Technical Support Document:

Chapter 35
Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for Pennsylvania

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 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 the 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 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.

[1] The term "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 Pennsylvania (Pennsylvania)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 installed and 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.

Pennsylvania submitted its first recommendation regarding designations for the 2010 1-hour SO_2 NAAQS on June 23, 2011. The Commonwealth recommended nonattainment for Allegheny, Beaver, Indiana and Warren counties and unclassifiable for the rest of the Commonwealth. Pennsylvania submitted. updated recommendations on April 8, 2013 and recommended that only a portion of Allegheny, Beaver and Warren counties be designated as nonattainment. In response, EPA designated four areas as nonattainment in Round 1; portions of Allegheny, Beaver, Armstrong, Warren and the entirety of Indiana county. Subsequently, Pennsylvania submitted several modeling analyses for areas within the state but did not update their designation recommendations. 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. In any such case, we have considered the recommendation in the later submission.

For the areas in Pennsylvania that are part of the Round 3 designations process, Table 1 identifies the EPA's intended designations and the counties or portions of counties to which they would apply. It also lists Pennsylvania'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, and could change based on changes to this information (or the availability of new information) that alters EPA's assessment and characterization of air quality.

[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).

Table 1. Summary of the EPA's Intended Designations and the Designation Recommendations by Pennsylvania

Area/County	Pennsylvania's Recommended Area Definition	Pennsylvania's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Cheswick Area/ Allegheny County (p)	Allegheny County (p)	Nonattainment	Remaining Undesignated Portion of County Remainder of County	Unclassifiable
Cambria County	Cambria County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable
Carbon County	Carbon County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable
Clearfield County	Clearfield County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable
Delaware County	Delaware County	Unclassifiable	Different than Commonwealth's Recommendation	Unclassifiable/ Attainment
Lawrence County	Lawrence County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable
Lehigh County	Lehigh County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable
Montour County	Montour County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Northampton County	Northampton County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable

Area/County	Pennsylvania's Recommended Area Definition	Pennsylvania's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Philadelphia County	Philadelphia	Unclassifiable	Different than Commonwealth's Recommendation	Unclassifiable/ attainment
Schuylkill County	Schuylkill County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable
Remaining Undesignated Areas to Be Designated in this Action*	Rest of state	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment

* Except for areas that are associated with sources for which Pennsylvania elected to install and began timely operation of a new, approved SO_2 monitoring network meeting EPA specifications referenced in the EPA's SO_2 DRR (*see* Table 2), the EPA intends to designate the remaining undesignated counties (or portions of counties) in Pennsylvania as "unclassifiable/attainment" as these areas were not required to be characterized by the state under the DRR 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 section11 of this TSD.

The area that Pennsylvania elected to install and began timely operation of a new, approved SO_2 monitoring network is 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 That the EPA Is Not Addressing in this Round of Designations (and Associated Sources)

Area	Source(s)
York County	Magnesita Refractories, PH Glatfelter Co, Talen Energy Brunner Island Power Plant

Areas that the EPA previously designated unclassifiable 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.

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.[4] Readers of this TSD should also refer to the additional general information on the EPA's Round 3 area designations relevant to Pennsylvania and all other states at issue in these intended designations.

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" SO_2 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 22 sources in Pennsylvania meeting DRR emissions criteria that states have chosen to be characterized using air dispersion modeling, the areas associated with 1 source in Pennsylvania for which air agencies imposed emissions limitations on sources to restrict their SO_2 emissions to less than 2,000 tpy, sources that met the DRR requirements by demonstrating shut down of the source (1 of which are in Pennsylvania), 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 county or group of counties for which modeling information is available. The remaining to-be-designated counties are then addressed together in section 11.

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.

[2] https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf. 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 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, 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, 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 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 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 SO2 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 Delaware County-Philadelphia County Area of Analysis

3.1. Introduction

The EPA must designate the Delaware County and Philadelphia County, Pennsylvania, area by December 31, 2017, because the area has not been previously designated and Pennsylvania 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 the Delaware County-Philadelphia County Area. Pursuant to the DRR (*see* 40 CFR part 51, subpart BB), states had the option to characterize large sources of SO_2 by either monitoring, modeling or capping emissions below 2000 tons of SO_2 per year. Although there are existing SO_2 monitors in Delaware County and Philadelphia County, Pennsylvania elected to conduct modeling for a cluster of emissions sources in Delaware and Philadelphia Counties that were subject to the DRR.

3.2. Air Quality Monitoring Data for the Delaware County-Philadelphia County Area

This factor considers the SO_2 air quality monitoring data in the area of Delaware County-Philadelphia County. Although the state did not provide specific monitoring data, EPA reviewed available monitoring data in Delaware County and Philadelphia County. An asterisk (*) indicates that the value is an incomplete or invalid design value.

Table 3. Air Quality Monitoring Data for the Delaware County-Philadelphia County Area of Analysis

County	AQS Monitor ID	Latitude	Longitude	2011-2013 Design Value	2012-2014 Design Value	2013-2015 Design Value	2014-2016 Design Value
Delaware	42-045-0002	39.835556	-75.3725	14	13*	11*	9*
Philadelphia	42-101-0048	39.991389	-75.080833	15*	12*	11*	13*
Philadelphia	42-101-0055	39.922867	-75.186921	13	11	10	9
Philadelphia	42-101-0004	40.008889	-75.09778	9	9*	9*	11*

- Air Quality System monitor 42-101-0055 is located in Philadelphia County at the Philadelphia Energy Solutions Refinery. 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 2014-2016 DV being 9 ppb.

- Air Quality System monitor 42-045-0002 is located in Delaware County near the Monroe Energy Trainer Refinery. Data collected at this monitor is incomplete for the 1st and 4th

quarters of 2014, therefore, the design values including 2014 are incomplete despite being well below the 75 ppb standard.

- Air Quality System monitor 42-101-0048 is located in Philadelphia County near the Philadelphia Energy Solutions Refinery. This monitor began operation during the 1st quarter of 2013. Data collected at this monitor is incomplete due to invalid data for 1 quarter in 2014 and 1 quarter in 2015.

