Technical Support Document:

Chapter 9
Intended Round 4 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for Virginia

1. Summary

Pursuant to section 107(d) of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (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. See CAA section 107(d)(1)(A)(i)-(iii).

In this action, EPA defines a nonattainment area as an area that, based on available information including (but not limited to) monitoring data and/or appropriate modeling analyses, 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. An attainment/unclassifiable area is defined as an area that, based on available information including (but not limited to) appropriate monitoring data and/or modeling analyses, EPA has determined meets the NAAQS and does not likely contribute to ambient air quality in a nearby area that does not meet the NAAQS. An unclassifiable area is defined as an area for which the available information does not allow EPA to determine whether the area meets the definition of a nonattainment area or the definition of an attainment/unclassifiable area.

EPA is under a December 31, 2020, deadline to designate all remaining undesignated areas as required by the U.S. District Court for the Northern District of California.[1] This deadline is the final of three deadlines established by the court for EPA to complete area designations for the 2010 SO_2 NAAQS. The remaining undesignated areas are: 1) those areas which, under the court order, did not meet the criteria that required designation in Round 2 and also were not required to be designated in Round 3 due to installation and operation of a new SO_2 monitoring network by January 2017 in the area meeting EPA's specifications referenced in EPA's SO_2 Data Requirements Rule (DRR)[2], and 2) those areas which EPA has not otherwise previously designated for the 2010 SO_2 NAAQS. EPA previously issued guidance on how to appropriately and sufficiently monitor ambient air quality in the "SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document" (SO_2 NAAQS Designations Monitoring TAD).[3]

[1] *Sierra Club v. McCarthy*, No. 3-13-cv-3953 (SI) (N.D. Cal. Mar. 2, 2015).
[2] *See* 80 FR 51052 (August 21, 2015), codified at 40 CFR part 51 subpart BB.
[3] https://www.epa.gov/sites/production/files/2016-04/documents/so2monitoringtad.pdf

In previous final actions, EPA has issued designations for the 2010 SO_2 NAAQS for most areas of the country.[4] We are referring to the set of designations being finalized by the deadline of December 31, 2020, as "Round 4" or the final round of the designations process for the 2010 SO_2 NAAQS. After these Round 4 designations are completed, there will be no remaining undesignated areas for the 2010 SO_2 NAAQS.

This technical support document (TSD) addresses designations for all remaining undesignated areas in Virginia for the 2010 SO_2 NAAQS. Areas with monitored violations of the NAAQS are explicitly evaluated in this TSD. Undesignated areas in Virginia without monitored violations are referenced in this TSD for completeness but are covered in more detail in Chapter 2.

Virginia submitted its first recommendation regarding designations for the 2010 1-hour SO_2 NAAQS on June 3, 2011. On January 11, 2017, Virginia submitted additional attainment/unclassifiable recommendations for certain jurisdictions based on modeling, monitoring, and other data. The Commonwealth submitted updated air quality analysis and updated recommendations on April 24, 2020 to address more recent air quality monitoring data for monitors that were installed pursuant the DRR. In our intended designations, we have considered all the submissions from the Commonwealth, except where a later submission indicates that it replaces an element of an earlier submission.

Table 1 identifies EPA's intended Round 4 designations and the areas in Virginia to which they would apply. It also lists Virginia's current recommendations. EPA intends to designate these areas by December 31, 2020, through an assessment and characterization of air quality based primarily on ambient monitoring data, including data from existing and new EPA-approved monitors that have collected data from January 2017 forward, pursuant to the DRR; however, other available evidence and supporting information, such as air dispersion modeling in certain situations, may also be considered.[5]

[4] Most areas of the U.S. were previously designated in actions published on August 5, 2013 (78 FR 47191), July 12, 2016 (81 FR 45039), December 13, 2016 (81 FR 89870), January 9, 2018 (83 FR 1098) and April 5, 2018 (83 FR 14597). EPA is not reopening these previous designation actions in this current Round 4 of designations under the 2010 SO_2 NAAQS, except where specifically discussed.

[5] Detailed SO_2 monitor information may be found in either the 2016 or 2017 ambient monitoring network plans, or associated addenda, for each state.

Table 1. Summary of 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
Giles County (partial)	43 Coordinates around Lhoist – Kimballton Plant (See Table 7)	Nonattainment	Same as Commonwealth's Recommendation	Nonattainment
Remaining portion of Giles County*	Remaining portion of Giles County not included in the nonattainment boundary	Attainment/ unclassifiable	Same as Commonwealth's Recommendation	Attainment/ unclassifiable
Alleghany County/ City of Covington*	Alleghany County/ City of Covington	Attainment/ unclassifiable	Same as Commonwealth's Recommendation	Attainment/ unclassifiable
Botetourt County*	Botetourt County	Attainment/ unclassifiable	Same as Commonwealth's Recommendation	Attainment/ unclassifiable

* EPA addresses this area in Chapter 2 with all other areas which EPA intends to designate "attainment/unclassifiable" or "unclassifiable."

Areas that EPA previously designated in Round 1 (*see* 78 FR 47191), Round 2 (*see* 81 FR 45039 and 81 FR 89870), and Round 3 (*see* 83 FR 1098 and 83 FR 14597) are not affected by the designations in Round 4 unless otherwise noted.

2. General Approach and Schedule

An updated designations guidance document was issued by EPA through a September 5, 2019, memorandum from Peter Tsirigotis, Director, U.S. EPA, Office of Air Quality Planning and Standards, to Regional Air Division Directors, U.S. EPA Regions 1-10.[6] To better reflect the Round 4 designations process, this memorandum supplements, where necessary, prior designations guidance documents on area designations for the 2010 primary SO_2 NAAQS issued on March 24, 2011, March 20, 2015, and July 22, 2016. This memorandum identifies factors that EPA intends to evaluate in determining whether areas are in violation of the 2010 SO_2 NAAQS. The document also contains the factors that EPA intends to evaluate in determining the

[6] https://www.epa.gov/sites/production/files/2019-09/documents/round_4_so2_designations_memo_09-05-2019_final.pdf

boundaries for all remaining areas in the country. These factors include: 1) air quality characterization via ambient monitoring and/or dispersion modeling results; 2) emissions-related data; 3) meteorology; 4) geography and topography; and 5) jurisdictional boundaries.

In EPA's September 2019 memorandum, we note that Round 4 area designations will be based primarily on ambient monitoring data, including data from existing and new EPA-approved monitors that have collected data at least from January 2017 forward, pursuant to the DRR. In addition, EPA may evaluate air dispersion modeling submitted by state air agencies for two specific circumstances. First, states may submit air dispersion modeling to support the geographic extent of a nonattainment boundary. Second, states may submit air dispersion modeling to demonstrate that new federally enforceable SO_2 emissions limits provide for attainment of the NAAQS and represent a more accurate characterization of current air quality at the time of designation than does monitoring of past air quality.

This TSD is organized such that there is a section for each area in Virginia for which air quality monitoring data indicate a violation of the 2010 SO_2 NAAQS. When modeling information is available, it is evaluated in the context of that section. EPA does not plan to revise this intended designations TSD after consideration of state and public comment on our intended designation. A separate final 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 2010 SO_2 NAAQS.
3) Intended designated nonattainment area –an area that, based on available information including (but not limited to) monitoring data and/or appropriate modeling analyses, EPA intends to determine 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) Intended designated attainment/unclassifiable area – an area that, based on available information including (but not limited to) appropriate monitoring data and/or appropriate modeling analyses, EPA intends to determine meets the 2010 SO_2 NAAQS and does not likely contribute to ambient air quality in a nearby area that does not meet the NAAQS.
5) Intended designated unclassifiable area – an area for which the available information does not allow EPA to determine whether the area meets the definition of a nonattainment area or the definition of an attainment/unclassifiable area.
6) Modeled violation – a modeled design value impact above the 2010 SO_2 NAAQS demonstrated by air dispersion modeling.
7) Recommended attainment area – an area that a state, territory, or tribe has recommended that EPA designate as attainment.
8) Recommended nonattainment area – an area that a state, territory, or tribe has recommended that EPA designate as nonattainment.

9) Recommended unclassifiable area – an area that a state, territory, or tribe has recommended that EPA designate as unclassifiable.
10) Recommended attainment/unclassifiable (or unclassifiable/attainment) area – an area that a state, territory, or tribe has recommended that EPA designate as attainment/unclassifiable (or 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 EPA.

3. Technical Analysis for the Giles County Area

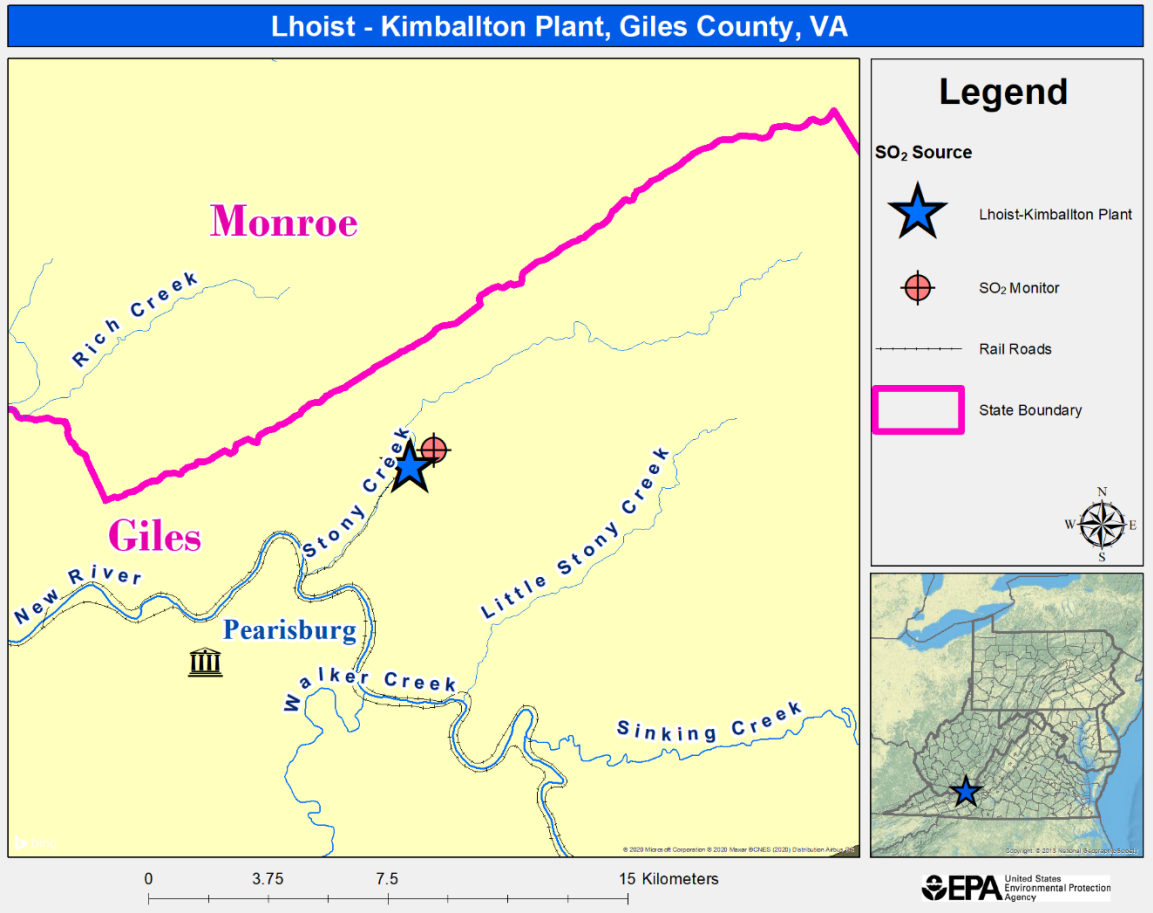
3.1. Introduction

EPA must designate the Giles County area by December 31, 2020, because the area has not been previously designated, and Virginia installed and began operating a new EPA-approved monitor pursuant to the DRR. This section presents all the available air quality information for the portion of Giles County that includes the following SO_2 source around which the DRR required the Commonwealth to characterize air quality:

- The Lhoist North America – Kimballton Plant (hereafter "Lhoist – Kimballton Plant, or Lhoist facility) emits 2,000 tons of SO_2 or more annually. Specifically, the Lhoist – Kimballton Plant emitted 6,294 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and Virginia has chosen to characterize it via monitoring.

