA finds that emissions from Jewell are likely confined to Buchanan County and likely do not impact the air quality of neighboring counties. For this reason, the EPA also finds that the jurisdictional boundary of Buchanan county is a suitable basis for defining our intended unclassifiable area.

6.7. Summary of Our Intended Designation for the Buchanan, Virginia Area

After careful evaluation of Virginia's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate Buchanan County as unclassifiable for the 2010 SO_2 NAAQS because the area was required to be characterized by the state under 40 CFR 51.1203(c) or (d), has not been previously designated, and on the basis of available information cannot be classified as either: (i) meeting or not meeting the 2010 SO_2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS. Specifically, the boundary is comprised of the jurisdictional boundary for Buchanan County. Figure 31 shows the boundary of this unclassifiable designated area.

Figure 31. Boundary of the Intended for the Buchanan Area



7. Technical Analysis for All Other Counties/Cities in Virginia

7.1. Introduction

Virginia has not installed and begun timely operation of a new, approved SO_2 monitoring network meeting EPA specifications referenced in EPA's SO_2 DRR for any sources of SO_2 emissions in the counties/cities identified in Table 23. Accordingly, the EPA must designate these counties by December 31, 2017. At this time, there are no air quality modeling results available to the EPA for these counties. In addition, there is no air quality monitoring data that indicate any violation of the 1-hour SO_2 NAAQS. The EPA is designating the counties in Table 23 in the state as "unclassifiable/attainment" since these counties were not required to be characterized under 40 CFR 51.1203(c) or (d) and EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

Table 23. Counties/Cities that the EPA Intends to Designate Unclassifiable/Attainment

County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Accomack	Accomack County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Albermarle	Albermarle County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Amelia	Amelia County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Amherst	Amherst County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Appomattox	Appomattox County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Arlington	Arlington County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Augusta	Augusta County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Bath	Bath County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Bedford	Bedford County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Bland	Bland County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Brunswick	Brunswick County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Buckingham	Buckingham County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Campbell	Campbell County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Caroline	Caroline County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Carroll	Carroll County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Clarke	Clarke County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Craig	Craig County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Culpeper	Culpeper County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Cumberland	Cumberland County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Dickenson	Dickenson County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Dinwiddie	Dinwiddie County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Essex	Essex County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Fairfax	Fairfax County	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Fauquier	Fauquier County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Floyd	Floyd County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Fluvanna	Fluvanna County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Franklin	Franklin County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Frederick	Frederick County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Gloucester	Gloucester County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Goochland	Goochland County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Grayson	Grayson County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Greene	Greene County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Greensville	Greensville County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Hanover	Hanover County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Henry	Henry County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Highland	Highland County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Isle of Wight	Isle of Wight County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
James City County	James City County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
King and Queen	King and Queen County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
King George	King George County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
King William	King William County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Lancaster	Lancaster County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Lee	Lee County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Loudoun	Loudoun County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Louisa	Louisa County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Lunenburg	Lunenburg County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Madison	Madison County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Mathews	Mathews County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Middlesex	Middlesex County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Montgomery	Montgomery County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Nelson	Nelson County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
New Kent	New Kent County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Northampton	Northampton County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Northumberland	Northumberland County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Nottoway	Nottoway County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Orange	Orange County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Page	Page County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Patrick	Patrick County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Pittsylvania	Pittsylvania County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Powhatan	Powhatan County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Prince Edward	Prince Edward County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Prince George	Prince George County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Prince William	Prince William County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Pulaski	Pulaski County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Rappahannock	Rappahannock County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Richmond	Richmond County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Roanoke	Roanoke County	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Rockbridge	Rockbridge County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Rockingham	Rockingham County	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Russell	Russell County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Scott	Scott County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Shenandoah	Shenandoah County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Smyth	Smyth County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Southampton	Southampton County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Spotsylvania	Spotsylvania County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Stafford	Stafford County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Surry	Surry County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