The EPA has reviewed all available monitoring data for the Delaware County-Philadelphia County area of analysis. However, EPA does not have information indicating this data is in an area of maximum concentration, so this data cannot be used as the basis for designation. There are no other air quality monitors located within Delaware County or Philadelphia County or the surrounding counties/cities which meet the completeness criteria. 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 Delaware County-Philadelphia County Area Addressing Several Sources

3.3.1. Introduction

The Pennsylvania Department of Environmental Protection (PA DEP) identified a cluster of emissions sources in Delaware and Philadelphia Counties that were subject to the DRR for the 2010 1-hour SO_2 primary NAAQS. This was outlined in a January 15, 2016 letter submitted to the EPA. The Commonwealth of Pennsylvania was required to submit a plan to the EPA with regards to the path forward for addressing the DRR-listed sources. The four (4) sources identified within Delaware and Philadelphia Counties were analyzed using a dispersion model to satisfy SO_2 DRR requirements. The analyses performed were consistent with the modeling protocol provided to PA DEP on July 12, 2016.

This section 3.3 presents all the available air quality modeling information for Delaware and Philadelphia Counties that include Kimberly Clark, Covanta Delaware Valley, Exelon Generating Company – Eddystone, and Philadelphia Energy Solutions. (Delaware and Philadelphia Counties will often be referred to as "the Delaware Co.-Philadelphia Co. area" within this analysis in section 3.3). This area contains the following SO_2 sources around which Pennsylvania 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 Kimberly Clark facility does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 1,069 tons of SO_2 according the 2014 NEI.
- The Covanta Delaware Valley facility does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 316 tons of SO_2 according the 2014 NEI.

- The Exelon Generating Company – Eddystone (Exelon – Eddystone) facility does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 155 tons of SO_2 according the 2014 NEI.
- The Philadelphia Energy Solutions facility does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 355 tons of SO_2 according 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.

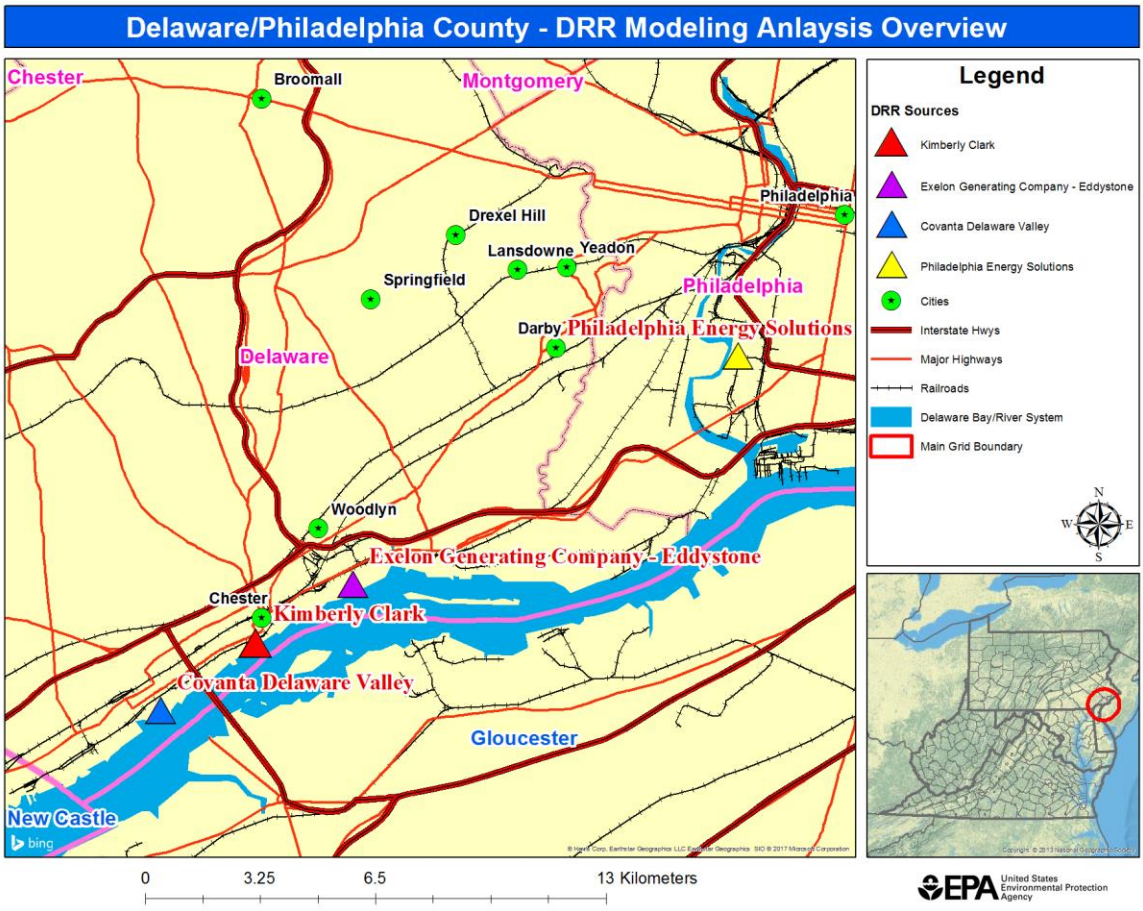
In Pennsylvania's original recommendation on June 23, 2011, Pennsylvania recommended that the area surrounding the cluster of facilities, specifically the entirety of Delaware and Philadelphia Counties, be designated as unclassifiable. On April 4, 2017, Pennsylvania submitted a modeling analysis for the cluster of sources in Delaware and Philadelphia Counties but did not update their recommendation. This assessment and characterization of air quality impacts was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the Commonwealth's assessment, supporting documentation, and all available data, the EPA intends to modify the Pennsylvania's recommendation for the area, and designate the area as unclassifiable/attainment. Our reasoning for this conclusion is explained below.

The area that the state has assessed via air quality modeling is located in portions of Delaware and Philadelphia counties that lie imbedded in a highly residential/industrial area along the Delaware River and Interstate Highway I-95.

As seen in Figure 3.1 below, the four (4) facilities included in the DRR modeling analysis are located along the Delaware River. Three (3) of the sources are located between the river and Interstate I-95 near the City of Chester, PA. From south to north they are, Covanta Delaware Valley, a resource-recovery facility, Kimberly Clark, a paper mill, Exelon– Eddystone, an oil and gas fired power plant, and further north in Philadelphia County, Philadelphia Energy Solutions, an oil refinery complex.