As seen in Figure 1 below, the Lhoist – Kimballton Plant is located on Big Stony Creek Road, north of US 460, between Blacksburg and Pearisburg, Virginia. The approximate location of the production area (i.e., the three lime kilns) is 529,900 meters Easting and 4,137,400 meters Northing (Universal Transverse Mercator (UTM) coordinate system Zone 17 of the Northern Hemisphere and the North American Datum of 1983 (NAD83)). The DRR monitor is located approximately 1.5 km northeast of the Lhoist facility.

Figure 1. Map of the Giles County, Virginia Area Addressing Lhoist North America – Kimballton Plant



In its April 24, 2020 recommendation letter, Virginia recommended that a portion of Giles County be designated as nonattainment for the 2010 SO_2 NAAQS, based on monitored air quality from 2017-2019. Specifically, the Commonwealth's recommended boundaries consist of 43 latitude and longitude coordinates as shown in Table 7 below. EPA agrees with Virginia's recommendation as to the designation category, and intends to designate a portion of Giles County, Virginia, as described below, as nonattainment for the 2010 SO_2 NAAQS based upon currently available monitoring information for the 2017-2019 period. Our intended boundaries are consistent with the Commonwealth's recommended boundaries and are described below.

3.2. Air Quality Monitoring Data for Giles County

EPA considered design values for air quality monitors in the Giles County area by assessing the most recent 3 consecutive years (i.e., 2017-2019) of quality-assured, certified ambient air quality data in the EPA Air Quality System (AQS) using data from Federal Reference Method and Federal Equivalent Method monitors that are sited and operated in accordance with 40 CFR parts

50 and 58.[7] Procedures for using monitored air quality data to determine whether a violation has occurred are given in 40 CFR part 50 Appendix T, as revised in the 2010 SO_2 NAAQS rulemaking. The 2010 1-hour SO_2 NAAQS is met when the design value is 75 ppb or less. Whenever several monitors are located in an area, the design value for the area is determined by the monitor with the highest valid design value. The presence of one or more violating monitors (i.e., monitors with design values greater than 75 ppb) in a geographic area forms the basis for designating that area as nonattainment. The remaining factors, described in the next section, are then used as the technical basis for determining the spatial extent of the designated nonattainment area surrounding the violating monitor. Table 2 contains the 2017-2019 design values for the area of analysis.

Table 2. 2010 SO_2 NAAQS Design Values for the Giles County Area

AQS Site ID	Monitor Location	2017 99th Percentile (ppb)	2018 99th Percentile (ppb)	2019 99th Percentile (ppb)	2017-2019 Design Value (ppb)
51-071-0007	-80.6539, 37,3863 2093 Big Stony Creek Rd. Ripplemead, VA 24150	462	66	80	**203**

3.3. Air Quality Modeling Analysis for the Giles County Area Addressing the Lhoist – Kimballton Plant

In its April 24, 2020, recommendation letter, Virginia provided an air quality modeling analysis for the area surrounding the Lhoist – Kimballton Plant to support a nonattainment area boundary.

This assessment and characterization were performed using air dispersion modeling software, i.e., AERMOD, analyzing hourly emission rates based on hourly production data. After careful review of the Commonwealth's assessment, supporting documentation, and all available data, EPA agrees with Virginia's recommendation for the area, and intends to designate the area as nonattainment for portions of Giles County, VA. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

The area that the Commonwealth has assessed via air quality modeling covered an area extending approximately 12 kilometers from the Lhoist – Kimballton Plant and covered portions of Giles County, VA and neighboring Monroe County, WV. The Commonwealth reported no other nearby emitters of SO_2 in this area.

[7] SO_2 air quality data are available from EPA's website at https://www.epa.gov/outdoor-air-quality-data. SO_2 air quality design values are available at https://www.epa.gov/air-trends/air-quality-design-values.

The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in EPA's September 5, 2019, guidance, July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.[8]

For this area, EPA received and considered modeling provided by the Virginia Department of Environmental Quality. No other modeling assessments were considered for designation purposes.

3.3.1. Modeling Analysis Provided by the Commonwealth

3.3.1.1.Model Selection and Modeling Components

The SO_2 NAAQS Designations Modeling Technical Assistance Document (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

The Commonwealth used AERMOD version 19191, the current version of the model available on EPA's Center for Regulatory Atmospheric Modeling or SCRAM website. A discussion of the Commonwealth's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

3.3.1.2.Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the determination of whether a source area is "urban" or "rural" 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 area 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 mode. Virginia based this decision on a review of land usage within 3 kilometers (km) of the Lhoist – Kimballton Plant. There are no major urban centers within 3 km of the plant. The nearest population center is the town of Pearisburg, VA located approximately 5 km southwest of the plant.

[8] https://www.epa.gov/sites/production/files/2016-04/documents/so2modelingtad.pdf.

EPA has reviewed Virginia's analysis and agrees in selecting the rural dispersion coefficients in AERMOD.

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

The Modeling 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 source of SO_2 emissions subject to the DRR in this area is described in the introduction to this section. For the Giles County area, the modeling domain included an area of approximately 10-12 km around the Lhoist – Kimballton Plant in any direction. The Commonwealth 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 grid receptor spacing for the area of analysis chosen by the Commonwealth is as follows:

- 25 meter spacing along the property boundary;
- 50 meter spacing from the property boundary extending to one km from the further extent of property boundary most immediately surrounding the production facility;
- 100 meter spacing from one km to three km from the facility; and
- 250 meter spacing from three km to 10 km from the facilities property boundary.

Model receptors were excluded from the Lhoist – Kimballton Plant's property boundary, which is quite extensive (GIS estimated 6.5 km^2 in area and a perimeter estimated at 26.4 km in length). It is unlikely that all of the plant's property would meet the current definition of ambient air. This distinction, however, is not relevant to the nonattainment boundary being proposed for this area.

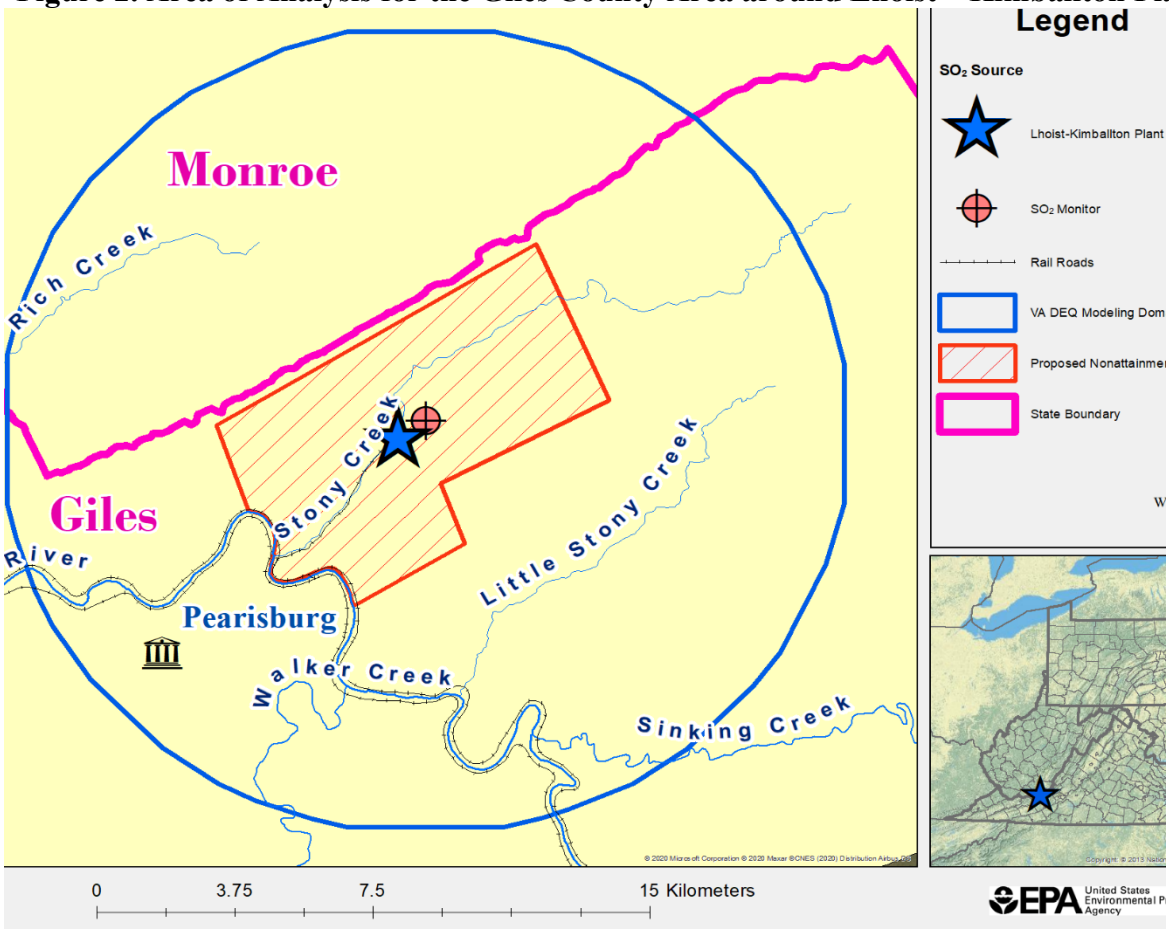
The receptor network contained 16,954 receptors, and the network covered an area extending approximately 10 km from the Lhoist – Kimballton Plant. Receptors covered portions of Giles County, Virginia and neighboring Monroe County, West Virginia.