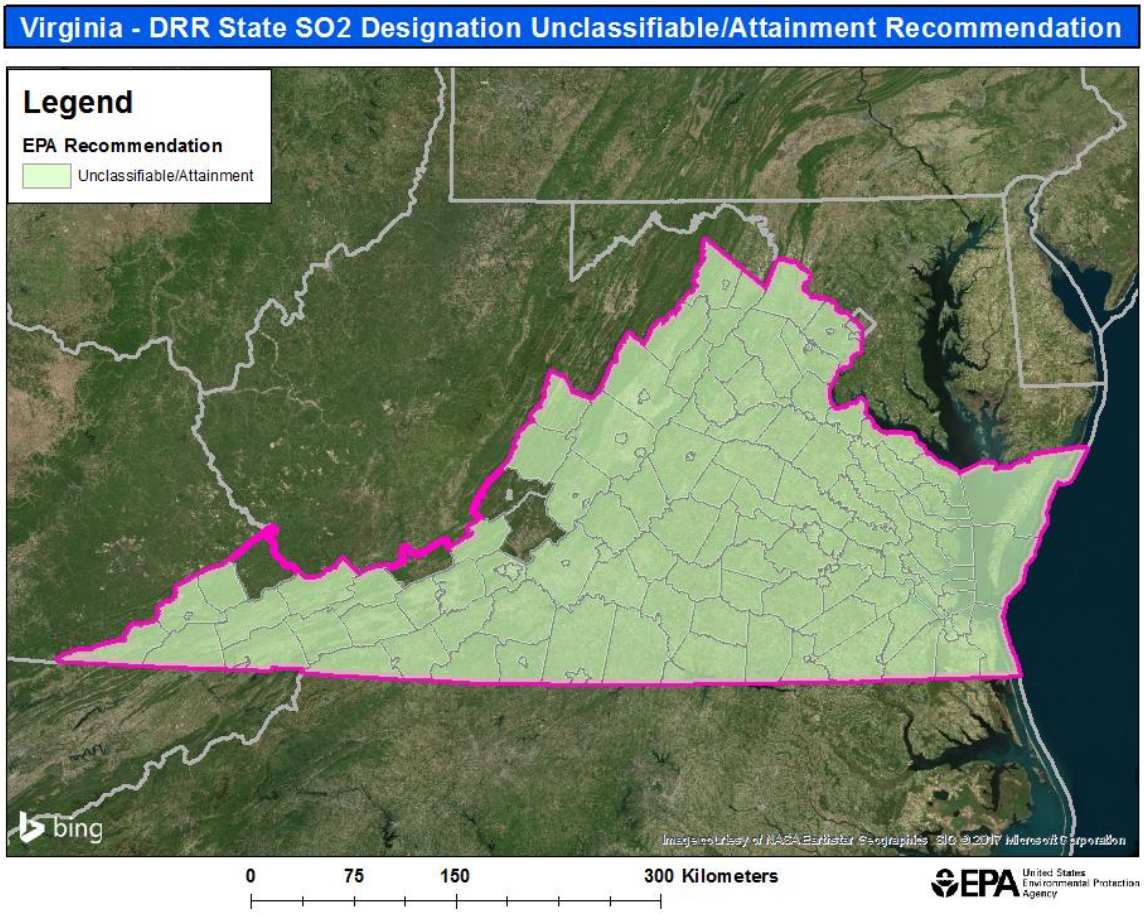
County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Sussex	Sussex County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Tazewell	Tazewell County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Warren	Warren County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Washington	Washington County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Westmoreland	Westmoreland County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Wise	Wise County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Wythe	Wythe County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Alexandria City	Alexandria City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Bedford City	Bedford City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Bristol City	Bristol City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Buena Vista City	Buena Vista City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Charlottesville City	Charlottesville City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Chesapeake City	Chesapeake City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Danville City	Danville City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Emporia City	Emporia City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Fairfax City	Fairfax City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Falls Church City	Falls Church City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Franklin City	Franklin City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Fredericksburg City	Fredericksburg City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Galax City	Galax City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Harrisonburg City	Harrisonburg City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Lexington City	Lexington City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Lynchburg City	Lynchburg City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Manassas City	Manassas City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Manassas Park City	Manassas Park City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Martinsville City	Martinsville city	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Norfolk City	Norfolk City	Attainment/ Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Norton City	Norton City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