The EPA's intended designation boundary for the Delaware Co.-Philadelphia Co. area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

Figure 3.1. Map of the Delaware Co.-Philadelphia Co., PA Area Addressing Several Sources



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, which was submitted by Pennsylvania.

3.3.2. Modeling Analysis Provided by the State

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

- 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

Pennsylvania used AERMOD version 15181 in regulatory default mode, which was the current version at the time of modeling. On January 17, 2017, the EPA published its revision to Appendix W – Guideline to Air Quality Models.[5] Since the publication of Appendix W, AERMOD version 16216r has since become the regulatory model version. There were no updates from 15181 to 16216r that would significantly affect the concentrations predicted here. A discussion of the Commonwealth'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 state determined that it was most appropriate to run the model in urban model. Land cover within 3 km of each source included in the source cluster was analyzed using the 1992 NLCD dataset, as well as the population density around each facility. This is critical since the selection of urban or rural in AERMOD determines the set of dispersion coefficients to apply to each stack plume as noted in Section 7.2.3 of the Guideline. The land use analysis is to be performed considering the area in close proximity to each source rather than areas at more distant receptors, regardless of change in rural/urban classification. This is important to note since an improper selection would impact the plume coming out the stack such that the model would not properly characterize the plume by the time it reaches the farther distances. In the land cover data category, only NLCD 1992 land cover codes 22 and 23 are classified as "urban." This finding confirms the use of the urban option in AERMOD for, at a minimum, Philadelphia Energy Solutions.

However, as noted in the modeling TAD (and AERMOD Implementation Guide), caution is necessary when classifying an area as urban or rural. An area "*may be in an urban area but located close enough to a body of water or other non-urban land use category to result in an erroneous rural classification for the source*." This is true of the setting for the cluster as the Delaware River skews the percent urban determine from AERSURFACE for Kimberly Clark, Covanta Delaware Valley and Exelon– Eddystone. As such, the population density of the area was investigated to further solidify the urban option choice. To do this, the average population density was calculated, per square kilometer, in a 3 km radius surrounding each facility. The

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

population density of each of these facilities was greater than 750, which supports an urban classification under Appendix W section 7.2.3 (d).

Each of the four (4) modeled sources was assigned a different population using the URBANOPT command line in AERMOD. In urban areas, AERMOD accounts for the dispersive nature of the "convective-like" boundary layer that forms during nighttime conditions by enhancing the turbulence over that which is expected in the adjacent rural, stable boundary layer. This enhanced turbulence is a function of population. The modeling analysis accounts for this using total populations within 3 km of each of the modeled sources using GIS software. Population numbers were highest for Philadelphia Energy Solutions followed by Kimberly Clark, Exelon– Eddystone and finally Covanta Delaware Valley. A default value of 1.0 meter was used for the urban roughness length for each source.

EPA reviewed the analysis and agrees with assigning the "urban" classification to all four (4) sources included in the modeling analysis.

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 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 Delaware Co.-Philadelphia Co. area, the state has included a total of four (4) emitters of SO_2 in southeastern Delaware County and southern Philadelphia County. The four (4) sources are located along a twenty kilometer stretch of the western side the Delaware River. Pennsylvania 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 Kimberly Clark, the other emitters of SO_2 included in the area of analysis are Covanta Delaware Valley, Exelon– Eddystone, and Philadelphia Energy Solutions. No other sources were determined by the state 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:

- Multiple fence lines for Kimberly Clark and Philadelphia Energy Solutions properties; single fence lines for Covanta Delaware Valley and Exelon - Eddystone. Ambient boundaries are of varying length (the longest are surrounding multiple areas around Philadelphia Energy Solutions) and receptors are placed at approximately 25-m intervals.
- a 50-m Cartesian receptor grid extending (radially) from the ambient boundary (fence line) to 2 km from Kimberly Clark, Exelon– Eddystone and Covanta Delaware Valley facilities.

- a 100-m Cartesian receptor grid extending (radially) from 2 km to 10 km from Kimberly Clark, Exelon– Eddystone and Covanta Delaware Valley.
- a 500-m Cartesian receptor grid extending (radially) from 10 km to 30 km from Kimberly Clark, Exelon – Eddystone and Covanta Delaware Valley.
- a 1,000-m Cartesian receptor grid extending (radially) from 30 km to 50 km from Kimberly Clark, Exelon – Eddystone and Covanta Delaware Valley.
- A 10-m 75 by 75 Cartesian grid centered on the peak receptor from the main grid (see discussion below)

The main model receptor network contained 87,389 receptors, and the network covered a roughly circular area extending slightly over 50 km from Kimberly Clark. The main grid covers portions of southeast Pennsylvania along with nearby areas in southwest New Jersey, northern Delaware, and northeast Maryland. Receptors over open water were retained. A fine Cartesian grid covers a roughly 750 m by 750 m area centered over the peak receptor from the main grid, approximately 1.8 km northwest of Kimberly Clark. This grid includes 5,625 receptors. Both grids combined have a total of 93,014 model receptors. A small gap was noted in a portion of the modeling grid extending south from the Commodore Barre Bridge. This receptor gap was not expected to impact the final model results since the peak receptor was not located in this area.

Figures 3.2 through 3,5, show the Commonwealth's chosen area of analysis surrounding each of the four (4) sources included in the modeling analysis as well as the receptor grid for the area of analysis shown in Figures 3.6 and 3.7.

The Pennsylvania did not place receptors in other locations that it considered to not be ambient air relative to at least one of the modeled facilities, i.e. all receptors within these facilities' properties. While this is inconsistent with the Modeling TAD, this should not mask any modeled peaks within other source's property boundary given that the actual model peak concentration occurs relatively distant from any source's ambient air boundary. Exelon -- Eddystone and Covanta Delaware Valley are fully fenced. Both facilities also have gated entrances, employ security cameras that are monitored in the control room and have a security guard at the main truck entrance. The remaining facilities do not have a fence around their entire property. In this case, for receptor placement the fence line is used where available, but natural borders (i.e. trees or water) were used to represent the boundary when no fence was present (e.g., along the river).