Figure 2 and Figure 3 below show the Commonwealth's chosen area of analysis surrounding the Lhoist – Kimballton Plant, 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 each modeled facility, including other facilities' properties with the exceptions of locations described in Section 4.2 of the Modeling TAD as not being feasible locations for placing a monitor. As noted earlier, model receptors were excluded from all areas owned by the Lhoist – Kimballton Plant. Access is generally not controlled in a manner as described in current EPA ambient air guidance

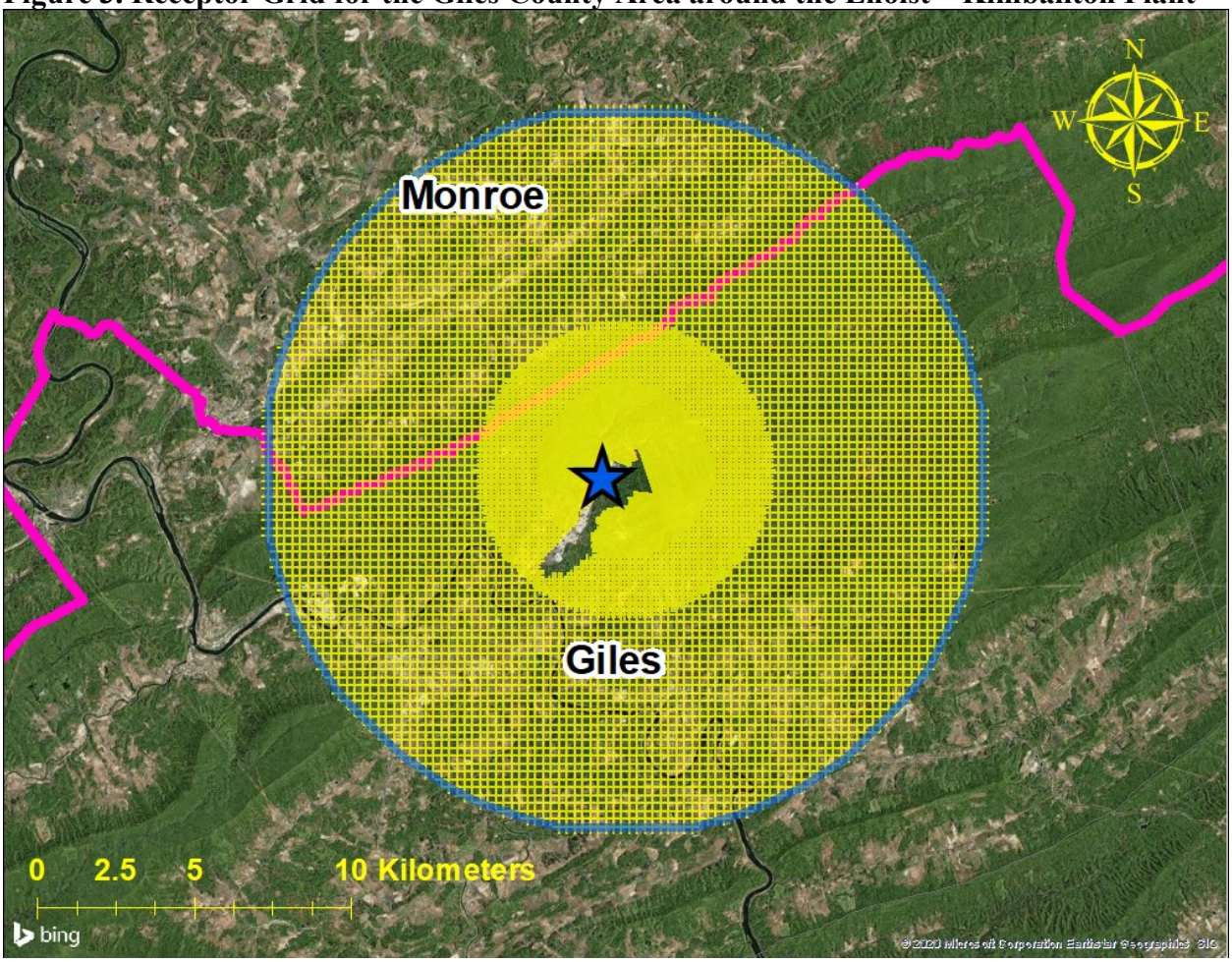
over the entire property owned by the Lhoist – Kimballton Plant. There are also several public roads that cross Lhoist's property boundary (east to west).[9]

Figure 2. Area of Analysis for the Giles County Area around Lhoist – Kimballton Plant



[9] EPA defines ambient air in 40 CFR §50.1(e) as "*that portion of the atmosphere, external to buildings, to which the general public has access.*" Since the proposed nonattainment area include all of the Lhoist – Kimballton Plant, the ambient air boundary is not relevant to this designation process. Proper delineation of the ambient air boundary, however, will be necessary in any future SIP. See EPA guidance: https://www.epa.gov/nsr/ambient-air-guidance.

Figure 3. Receptor Grid for the Giles County Area around the Lhoist – Kimballton Plant



EPA concludes that the model receptor grid developed by Virginia and summarized in the above paragraphs is adequate to resolve the model peak concentrations in the area of the Lhoist – Kimballton Plant because it follows the Modeling TAD with the exception of the exclusion of receptors from inside the facility's property boundary. EPA does not believe this will prevent the proper delineation of the proposed nonattainment area (since the entire property of the facility is included within the nonattainment area boundary). Rather, ambient air boundaries will be resolved in the State Implementation Plan (SIP) development phase. Model receptor grid spacing appears to be of sufficient receptor density and extends far enough from the primary kilns to ensure the peak model concentrations are properly resolved. EPA reviewed the 2018 Emission Inventory System (EIS) for point sources and confirmed that there are three small sources of SO_2 within 50 km of the Lhoist – Kimballton Plant: the Radford Army Ammunition Plant, Virginia Tech, and Celanese Acetate LLC. In 2018, their respective reported SO_2 emissions were 1.8 tpy, 27.6 tpy and 3.1 tpy. These relatively small sources are accounted for through the use of a background concentration in Virginia's modeling analysis. Therefore, EPA believes that Virginia adequately addressed sources that contribute to SO_2 concentrations within the Lhoist facility area.

3.3.1.4.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.

Virginia modeled the Lhoist – Kimballton Plant's three kiln stacks, the primary SO_2 sources, using actual stack heights, stack temperatures, and stack exhaust velocities based on a 2017 stack test. The kilns are defined as point sources for modeling purposes. EPA examined the modeled building information provided by Virginia using GIS software and believes downwash is adequately represented, though model peak concentrations are located a little over a kilometer away indicating building downwash is not a controlling factor.

Virginia characterized these sources (3 kiln units) within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the Commonwealth used actual stack heights in conjunction with emissions calculated from actual production data and data from a December 2017 stack test.[10] The Commonwealth 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.

EPA believes Virginia's characterization of SO_2 emissions from the Lhoist – Kimballton Plant is adequate and follows the methodology outlined in the Modeling TAD.

3.3.1.5.Modeling Parameter: Emissions
The 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 three years of actual emissions data and concurrent meteorological data.

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 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, EPA recommends using detailed throughput, operating schedules, and emissions information from the impacted source(s).

As previously noted, the Commonwealth only included the Lhoist – Kimballton Plant in the area of analysis. The Commonwealth has chosen to model this facility using maximum hourly emissions based on actual production data reviewed by Virginia.

[10] The detailed SO2 emissions data used in the modeling analysis were provided by the facility to Virginia in a letter dated February 7, 2020. The specific SO2 emissions used in the modeling analysis, however, were based on maximum hourly actual production data for 2017-2019 multiplied by the emissions factors and not the annual SO2 emissions. These emission factors and associated calculations were not submitted by Virginia to EPA in its April 24, 2020 modeling analysis.

For the Lhoist – Kimballton Plant, Virginia provided annual SO_2 emissions for the years 2016, 2017, and 2018. This information is summarized in Table 3. A description of how the Commonwealth obtained hourly emission rates is given below this table.

Table 3. Actual SO_2 Emissions Between 2016 – 2018 from Facilities in the Giles County Area or within 50 km

Facility Name	SO_2 Emissions (tpy)		
	2016	2017	2018
Lhoist North America – Kimballton Plant	5,502.09	3,255.50	498.75
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	5,502.09	3,255.50	498.75

For the Lhoist – Kimballton Plant, the hourly emissions data were obtained from emission factors and production data. The emission factors are based on a December 2017 stack test when the kilns were burning 100% coal. SO_2 emissions used in the modeling analysis were based on maximum hourly actual production data for 2017-2019 multiplied by the emissions factors (and not the annual SO_2 emissions in Table 3). The use of maximum hourly emissions per modeled year reflects the maximum hourly production data for the year and does not vary the modeled emission values based on actual hourly production. This is a reasonable and likely conservative approach for modeling a nonattainment boundary because the boundary should be determined based on actual emissions, which are based on actual production; here, the maximum hourly production is used, thereby overestimating the hourly emissions used in the modeling. Because the maximum hourly emission values rather than the varying hourly emission values were used as an input to AERMOD, this approach is expected to yield a larger geographic area of modeled violations.

Table 4 summarizes the modeled emissions in grams per second (g/s) and tpy along with reported emissions (in tpy)[11] for 2017 and 2018 (2019 emissions are not currently available). A recent fuel switch (September 2017) has contributed to lower plantwide SO_2 emissions reported in 2018. The 2017 reported emissions are higher than the modeled emissions for that year because the modeled emissions are based on a December 2017 stack test which was after the September 2017 fuel switch. This fuel switch is representative of current conditions, and therefore, EPA agrees that Virginia's modeling adequately represents current conditions. The modeled annual emissions for 2018 are more than two and a half times the reported emissions for that year. Monitor exceedances for 2018 and 2019 ranged from 75-160 ppb while model receptors' 99th percentile of the maximum daily 1-hour values nearest the monitor ranged from 135-148 ppb.[12]

[11] https://www.deq.virginia.gov/Programs/Air/AirQualityPlanningEmissions/EmissionInventory.aspx

[12] EPA used the closest model receptor to the actual SO_2 monitor. Model receptor (530,696.1 easting, 4,137,833.6 northing) with 99th percentile of maximum daily 1-hour model concentrations of 364.57337 µg/m^3, 388.52984 µg/m^3 and 353.14239 µg/m^3 (for 2017-19, respectively) using a conversion of 1 ppb = 2.619 µg/m^3.

Table 4. Lhoist – Kimballton Plant Modeled and Reported SO_2 emissions.

L'Hoist Modeled SO2 Emissions/State Reported Table Summary			
L'Hoiust Stack ID	**2017 Modeled Emission Rate (g/s)**	**2018 Modeled Emission Rate (g/s)**	**2019 Modeled Emission Rate (g/s)**
Kiln 1 Stack (S1306)	3.86	4.08	3.81
Kiln 2 Stack (S1405)	15.16	16.58	14.33
Kiln 3 Stack (S1502)	18.09	18.71	17.96
Modeled Total (g/s)	**37.10**	**39.37**	**36.10**
Modeled Total (tpy)	**1,289.78**	**1,368.75**	**1,255.05**
State Reported (tpy)	**3,255.50**	**498.75**	**N/A**

3.3.1.6.Modeling Parameter: Meteorology and Surface Characteristics

As noted in the Modeling TAD, the most recent three years of meteorological data (concurrent with the most recent three years of emissions data, for sources modeled with actual emissions) 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 Giles County area analysis, Virginia selected to use surface meteorology from a previous on-site collection program that included a 30 meter multi-level instrumented tower and a co-located SOnic Detection And Ranging (SODAR) system. The 30 meter tower was located next to the primary SO_2 sources, the three kilns at the Lhoist – Kimballton Plant. Only tower measurements were utilized for the modeling analysis used to delineate the nonattainment area. Given the location of the collection site, the data would be considered site-specific surface meteorological data in accordance with section 8.4.4 of Appendix W of Part 51. Data were collected using the methodology outlined in the *Lhoist Meteorological Monitoring Plan/Quality Assurance Project Plan* (November 2012). All data were collected in a manner consistent with the recommendations contained in EPA's *Ambient Monitoring Guidelines for the Prevention of Significant Deterioration* and *Meteorological Monitoring Guidance for Regulatory Modeling Applications*. The period of data collection was October 1, 2012 through September 30, 2013. Quality Assurance/Quality Control (QA/QC) documentation was retained by the facility and Virginia and is available upon request.