County	Virginia's Recommended Area Definition	Virginia's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Portsmouth City	Portsmouth City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Radford City	Radford City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Roanoke City	Roanoke City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Salem City	Salem City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Staunton City	Staunton City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Suffolk City	Suffolk City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Virginia Beach City	Virginia Beach City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Waynesboro City	Waynesboro City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Williamsburg City	Williamsburg City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment
Winchester City	Winchester City	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ Attainment

Table 23 also summarizes Virginia's recommendations for these areas. Specifically, Virginia recommended that the entirety of the counties/cities be designated as unclassifiable based on the lack of air quality monitoring and modeling data. After careful review of Virginia's assessment, supporting documentation, and all available data, the EPA intends to modify Virginia's recommendation for these areas, and designate the areas as unclassifiable/attainment. Figure 32 shows the locations of these areas within Virginia.

Figure 32. The EPA's Intended Unclassifiable/Attainment Designations for Counties and Cities in Virginia



As referenced in the Introduction (see Table 2), the counties associated with sources for which Virginia has installed and begun timely operation of a new, approved SO_2 monitoring network are required to be designated by December 31, 2020, but are not being addressed at this time. Counties previously designated in Round 1 (*See* 78 *Federal Register* 4719) and Round 2 (*See* 81 *Federal Register* 45039) will remain unchanged unless otherwise noted.

7.2. Air Quality Monitoring Data for All Other Counties/Cities in Virginia

There are several air quality monitors located in the counties/cities listed in Table 24.

Table 24: Air Quality Monitoring Data

County	Air Quality Systems (AQS) Monitor ID	Monitor Location	2013 – 2015 SO_2 Design Value (ppb)	2014 – 2016 SO_2 Design Value (ppb)
Fairfax	51-059-0030	38.77335, -77.10468	10*	8
Roanoke	51-161-1004	37.28342, -79.88452	5*	5
Rockingham	51-165-0003	38.47753, -78.81952	5	4
City of Norfolk	51-710-0024	36.85555, -76.30135	34	19

* Invalid design value.

7.3. Jurisdictional Boundaries for All Other Counties/Cities in Virginia

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for all other counties/cities in Virginia. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable.

Virginia's original recommendation, dated June 2, 2011, recommended that each county or city in Virginia be designated as unclassifiable. Virginia's January 11, 2017 recommendation updated designation recommendations for the counties/cities listed in Table 1. With the exception of the counties/cities deferred to Round 4 designations, the remaining counties/cities listed in Table 23 have recommended boundaries defaulted to the jurisdictional boundary for each county/city.

7.4. The EPA's Assessment of the Available Information for All Other Counties/Cities in Virginia

These counties were not required to be characterized under 40 CFR 51.1203(c) or (d) and EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS. These counties therefore meet the definition of an "unclassifiable/attainment" area. Therefore, the EPA intends

to designate the areas in the above Table 23 as unclassifiable/attainment for the 2010 SO_2 NAAQS.

Our intended unclassifiable/attainment areas, bounded by the county or city jurisdictional boundary, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable areas.

7.5. Summary of Our Intended Designation for All Other Counties/Cities in Virginia

After careful evaluation of Virginia's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate all counties/cities listed in Table 23 as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of the jurisdictional boundary of each county/city. Figure 32 above shows the location of these areas.

At this time, our intended designations for Virginia only apply to these areas and the other areas presented in this technical support document. The EPA intends to evaluate and designate all remaining undesignated areas (Giles County, Botetourt County, City of Covington, and Alleghany County) in Virginia by December 31, 2020.