Figure 3.2: Area of Analysis for the Delaware Co.-Philadelphia Co. area Covanta Delaware Valley Source

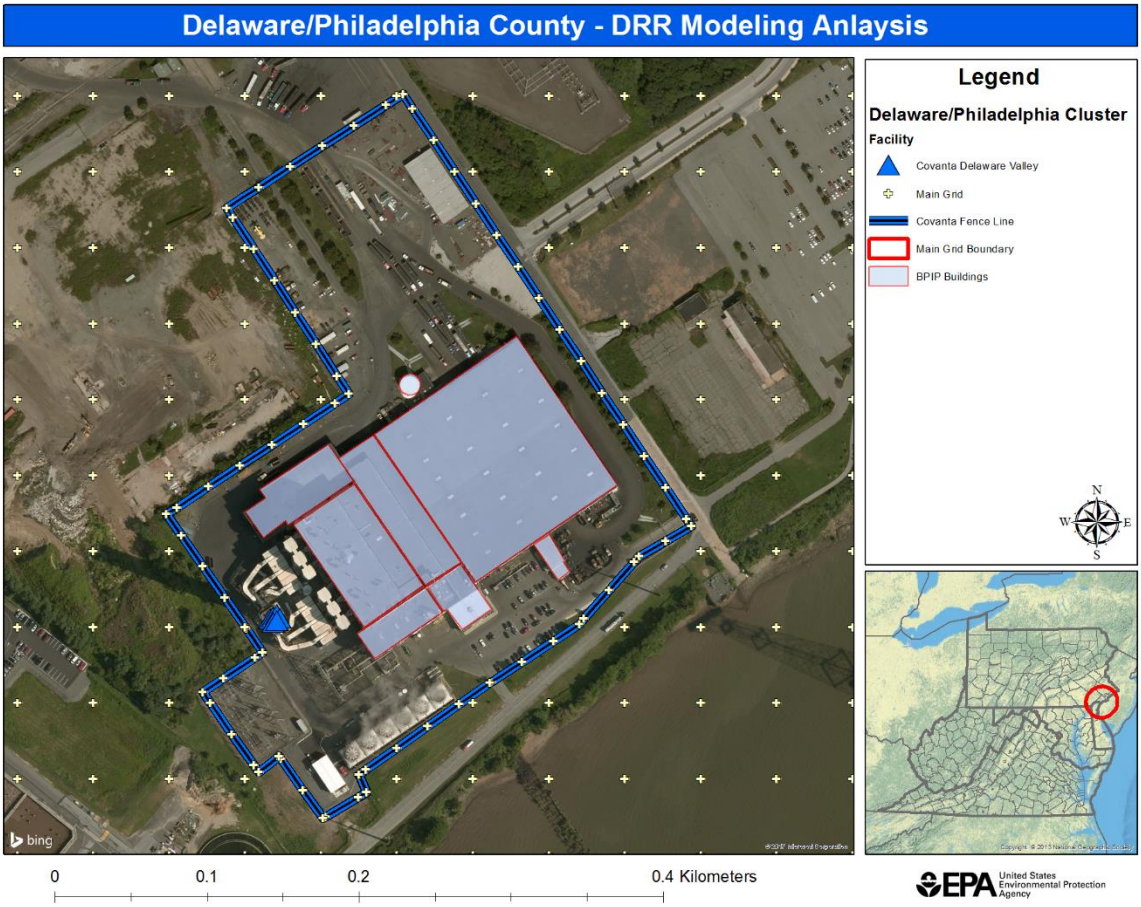


Figure 3.3: Area of Analysis for the Delaware Co.-Philadelphia Co. area Exelon -- Eddystone Source