The site-specific meteorology was processed with concurrent National Weather Service (NWS) upper-air (sounding) data from Blacksburg (WBAN 53829) in Montgomery County, Virginia, which is located approximately 29 km southeast of the met tower location. The site-specific data included solar radiation, net radiation and delta-T measurements allowing for AERMET to develop the necessary boundary layer information without needing cloud-cover data from a nearby NWS surface reporting station. No NWS surface data, therefore, was utilized in the AERMET processing because of the availability of site-specific data. Turbulence measurements

from onsite were used in Virginia's modeling analysis without the use of AERMOD's adjust u* option in accordance with current EPA guidance.[13]

EPA has developed a tool called AERSURFACE that can be used to determine the site characteristics based on digitized land cover data in accordance with the recommendations from EPA's AERMOD Implementation Guide (AIG). Virginia considered using two versions of AERSURFACE, version 13016 and version 19039_DRFT. The primary difference between the two versions of AERSURFACE is that the draft 2019 version can use more recent United States Geological Survey (USGS) National Land Cover Database (NLCD) datasets from 2001, 2006, and 2011 compared to Version 13016 that only accepts 1992 NLCD data as input. In addition, one of the main benefits of Version 19039_DRFT is that the program accepts supplemental databases to help characterize surface roughness, including percent impervious and percent tree canopy data, when available.

For this analysis, NLCD data are available for both 1992 and 2011. The 2011 NLCD data also includes the supplemental percent impervious and percent tree canopy data. Therefore, the more recent and representative 2011 NLCD data were selected for AERSURFACE processing; this data set represent land use conditions that are more reflective of conditions closer (in time) to the site-specific meteorological data collection times (Oct 1, 2012 through September 30, 2013). The latest version of EPA's Draft AERSURFACE that could process the 2011 data was employed. As recommended in the 2019 AERSURFACE User's Guide, the surface roughness processing is performed using the default ZORAD method. The use of EPA's Draft AERSURFACE processor (current regulatory version is AERSURFACE 20060) is not expected to change Virginia's modeling results because there were no changes between the draft and final for this specific processor. The Commonwealth completed its modeling analysis prior to the release of the final version.

Virginia estimated values for four unevenly divided sectors out to one km at a seasonal temporal resolution for dry, wet or average conditions. As recommended in the draft AERSURACE users guide, a nearby representative precipitation station (Roanoke, Virginia NWS site) was used to determine surface moisture conditions for each month. This was done by comparing precipitation over the meteorological data collection period (October 2012 through September 2013) to the 30-year average (1989-2018) to assign each month's soil moisture state (dry, average, and wet). Results of this analysis were summarized in Table 4 of Virginia's April 24, 2020 recommendation letter, Enclosure 2. The Commonwealth 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" and is related to the height of obstacles to the wind flow, which is an important factor in determining the magnitude of mechanical turbulence and the stability of the boundary layer). Figure 4 graphically shows the four sectors used to define the meteorological surface characteristics for the 30 meter tower. Each of the four sectors processed were assigned non-airport designations for determining surface roughness. This was reasonable given the significant tree cover surrounding the 30 meter met tower.

[13] See section 4.7.6.5 of EPA's AERMET (19191) Users Guide

Figure 4. AERSURFACE Sectors Used in Virginia Modeling

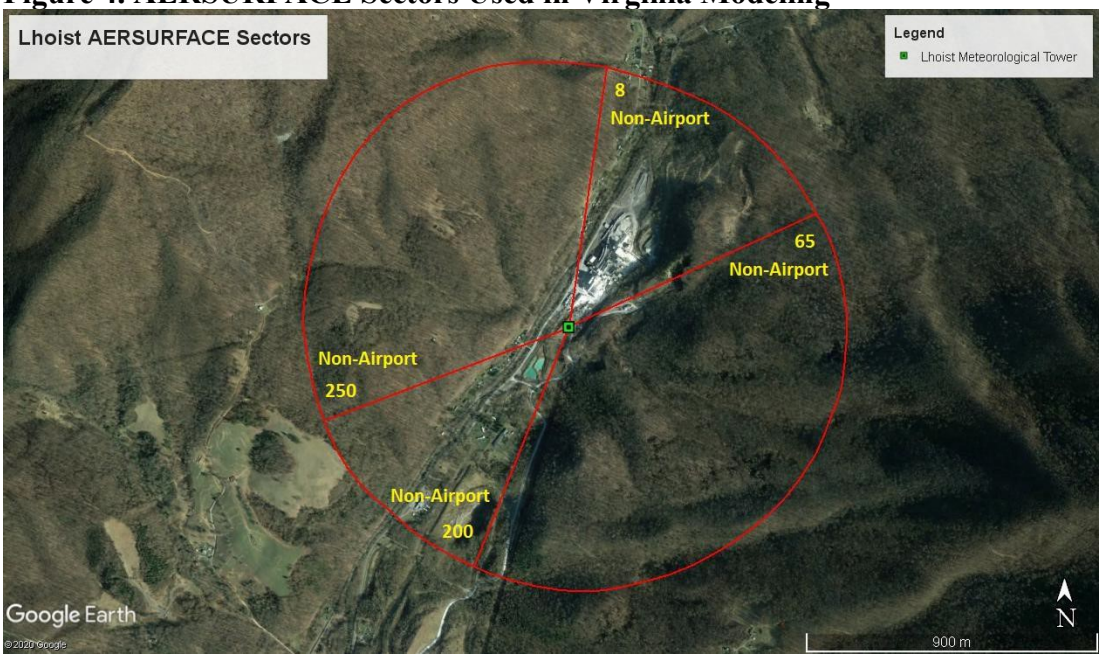
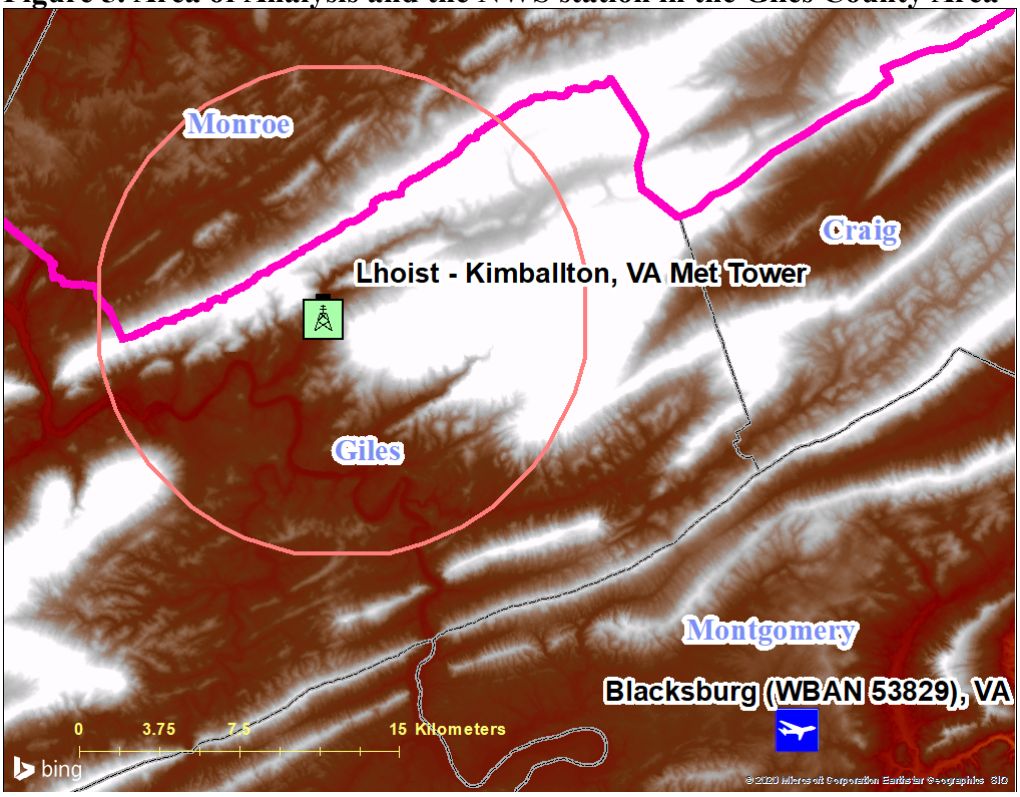


Figure 5, generated by EPA, shows the location of the site-specific 30 m meteorological tower and the upper-air NWS station along with the model domain. Elevation data is also included on the map to allow for the examination of prominent terrain features.

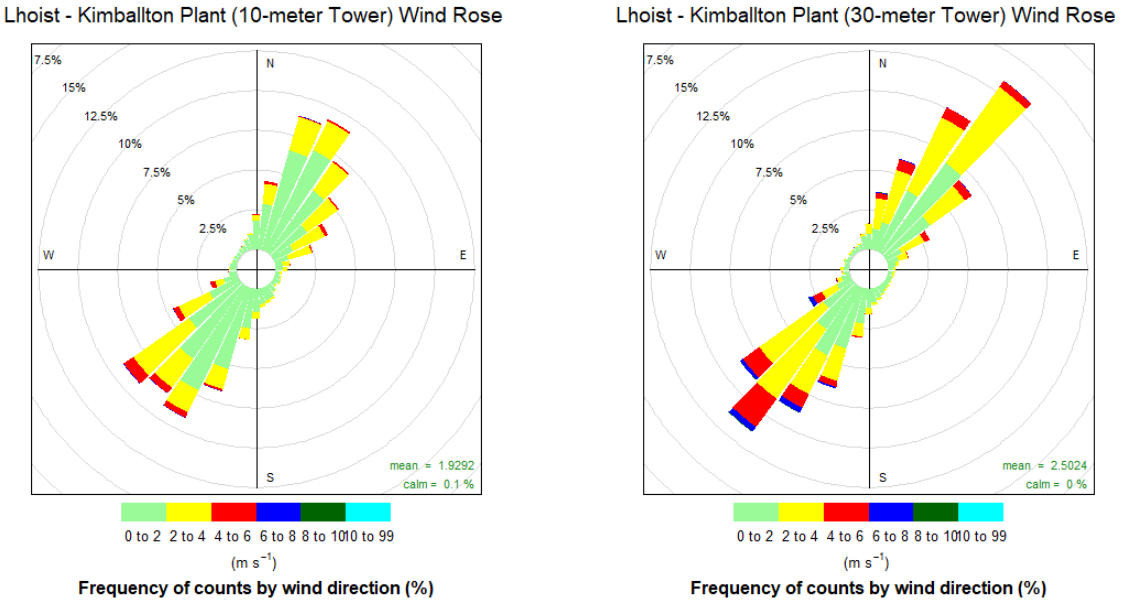
Figure 5. Area of Analysis and the NWS station in the Giles County Area



As part of its recommendation, the Commonwealth provided a simple wind rose showing wind direction and wind speed distributions for its 10 m level at the site-specific meteorological tower. EPA examined the raw collection files and produced additional wind roses for both the 10 m and 30 m tower levels using R[14], an open-source language and environment for statistical computing and graphics.