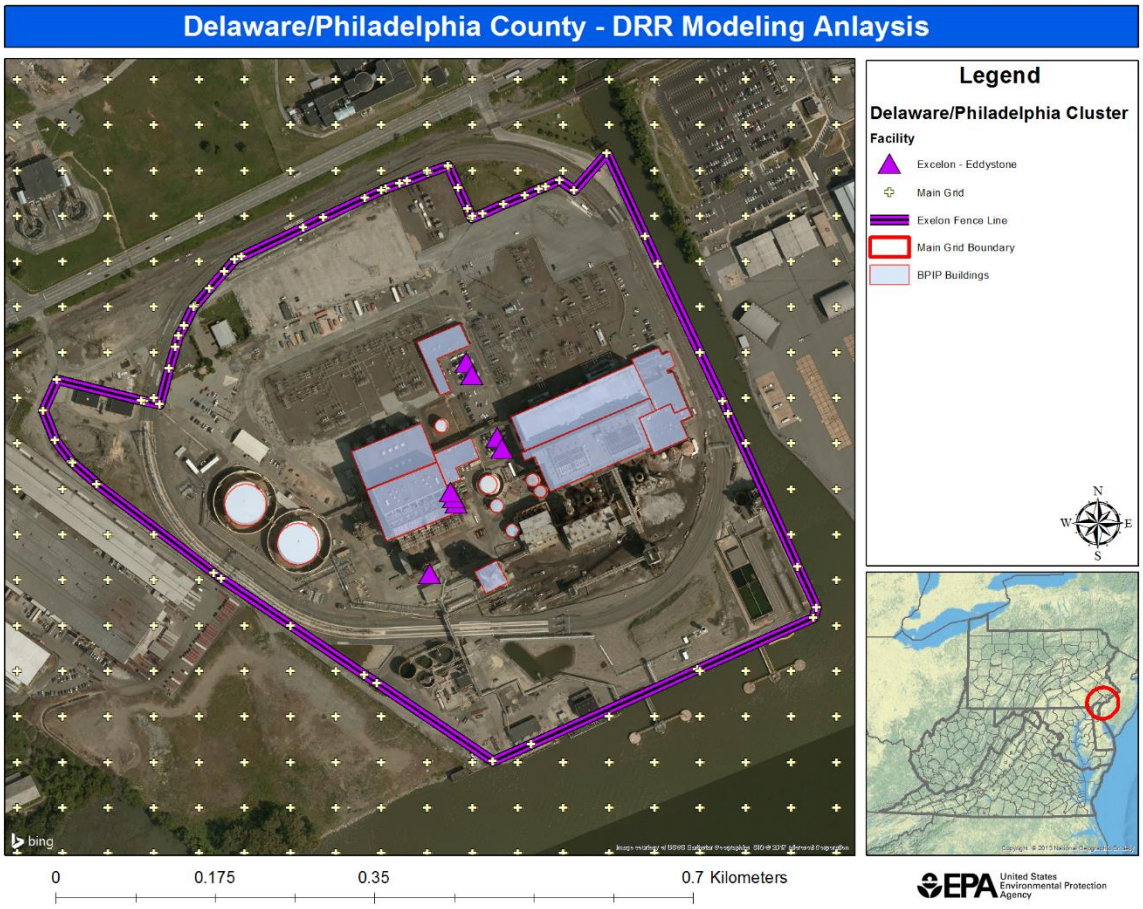


Figure 3.4: Area of Analysis for the Delaware Co-Philadelphia Co. area Kimberly Clark Source

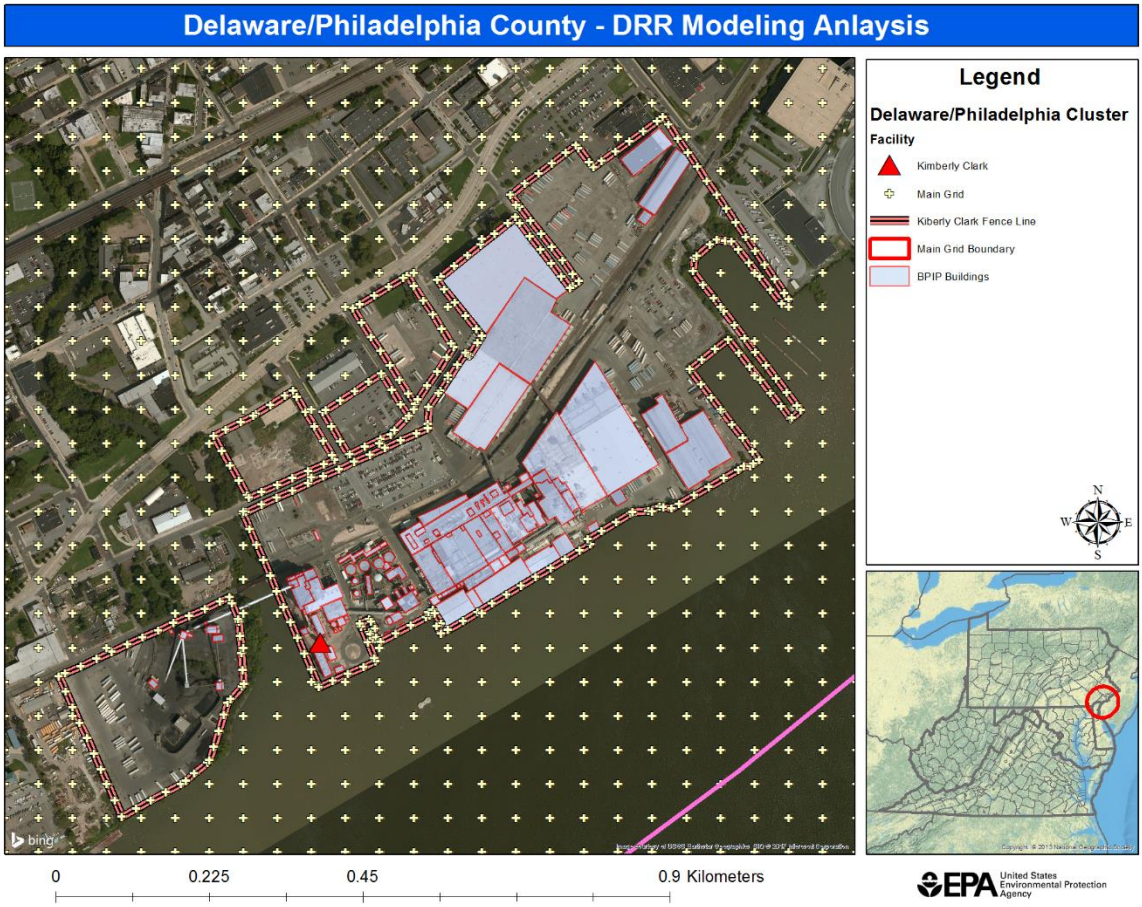


Figure 3.5: Area of Analysis for the Delaware Co.-Philadelphia Co. area Philadelphia Energy Solutions Source

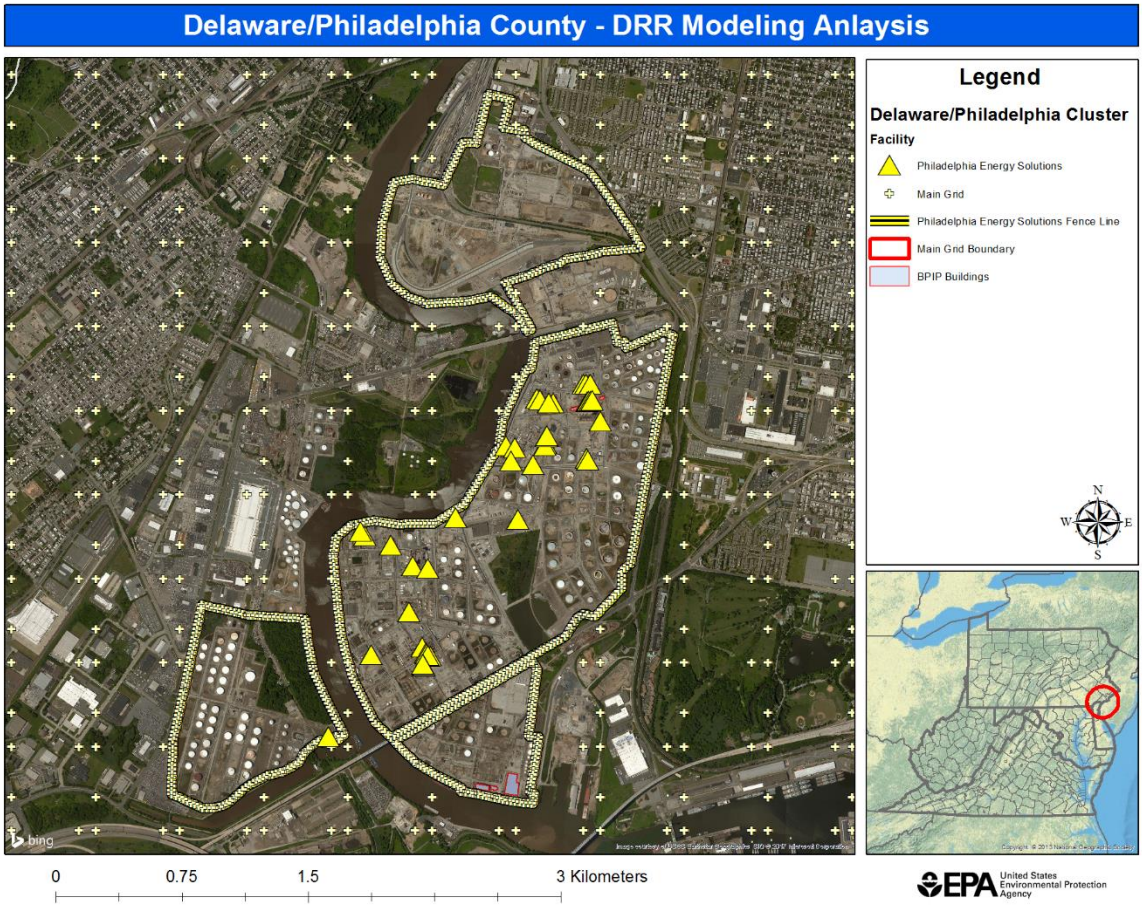


Figure 3.6: Receptor Grid for the Delaware Co.-Philadelphia Co. Area

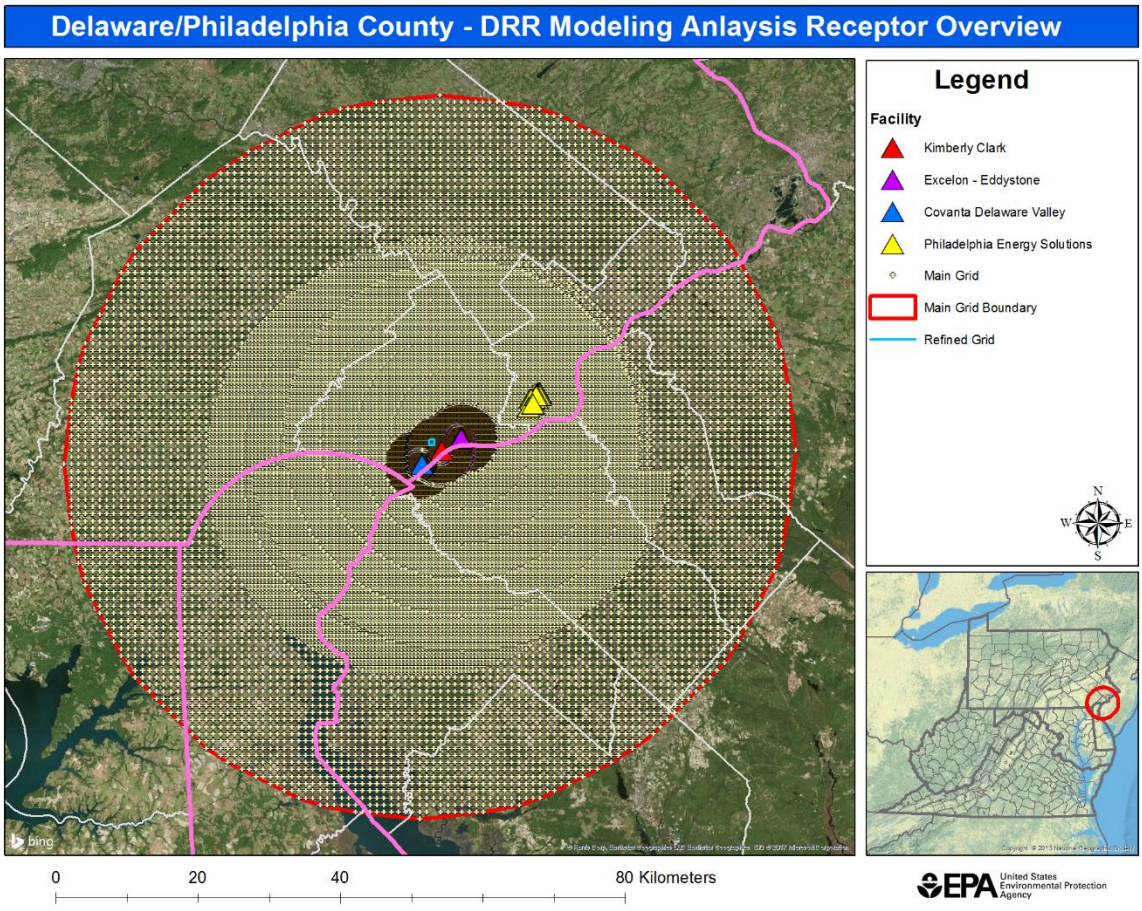
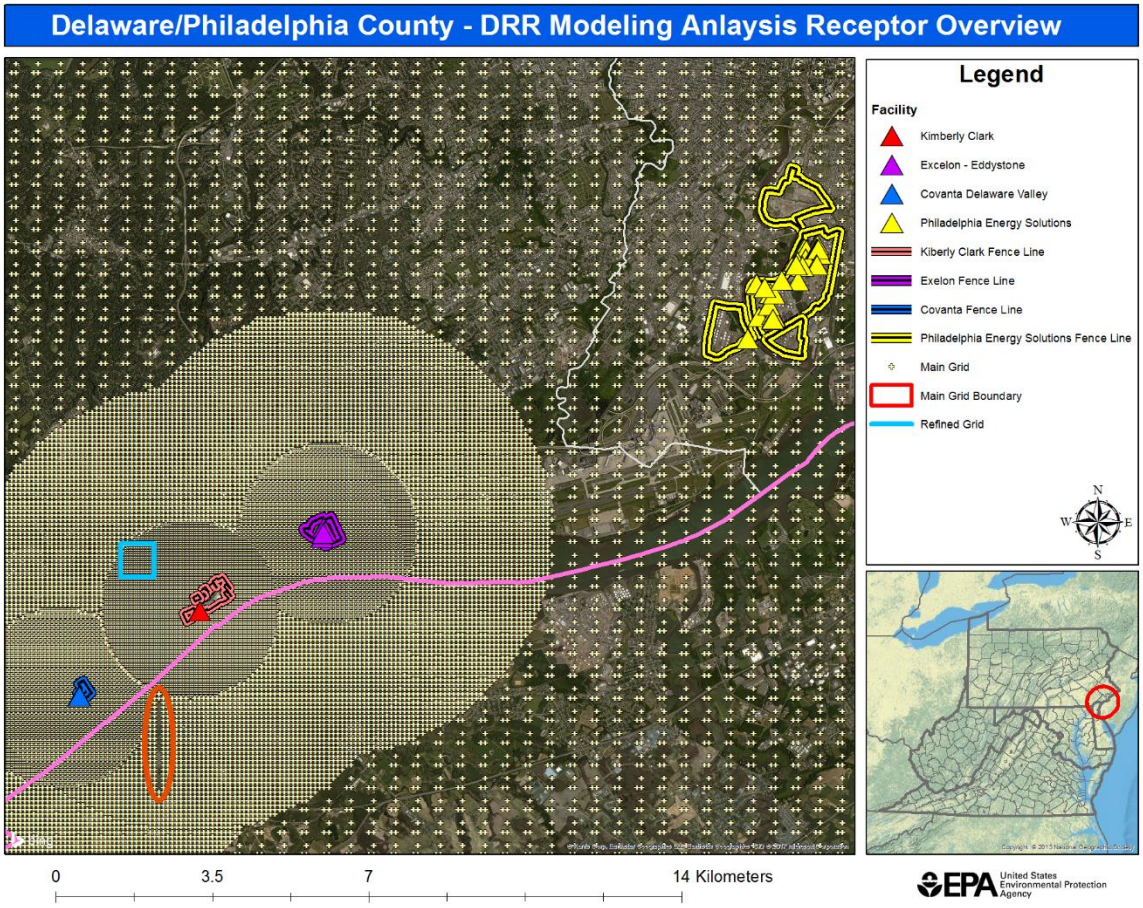