Figure 6 shows both the 10 m and 30 m wind roses using the one-year of site-specific winds collected between October 1, 2012 and September 30, 2013. Winds are predominantly from the southwest and northeast directions for both levels and may be influenced by diurnal in-valley flow induced by local topography.

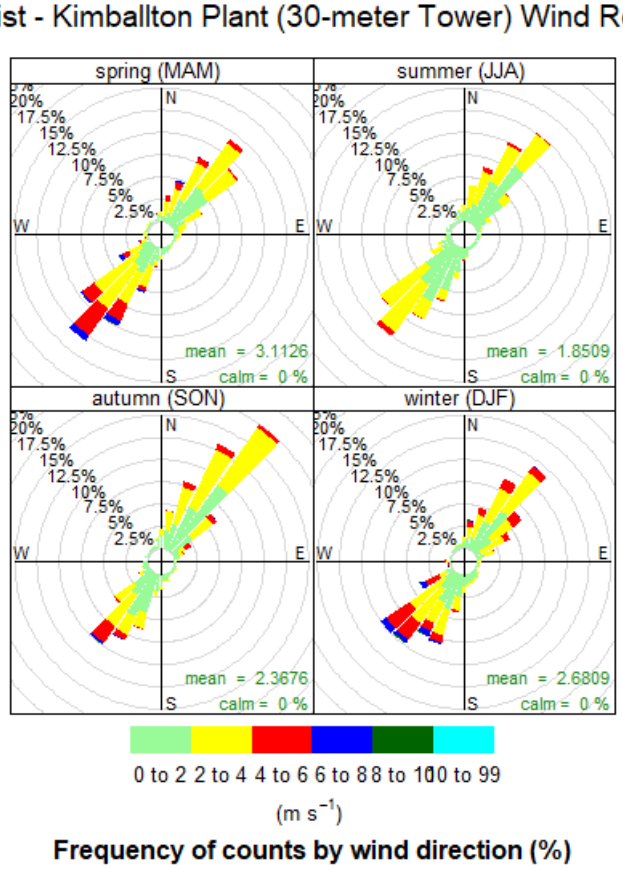
Figure 6. Giles County, Virginia 10 m and 30 m Site-Specific Cumulative Annual Wind Roses



Wind roses for the 30 m tower level are broken down by season in Figure 7; 10 m winds are omitted for simplicity and since the kiln stacks are closer to the 30 m level, therefore, this level is more indicative of winds at stack or plume level. The 30 m winds show the same southwest/northeast predominant wind directions, but wind speeds are generally higher during the spring and winter seasons and lower during the summer and autumn months.

[14] R Core Team (2017). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Figure 7. Giles County, Virginia 30 m Site-Specific Seasonal Wind Roses

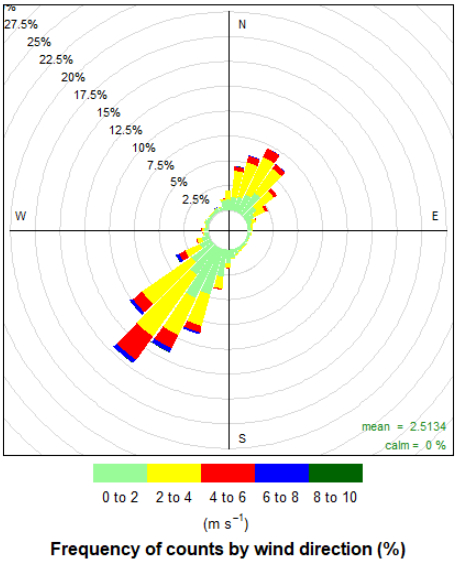


Site-specific solar insolation values were used to divide hours into overnight and daytime categories and then run through R's windRose function.[15] This was done to determine any diurnal wind patterns in the site-specific data. Figure 8 shows wind roses made from the daytime and overnight hours as determined from the site-specific solar insulation values (0 = overnight). The wind roses appear to confirm a diurnal in-valley flow pattern near the Lhoist – Kimballton Plant with daytime winds moving up the valley (from the southwest) and nocturnal drainage setting up during the overnight hours causing winds to flow back down the valley (from the northeast). To further examine this possibility, wind roses were generated based on hour of day. Figure 9 shows the 30 m winds by hour of day. One can see the winds shifting from a predominant northeasterly direction starting around twilight (hour 19) then shifting to the southwest around hour 8 (early morning local time). Southwest winds then remain predominant with higher wind speeds for hours 10-14 (afternoon) then slowly turn back to the northeast by hour 19 (early evening) and continuing in this direction but with generally lower wind speeds until sunrise.

[15] See https://www.rdocumentation.org/packages/openair/versions/0.3-8/topics/windRose

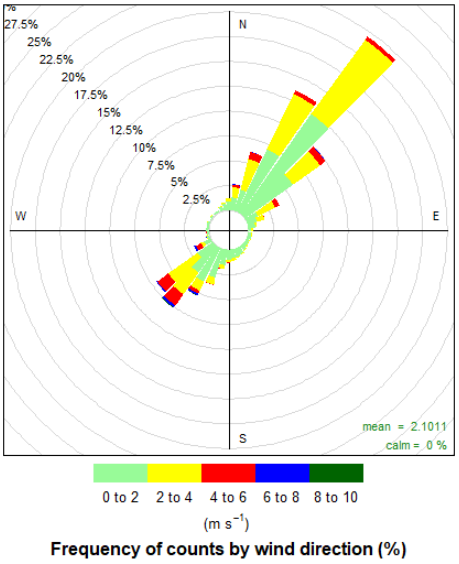
Figure 8. Giles County, Virginia 30 m Site-Specific Daytime and Overnight Wind Roses

Lhoist - Kimballton Plant (30-meter Tower) Daytime Wind Rose



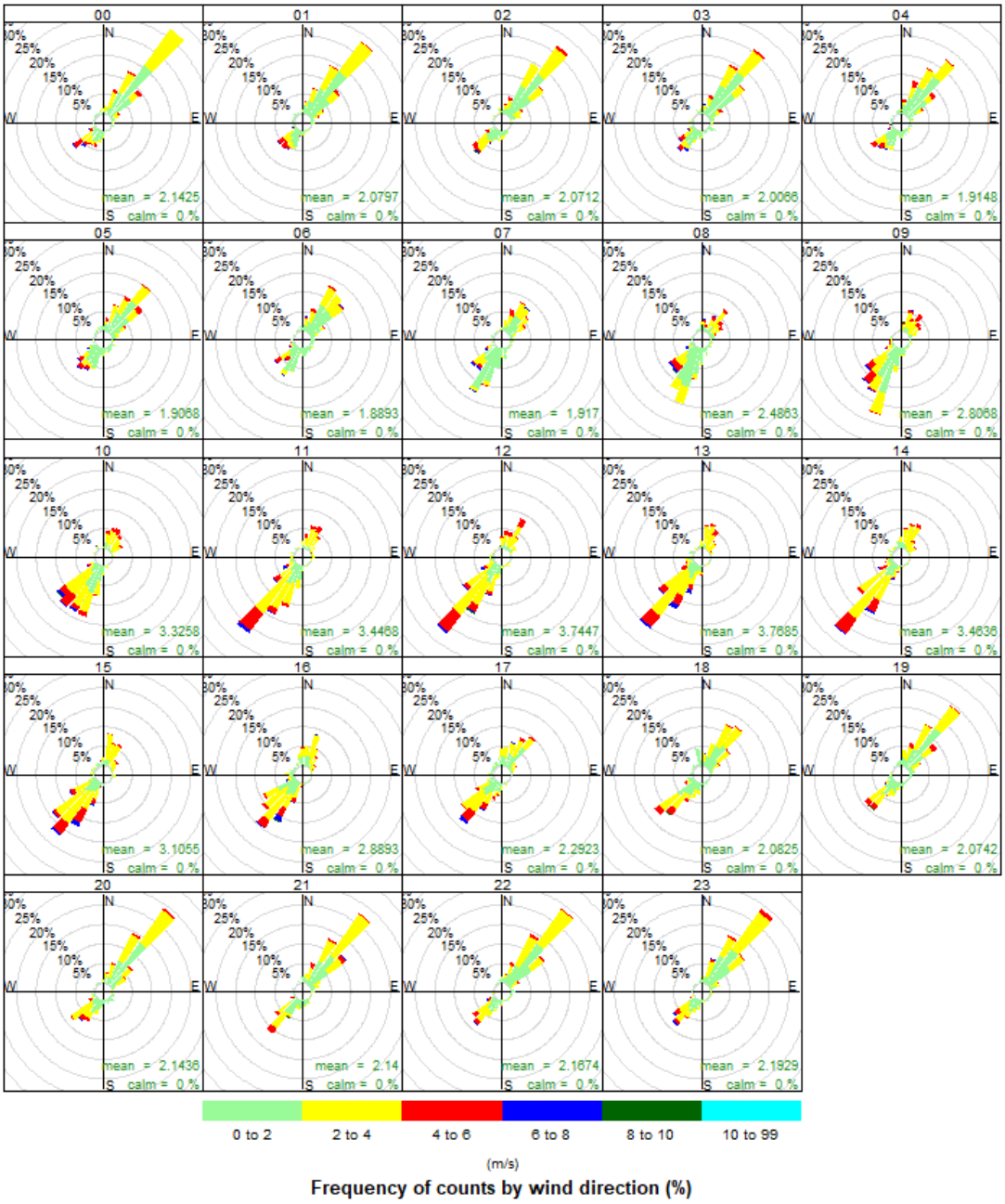
Frequency of counts by wind direction (%)

Lhoist - Kimballton Plant (30-meter Tower) Overnight Wind Rose



Frequency of counts by wind direction (%)

Figure 9. Giles County, Virginia 30-m Wind Roses by Hour of Day



Meteorological data from the site-specific meteorological tower and the upper air NWS station 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 EPA guidance, appropriate Users Guides and EPA's AERMOD Implementation Guide or AIG 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. The use of one year of site-specific meteorological data precluded the need to process meteorological data from a representative National Weather Service meteorological site so no AERMINUTE processing was necessary. As noted previously, additional meteorological data was collected such that the Bulk Richardson approach was utilized in AERMET's Stage 3 input. The Stage 3 output from the AERMET processing (which utilizes the surface characteristics from the 30-m met tower) consists of a surface data file and a vertical profile data file ready for input to AERMOD. The minimal wind speed threshold for the site-specific tower data was set to 0.3 m/s. Turbulence data (sigma-Θ) was collected and used in the modeling analysis and in accordance with EPA guidance, the adjust u* option was not utilized. Virginia followed sections 7.3.2 of EPA's Modeling TAD as far as processing and section 7.4 in regard to utilizing the one-year of site-specific data with respect to the actual modeled emission time frame. Virginia used its 1 year of site-specific meteorological data combined with its maximum hourly emission rate for 2017, 2018 and 2019 (the meteorological data set's month, date and times were kept the same, only the year was changed) to develop its 3 year simulation and subsequent modeled design value. Given the site-specific meteorological data was collected within the last decade, it is still anticipated that it would be acceptable for the modeling analysis used to define the proposed nonattainment area.