Figure 3.7: Receptor Grid for the Delaware Co.-Philadelphia Co. Area Around Four Sources



EPA examined property boundaries for each facility using GIS software. Model results include building downwash and show each facility's peak model concentration occurs well away from the property boundaries meaning proper boundary delineation is not a critical component of this modeling analysis. EPA also concludes the model receptor grid is adequate to capture the maximum modeled concentrations.

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.

This section will briefly summarize the modeled emission sources at the four (4) facilities located in Delaware and Philadelphia Counties that were identified as a cluster of possible contributing sources and included in the final modeling analysis:

Kimberly Clark: A paper manufacturing facility that has several paper machines and boilers. The largest source of SO_2 emissions at the site is from Source ID 035, which is a culm cogeneration boiler. There are a few paper machines that emit emissions on the order of 0.1 tpy, which the state determined did not merit these sources being included in the final modeling analysis. Kimberly Clark maintains and operates a SO_2 continuous emissions monitoring system (CEMS) that also records exhaust flowrate and temperature on an hourly basis. As such, an hourly emissions file for 2012 through 2014 was used in this analysis that is based on hourly values of SO_2 emissions, exit temperature, and exhaust flowrate as measured by the CEMS. The data used is consistent with that reported to PA DEP and EPA and already reflects the missing data procedures used for those reporting efforts. Over 100 building structures were included in Kimberly Clark's BPIP analysis, which was included in the final modeling analysis. A single stack was modeled as a point source in AERMOD.

Covanta Delaware Valley: A waste to energy facility that operates six (6) municipal waste combustion units. There are no other stationary sources of SO_2 emissions at the site. The preferred modeling approach for establishing modeled emission rates recommended in the modeling TAD is the use of CEMS data, where available, as a CEMS-derived, hour-by-hour modeled emission rate dataset provides the most accurate representation of the actual emissions history of the source. Although Covanta Delaware Valley maintains and operates a CEMS that includes measurement of SO_2 pollutant concentrations level (ppm), it does not record exhaust flowrate on an hourly basis. Therefore, hourly emissions data for 2012 through 2014 is not available from the CEMS. Instead for the purpose of determining modeled emission rates, each MWC's emissions is calculated based on a ratio of monthly fuel input to annual fuel throughput and the total SO_2 emissions per year from annual emissions reports. This procedure was performed for 2012 through 2014. Additionally, the temperature and velocity data were taken from the emission statements. Eight (8) building structures were included in Covanta Delaware Valley's BPIP analysis, which was included in the final modeling analysis. The six (6) emission sources were modeled as a point source in AERMOD.

Exelon - Eddystone: An electric generation facility that operates several turbines and boilers. There are two (2) main boilers, four (4) combustion turbines and three (3) auxiliary boilers which are sources of SO_2 emissions. Primary fuel includes oil and natural gas. Emissions from the Natural Gas Preheater were not included by the Commonwealth in this analysis on the basis of their SO_2 emissions being less than 0.001 tons per year. The preferred approach for establishing modeled emission rates recommended in the modeling TAD is the use of CEMS data, as this dataset provides the most accurate representation of the actual emissions history. CEMS data, however, were only available for the Boilers 3 and 4 stack. This stack operated a SO_2 CEMS and stack flow monitor that recorded exhaust flowrate and temperature on an hourly basis. As such, an hourly emissions file for 2012 through 2014 was used in this analysis that is based on hourly values of SO_2 emissions, exit temperature, and exhaust flowrate as measured by the CEMS. There is no CEMS data available for the four (4) turbines. Instead, monthly emission rates were calculated based on a ratio of the monthly to annual amounts of #2 fuel oil and the actual SO_2 emissions reported in annual emissions statements for each

turbine. As such, an hourly emissions file for 2012 through 2014 was used in this analysis that is based on monthly throughput emissions as reported in the annual emissions statements. Temperature and velocity data, for these units, were obtained from the average stack test result (one test). There was also no CEMS data available for the three (3) auxiliary boilers. Instead, monthly emission rates were calculated based on the monthly amount of natural gas and #2 fuel oil used, the sulfur content of the fuel reported in the annual emission statement, and AP-42 emission factors. An hourly emissions file for 2012 through 2014 that is based on monthly throughput emissions as reported in annual emissions statements, sulfur content, and representative AP-42 factors was used in this analysis. Additionally, the temperature and velocity data were obtained from the average stack test result (one test). Seventeen (17) building structures were included in Exelon - Eddystone's BPIP analysis, which was included in the final modeling analysis. The nine (9) emission sources were modeled as a point source in AERMOD.