EPA has reviewed the site-specific meteorological tower data Virginia has utilized in its boundary recommendation modeling. The data was collected over a one-year period from October 1, 2012 through September 30, 2013 according to appropriate EPA guidance and following an established Quality Assurance Project Plan (QAPP) and record keeping requirements with proper Virginia oversight. Processing steps were taken in accordance with EPA guidance and recommendations and will provide the proper meteorological input to outline the proposed nonattainment area in Giles County, VA.

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

The Lhoist – Kimballton Plant resides in the Ridge and Valley physiographic province of the Appalachian Mountains on the western side of the eastern continental divide. Stoney Creek sits on the western side of the plant forming a valley that is oriented from northeast to southwest. Stoney Creek empties into the New River which flows northwest making it part of the Ohio River drainage system. Plant elevations are approximately 550 meters while terrain bounding Stoney Creek to the northwest rises to 1,100 meters on Peters Mountain along Giles County's border with West Virginia to a little over 1,200 m along Butt Mountain/Lookoff Rock east of the plant.

The terrain in the area of analysis is best described as complex with terrain surrounding the Lhoist – Kimballton Plant's primary kilns exceeding its stack heights. To account for these terrain changes, Virginia used the AERMAP terrain preprocessor for AERMOD to specify terrain elevations for all the receptors. Ground elevation and hill scale heights for each modeled receptor was based on data obtained from the USGS NED (National Elevation Dataset). The NED data has a horizontal resolution of 1/3 arc-second (10-meter intervals). The NED data are distributed by USGS and referenced to NAD83. Source and building elevations input into the

model were based upon a combination of site-specific measurements and interpolation from the United States Geologic Survey's 1/3 arc-second NED.

EPA believes the terrain features near the Lhoist – Kimballton Plant influence local wind patterns based on its analysis of the site-specific meteorological data used in Virginia's designation modeling. Predominant northeast/southwest winds align with the valley in which Stoney Creek and the plant reside. Diurnal flow patterns are evident in the site-specific wind fields with overnight nocturnal drainage (northeast winds) evident during the overnight hours and up-valley flow during the day due to daytime heating of the elevated terrain in the upper regions of the valley. This flow pattern may influence the timing of both modeled concentrations and the nearby SO_2 monitor located northeast of the Lhoist – Kimballton Plant. EPA concludes that Virginia correctly processed the terrain features within its modeling domain and properly determined stack and building base elevations.

3.3.1.8.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 "first tier" approach and selected an SO_2 background concentration of 3 ppb, and that value was incorporated into the final AERMOD results. This concentration is based on the 2016-2018 design value[16] for the most representative ambient air monitor located in Roanoke County, Virginia (EPA ID 51-161-1004).

A review of emission sources by EPA established that the Lhoist – Kimballton Plant is isolated from any other major sources of SO_2. A background monitor should be chosen to reflect a true background concentration that is unaffected by any major SO_2 sources. EPA concludes Virginia's use of 3 ppb reflects a true background concentration that is representative of the area where the Lhoist – Kimballton Plant is located.

3.3.1.9.Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Giles County area of analysis are summarized below in Table 5.

[16] The Roanoke County monitor's 2017-19 design value is 3 ppb, which is identical to the 2016-18 design value. Current design values are available at EPA's *Air Trends* website: https://www.epa.gov/air-trends/air-quality-design-values

Table 5. Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Giles County Area

Input Parameter	Value
AERMOD Version	19191 (default)
Dispersion Characteristics	Rural
Modeled Sources	3
Modeled Stacks	3
Modeled Structures	36
Modeled Fencelines	Assumed Property Boundary is Ambient Air Boundary
Total receptors	16,954
Emissions Type	Estimated maximum 24-hr emission rates based on actual production data for each kiln for each year modeled
Emissions Years	2017-19
Meteorology Years	One Year, Site-Specific (October 1, 2012 to September 30, 2013), data repeated over 3-year simulation
NWS Station for Surface Meteorology	None
NWS Station Upper Air Meteorology	Blacksburg (WBAN 53829)
NWS Station for Calculating Surface Characteristics	On-Site Met Tower
Methodology for Calculating Background SO_2 Concentration	Roanoke County, Virginia (EPA ID 51-161-1004) 2016-18 Design Value
Calculated Background SO_2 Concentration	3 ppb

All three kiln stacks are under 65 meters. Building downwash was included for structures near the kiln stacks using EPA's Building Profile Input Program (BPIPPRM).

Virginia characterized the kiln emissions in its modeling analysis using the maximum hourly emission rate for each of Lhoist – Kimballton Plant's three kilns for 2017, 2018 and 2019. AERMOD simulations were completed for each year using each kiln's maximum hourly emission rate for the respective year, which was based on production data and emission factors derived from a December 2017 stack test. Model results for each year were then combined and averaged for each receptor to produce a modeled design value (the maximum of the 3 year average of each receptor's 99th percentile value of the maximum daily 1-hour modeled concentrations). Because this approach uses the maximum hourly emissions value for the year, rather than varying hourly emissions data, it overestimates SO_2 modeling concentration results. Virginia provided a 2018 emissions statement and document certification in support of its modeled emission rates. EPA used R[17], an open-source language and environment for statistical computing and graphics, to combine the yearly model results and confirm the summary model result spreadsheet provided by Virginia.

The results presented below in Table 6 and Figure 10 show the geographic extent of the predicted modeled violations based on the input parameters.

Table 6. Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentration Averaged Over Three Years for the Area of Analysis for the Giles County Area around the Lhoist – Kimballton Plant

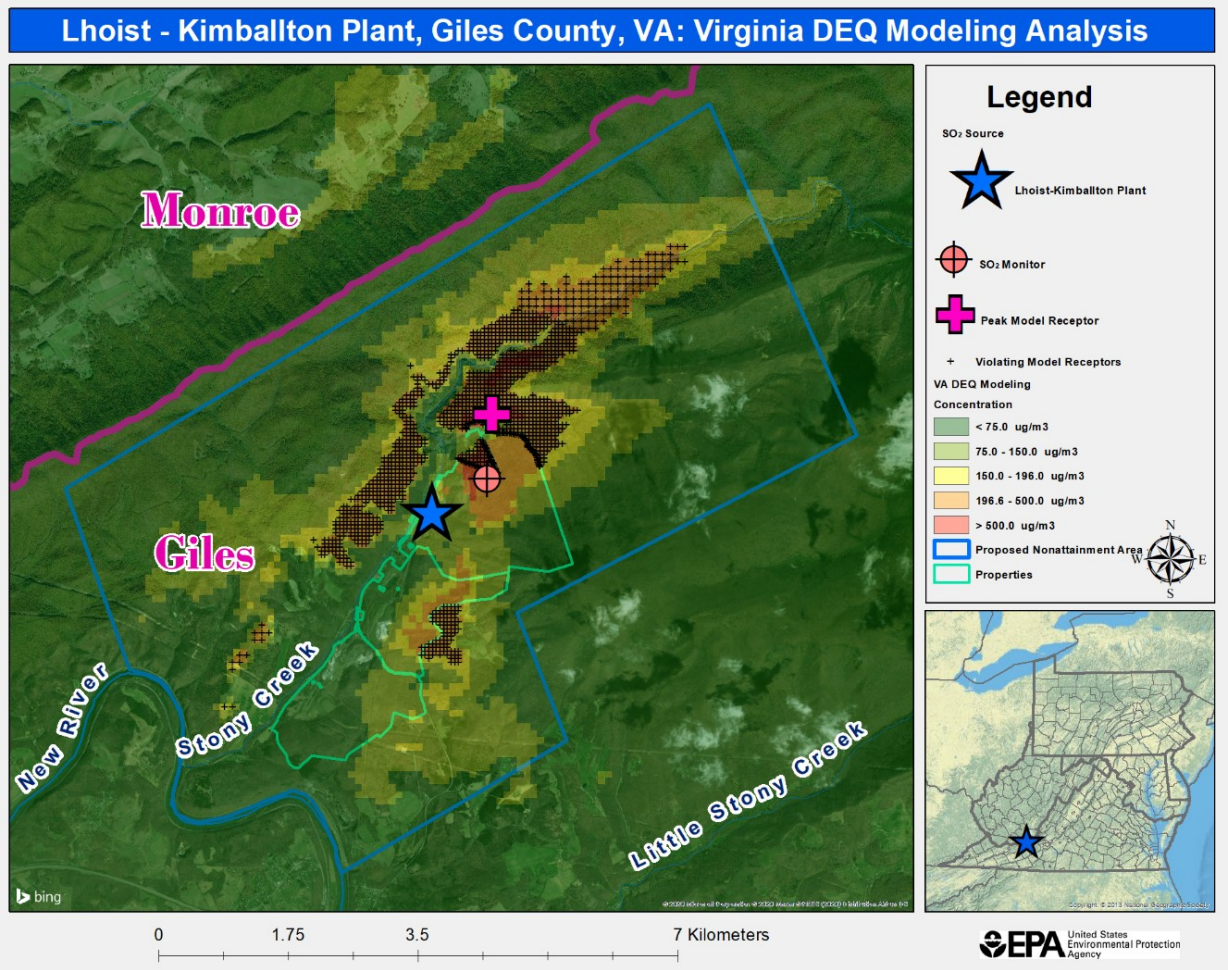
Averaging Period	Data Period	Receptor Location UTM Zone 17		99th percentile daily maximum 1-hour SO_2 Concentration (µg/m^3)	
		UTM Easting	UTM Northing	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2017-19	530,700	4,138,650	935.76205	196.4*

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

Figure 10 was generated by EPA and indicates that the predicted modeled violations are fully contained within the Commonwealth's recommended nonattainment area boundary. Model results from the Commonwealth's receptor grid are also shown in the figure along with the locations of all violating model receptors.

[17] R Core Team (2017). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Figure 10. Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Giles County Area



The modeling submitted by Virginia indicates that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration. The modeling results also include the area in which a NAAQS violation was modeled, information that is relevant to the selection of the boundaries of the area that will be designated. A proposed nonattainment area was developed to encircle all violating model receptors in the portion of Giles County, Virginia surrounding the Lhoist – Kimballton Plant.

Virginia also provided additional analysis indicating that violating model receptors are confined to a range of elevations within 50 meters of approximately 685 meter contour. This information was used in setting the nonattainment area boundary.

Virginia compared its monitored 99th percentile daily maximum concentrations in 2018 and 2019 to its modeled 2018 99th percentile daily maximum concentrations, and showed model concentrations were twice as high as the monitor concentrations. This is expected and consistent with the conservative manner in which the emission rates were determined. As described in section 3.4 addressing emissions information, a fuel switch was made in 2017 and Virginia believes, and EPA concurs, that a model-monitor comparison for that year would not be

representative of current plant operations. Model peaks appear to mimic the monitor in that model and monitor concentration peaks have a tendency to occur during the overnight and early morning hours and under light wind conditions. This appears to indicate the modeling which produced higher concentrations than the monitor data is conservative but also properly captures the impacts from the Lhoist – Kimballton Plant.

3.3.1.10. EPA's Assessment of the Modeling Information Provided by Virginia
EPA reviewed the modeling, emissions and monitoring data provided by Virginia in support of its nonattainment designation for portions of Giles County surrounding the Lhoist – Kimballton Plant. The proposed nonattainment area encompasses all violating model receptors.

EPA believes the modeling analysis developed for the Lhoist – Kimballton Plant captures atmospheric conditions contributing to nonattainment at its monitor and supports its proposed nonattainment area.

3.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Giles County, Virginia Area

These factors have been incorporated into the air quality modeling efforts and results discussed above. 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.

Virginia used the geography and topography of the surrounding area as critical factors in the development of the nonattainment area boundary. Specifically, the boundary is delineated by using the modeling results in combination with nearby geographic and topographic features where appropriate.

All of the modeled violations occur at elevations between 2,000 ft and 2,800 ft, which provide a useful topographical reference for establishing the boundary. Virginia proposes to use the 3,000 ft contour as the general guide for the extent of the nonattainment area, providing an adequate buffer which extends beyond all violating receptors. The proposed northernmost boundary tracks the 3,000 ft contour line just inside the Virginia/West Virginia border. On the eastern and southern boundary, the proposed border does include some areas over 3,000 ft, such as White Rock Mountain, but removes parts of Butt Mountain because elevations there range from 3,000 ft to 4,200 ft. In the southwest corner of the proposed nonattainment area, the boundary generally aligns with the 1,600 ft contour that aligns with the New River, a recognized geographic boundary. Coordinates 5 through 42 in Table 7 correspond to the portion of the New River from approximately mile marker 145.8 to mile marker 149.

Data collected at the DRR monitor indicates that a fuel switch made at the Lhoist facility has reduced ambient concentrations of SO_2 since 2017, however, the monitor is still measuring concentrations above the standard. The facility replaced its coke fuel (5.6% sulfur content) with a lower sulfur coal (0.6%) in September 2017. Specifically, the monitoring data from 2017 reflects the use of a fuel mix of coke and coal and led to 74 individual days where the numeric value of the NAAQS was exceeded. The facility changed the fuel mix to 100% coal in September of 2017, which led to three exceedance days in 2018 and four exceedance days in 2019. Evaluating

the data from 2017, the bulk of the exceedances occurred in the morning around dawn. Evaluating the meteorology associated with these exceedances, generally the wind speed is very near zero in all cases and the wind direction is primarily from due north with some instances of wind from the south to south-southwest. The exceedances from 2018 and 2019 generally occur in the same timeframe as the bulk of the exceedances from 2017. While the fuel switch has addressed the bulk of the issues associated with the 2017 operation of the facility, in 2019 the 99th percentile daily maximum one-hour concentration exceeded the numeric value of the NAAQS. Also, this fuel switch is not federally enforceable. In any case, both the monitoring and the modeling evidence indicate that violations are currently occurring within the nonattainment area recommended by Virginia.

3.5. Jurisdictional Boundaries in the Giles County, Virginia Area

EPA considers existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary for carrying out the air quality planning and enforcement functions for the area. Our goal is to base designations on clearly defined legal boundaries that align with existing administrative boundaries when reasonable. Existing jurisdictional boundaries used to define a nonattainment area must encompass the area that has been identified as meeting the nonattainment definition.

In Virginia's April 24, 2020, letter, they recommended that the area bounded by lines connecting the 43 latitude and longitude coordinates in a clockwise manner listed in Table 7 be designated nonattainment. As described above, Virginia provided other factors such as modeling, geography and topography in lieu of jurisdictional boundaries because they believe these factors more accurately define the area of potential air quality violations. The New River acts as the jurisdictional boundary for a western portion of Virginia's recommended nonattainment area (Figure 14). A total of 36 of the 43 coordinates accounts for the S-curve in the river boundary. Straight lines connecting the remaining coordinates form the other portions of the recommended nonattainment boundary to the north, south, east, and west of the Lhoist facility.

Table 7. Virginia's Recommended Nonattainment Boundary Coordinates (decimal degrees)

Boundary Point	Latitude*	Longitude*
0	37.385249	-80.718248
1	37.431656	-80.619986
2	37.391368	-80.597698
3	37.369986	-80.649488
4	37.354441	-80.642085
5	37.338479	-80.676322
6	37.339474	-80.676771
7	37.340652	-80.677123
8	37.341580	-80.677298
9	37.343330	-80.678318
10	37.344937	-80.679026
11	37.345866	-80.679692
12	37.347105	-80.680670
13	37.347976	-80.681783
14	37.348229	-80.682898
15	37.348480	-80.683657
16	37.348185	-80.684689
17	37.347824	-80.685948
18	37.347241	-80.687983
19	37.346509	-80.689766
20	37.346075	-80.691489
21	37.345317	-80.693571
22	37.345091	-80.694767
23	37.344900	-80.696603
24	37.344679	-80.697755
25	37.344700	-80.698520
26	37.344989	-80.699570
27	37.345395	-80.700635
28	37.345740	-80.701485
29	37.347021	-80.701929
30	37.348308	-80.701922
31	37.349556	-80.701498
32	37.350789	-80.701099
33	37.352718	-80.700642
34	37.354894	-80.700352
35	37.356601	-80.700486
36	37.358442	-80.700844
37	37.359567	-80.701852
38	37.361185	-80.702914
39	37.361950	-80.703726
40	37.362516	-80.705580
41	37.362901	-80.707040
42	37.363285	-80.708539

*Geographic Coordinate System: GCS_North_American_1983; Datum: D_North_American_1983

3.6. Other Information Relevant to the Designation of the Giles County, Virginia Area

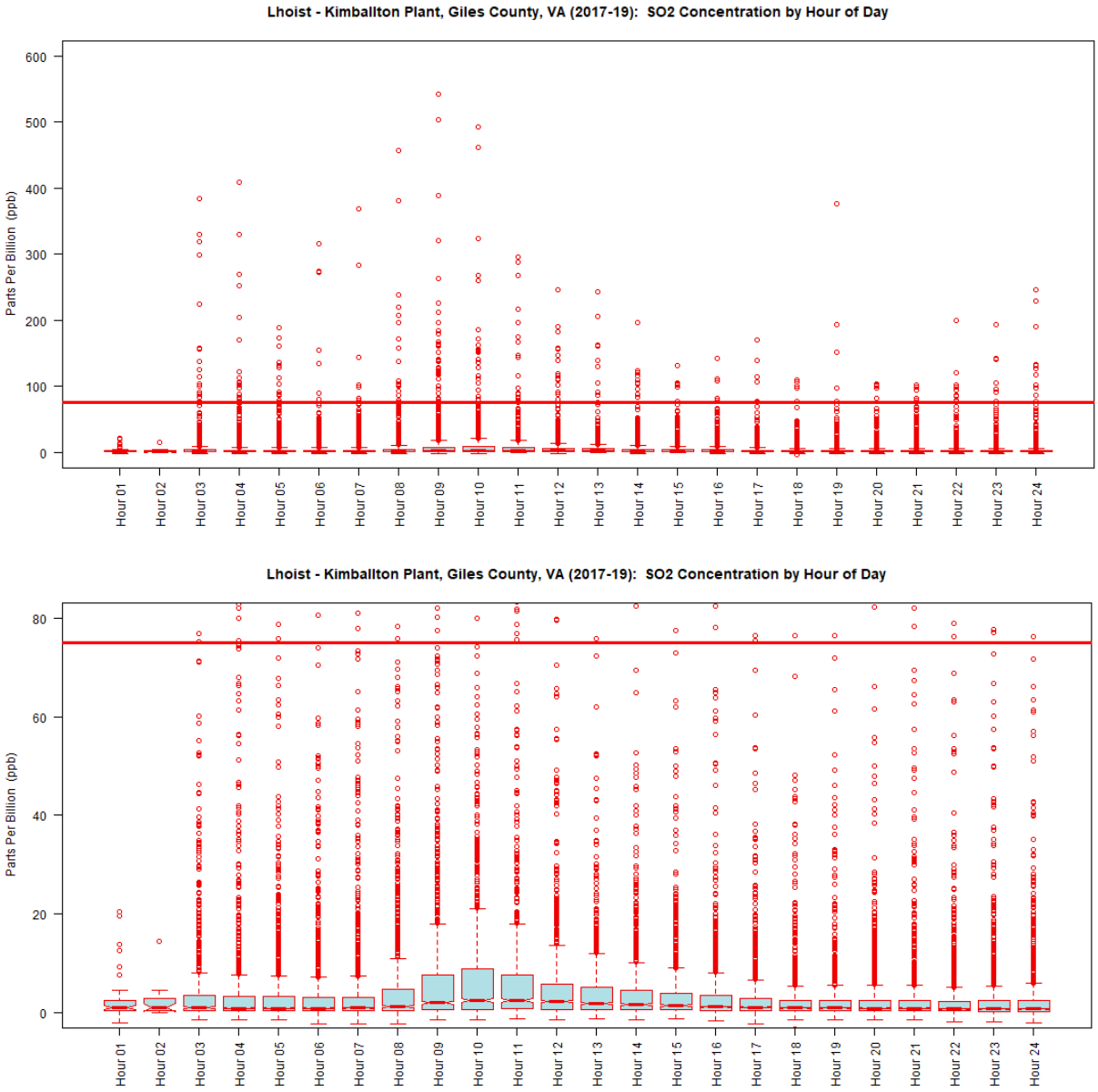
EPA did not receive additional information relevant to the designation of this area.

To better understand the modeling analysis, EPA conducted additional analysis of the SO_2 monitor data to ascertain any monitor tendencies that could be compared to the modeling analysis submitted in support of the nonattainment area designation.

Figure 11 shows a box plot of monitor concentration by hour of day for 2017-19. The 1-hour SO_2 NAAQS level (75 ppb) is also included on the figure. An additional figure is also included to show results for all values below 80 ppb to provide additional detail. Box plots are designed as follows, the red line within the "notch" is the sample median, the 2nd and 3rd sample quartiles are marked by the box portions on either side of the median marker (the area represents samples between the 25% and 75% quartiles), the line to the "whisker" mark represents the samples outside the 25% and 75% quartiles but within several standard deviations of the entire (monitor) sample. Dots mark the extreme outliers in the sample; generally speaking, these are the monitor exceedance events.

Monitor exceedances can occur at any hour of the day but appear to be clustered in the hours between midnight and the early morning hours just shortly after dawn. It also should be apparent from the monitoring data that concentrations are well under the 1-hour SO_2 NAAQS for the vast majority of hours, with most hours less than 10 ppb. There appears to be a slight uptick in monitor concentrations during hours 9 through 11 in addition to higher SO_2 concentrations in the monitor outliers for these hours.

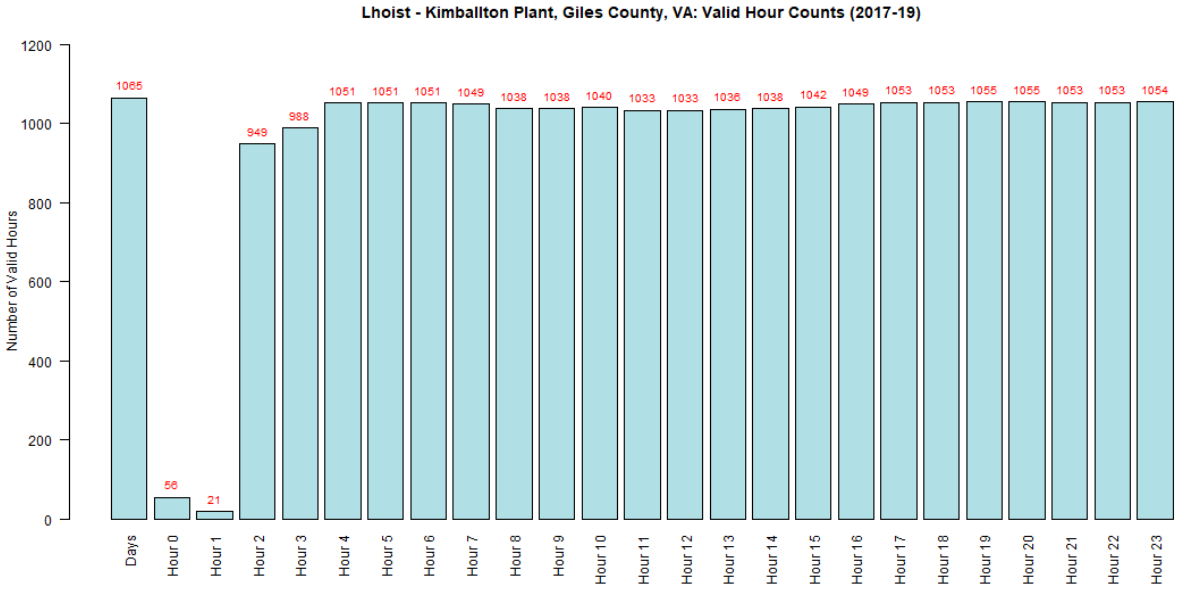
Figure 11. R Generated Box Plot of SO_2 1-Hour Monitor Values by Hour of Day (2017-19)



EPA noticed there was a lack of exceedances during hours 1 and 2. Figure 12 shows the count of valid monitor values by hour of day. Both hours 1 and 2 have significantly fewer valid hours than the other hours of the day. Based on the missing data qualifier code in the Air Quality System (AQS)[18], this is due to instrument calibration and span checks being scheduled during these hours, which are not considered valid sampling hours.

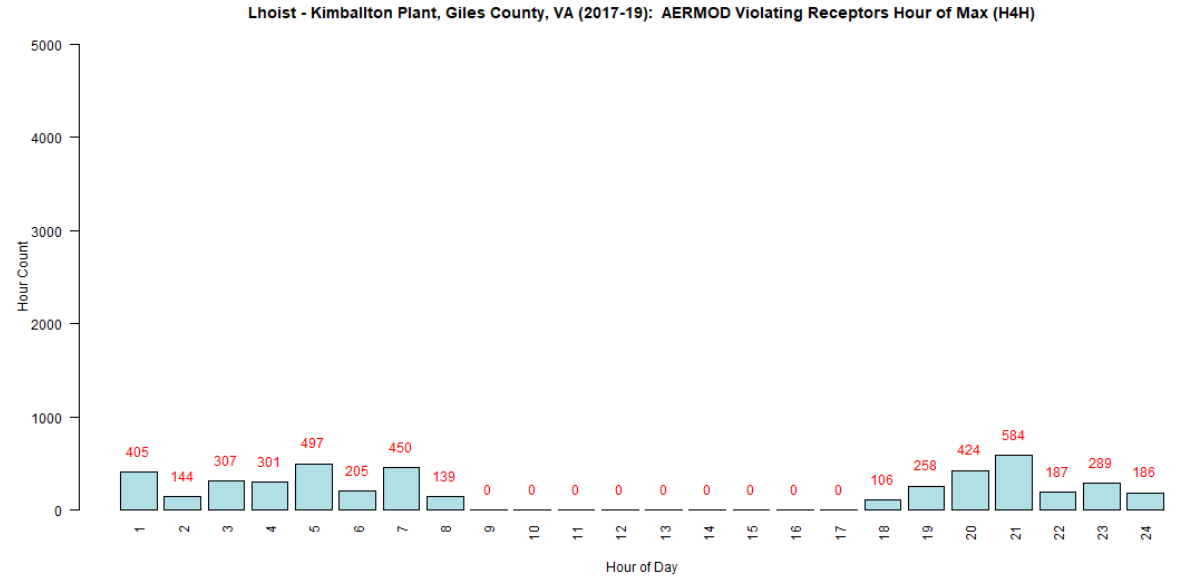
[18] https://www.epa.gov/aqs

Figure 12. SO_2 Monitor Valid Hour Count by Hour of Day



EPA examined the violating model receptors to determine if Virginia's modeling analysis mimicked the patterns observed in the monitoring data. Figure 13 shows the hour of the modeled 99th percentile values over the model simulation period (only for violating model receptors). Similar to the monitoring data, modeled 99th percentile values tend to occur during the overnight hours with no instances appearing to have occurred during daytime hours of the simulation; note that no hours of 99th percentile daily maximum hourly concentrations occurred during model hours 9 through 11 when monitor concentrations are generally the highest.

Figure 13. Hour of Modeled 99th Percentile Daily Maximum Concentrations for Violating Model Receptors



3.7. EPA's Assessment of the Available Information for the Giles County, Virginia Area

A monitor in the Giles County area is violating the NAAQS based on the 2017-2019 design value. Virginia submitted air dispersion modeling to demonstrate the extent of the NAAQS violations and to establish a nonattainment boundary.

Virginia submitted a recommended nonattainment area boundary which consists of 43 latitude and longitude boundary points. These points were selected to enclose the area where the modeled violations occurred plus a proper buffer area which considered the topography and geography of the area. There are no other major sources of SO_2 emissions in Giles County.

EPA has reviewed the emissions data, modeling analysis, the site-specific meteorological data and the monitoring data and believes Virginia's analysis, while possibly conservative due to emission assumptions, correctly captures the atmospheric conditions contributing to the nonattainment monitor and supports their recommended nonattainment area for a portion of Giles County surrounding the Lhoist – Kimballton Plant.[19]

EPA believes that our intended nonattainment area, bounded by the latitude and longitude points listed in Table 7, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended nonattainment area.

EPA believes that the information provided by Virginia supports the designation of attainment/unclassifiable for the remaining portion of Giles County. Prior to 2018, there were two other sources of SO_2 emissions in the remaining portion of Giles County. However, the two facilities, American Electric Power (AEP) Glen Lyn (Reg # 20460) and Celanese Acetate (Reg # 20304) retired their coal fired boilers and signed mutual determinations of shutdown on January 26, 2016, and March 15, 2018, respectively. Emissions from these sources in 2017 and 2018 are very close to zero.

3.8. Summary of EPA's Intended Designation for the Giles County, Virginia Area

After careful evaluation of the Commonwealth's recommendation and supporting information, as well as all available relevant information, EPA intends to designate a portion of Giles County, Virginia as nonattainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of the coordinates listed in Table 7. Figure 14 shows the boundary of this intended designated area. The nonattainment area, based on GIS calculations, encompasses approximately 54 km^2.

Additionally, EPA intends to designate the remainder of Giles County, Virginia as attainment/unclassifiable. Figure 15 shows the boundary of this intended designated area.

[19] EPA's reliance on the modeling for the Giles County area to inform our intended nonattainment boundary for 2010 SO_2 NAAQS designations does not imply that the modeling is appropriate for other purposes, such as NSR, interstate transport, or SIP demonstrations.

Figure 14. Boundary of the Intended Giles County Nonattainment Area

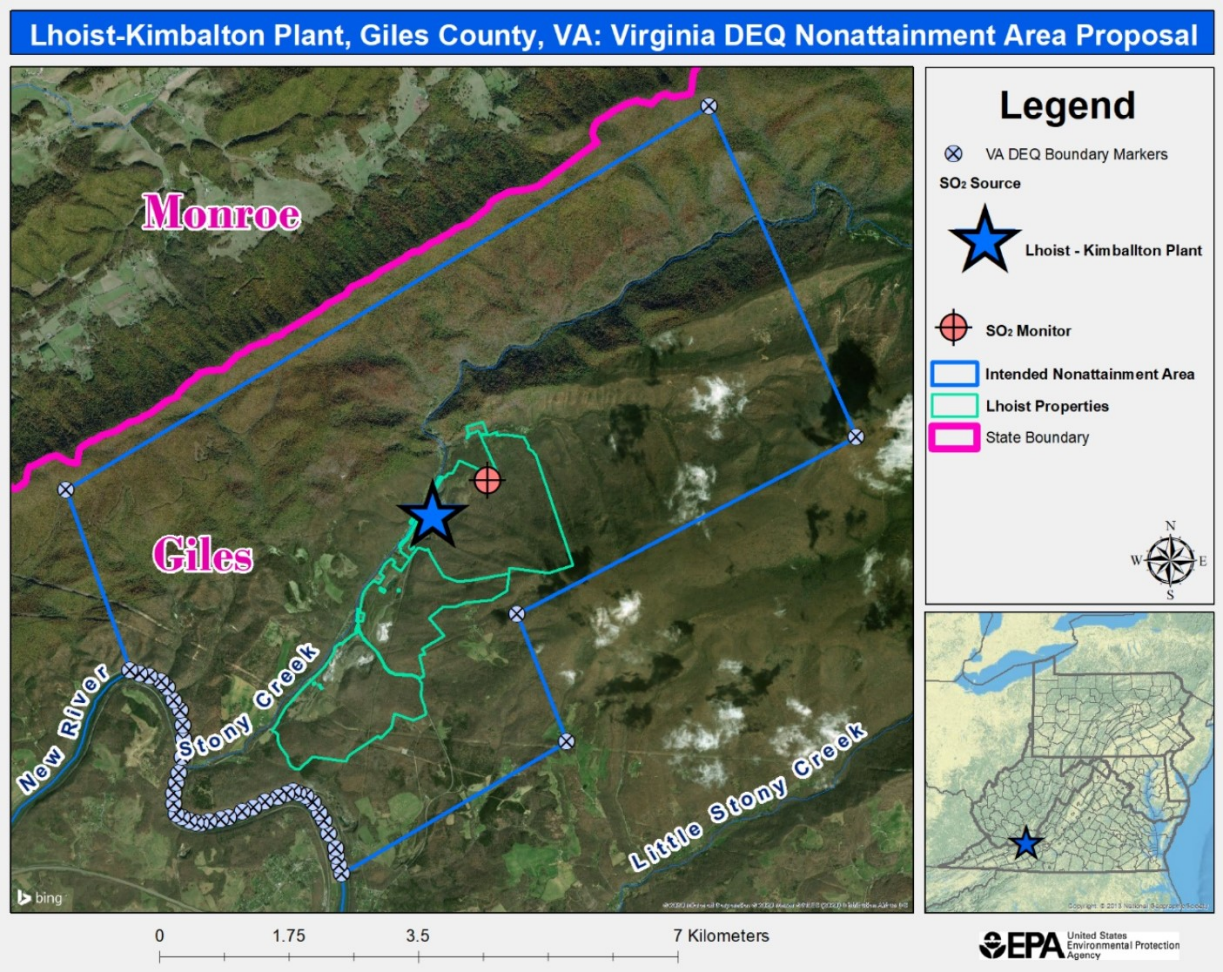


Figure 15. Boundary of the Giles County Intended Nonattainment Area and Intended Attainment/Unclassifiable Area