Philadelphia Energy Solutions: An oil refinery that operates several heaters, boilers, flares, and other refinery equipment. There are thirty-two (32) heater stacks, five (5) flares, two (2) Fluid Catalytic Cracking Units (FCCU), one (1) boilerhouse, and two (2) sulfur recovery units. The preferred modeling approach for establishing emission rates recommended in the modeling TAD is the use of CEMS data, where available, as a CEMS-derived, hour-by-hour modeled emission rate dataset provides the most accurate representation of the actual emissions history. Daily H_2S fuel gas data are available for numerous sources including one heater stack (PES Unit F-1/F-2 Heater stack) and the boiler house (PES No. 3 Boiler House). For the two FCCU units and the sulfur recovery units, PES maintains and operates SO_2 CEMS. Daily average CEMS data was in the modeling. An hourly emissions file for 2012 through 2014 was used in this analysis that is based on daily varying values of SO_2 emissions. The exit temperature and exhaust flowrate for each stack is not measured by the CEMS. Temperature and flow rates were either provided by Philadelphia Energy Solutions or taken from previous Plan Approval Applications. No CEMS data was available for the five (5) flares during the 2012 through 2014 period. Similar to the remaining heaters, the maximum emission rate calculated based on the maximum annual average emission rate was taken from emissions reports from 2012 to 2014. Overall, the emissions and characteristics of a flare were modeled as a pseudo-point source with the modeled values of stack height, exit temperature, and exit diameter adjusted to account for the unique buoyancy flux occurring at the flare tip. The U.S. EPA AERSCREEN User's Guide was used for the determination of the characteristics input to the model.[6] The temperature and exhaust velocity of the flare was assumed to be 1,273 K (1,832° F) and 20 m/s (3,937 fpm), respectively. All emission sources were modeled at point sources in AERMOD. Six (6) building structures were included in Philadelphia Energy Solution's BPIP analysis, which was incorporated into the final modeling analysis.

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

[6] https://www3.epa.gov/scram001/models/screen/aerscreen_userguide.pdf

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 concludes the Commonwealth's source characterization is generally accurate. Ancillary emissions from some sources were not included in the final modeling analysis. These sources are not expected to occur frequently enough to contribute to the annual distribution of daily maximum 1-hour concentrations in accordance with EPA's March 1, 2011 Clarification Memo.[7] The use of daily average emissions are also not expected to impact final model concentrations given production levels for most sources are fairly constant.

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 three (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 concludes that 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 three (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."

For Kimberly Clark, Covanta Delaware Valley, Exelon – Eddystone, and Philadelphia Energy Solutions, Pennsylvania provided annual actual SO_2 emissions between 2012 to 2014. This information is summarized in Table 3.2. A description of how Pennsylvania obtained hourly emission rates is given below this table.

[7] https://www3.epa.gov/ttn/scram/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf

Table 3.24. Actual SO_2 Emissions Between 2012 – 2014 from Facilities in the Delaware Co.-Philadelphia Co. Area.

Modeled Emissions			
Facility Name	**SO_2 Emissions (tpy)**		
	2012	**2013**	**2014**
Kimberly Clark	1,240.8	1,116.0	1,148.7
Covanta Delaware Valley	202.1	202.5	261.2
Exelon Generation Company, Eddystone	126.6	48.4	153.8
Philadelphia Energy Solutions	536.3	415.4	325.4
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**2,105.9**	**1,782.3**	**1,889.1**
EPA Clean Air Markets Division Emissions for Exelon Generation Company			
Facility Name	**SO_2 Emissions (tpy)**		
	2012	**2013**	**2014**
Exelon Generation Company, Eddystone Unit 2	0.0	0.0	0.0
Exelon Generation Company, Eddystone Unit 3	53.4	23.7	69.1
Exelon Generation Company, Eddystone Unit 4	71.0	20.9	72.7
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**124.4**	**44.6**	**141.8**
eFACTS[8] Emissions (State Reported)			
Facility Name	**SO_2 Emissions (tpy)**		
	2012	**2013**	**2014**
Kimberly Clark	1,259.0	1,029.2	1,069.7
Covanta Delaware Valley	250.6	237.8	316.0
Exelon Generation Company, Eddystone	126.3	47.0	155.2
Philadelphia Energy Solutions	566.5	442.7	353.9
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**2,202.3**	**1,756.7**	**1,894.7**

2014 NEI Emissions	
Facility	**2014 NEI (tpy)**
Kimberly Clark	1,068.5
Covanta Delaware Valley	316.2
Exelon Generation Company, Eddystone	155.2
Philadelphia Energy Solutions	354.8
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**1,894.8**

Several sources of SO_2 emissions data were available to compare to the modeled emissions used for the four (4) sources included in the modeling analysis. Most were annual emission totals; only CAMD had hourly emissions for Exelon – Eddystone Units 3 & 4 to compare to the AERMOD hourly input file. Sources of annual emission totals included Pennsylvania-reported emissions available from PA DEP's eFACTS system, CAMD totals and 2014 National Emission Inventory (NEI) information. All source totals for each of the four (4) modeled sources are relatively consistent from the totals taken from the modeling files. This indicates the modeling analysis has probably correctly captured the actual emissions from the 2012-14 time period. Histograms showing the difference between the hourly modeled emission rates and the hourly CAMD emission rates for the Exelon – Eddystone Units 3 & 4 are shown in Table 3.5. The histogram shows modeled hourly emission rates for Units 3 & 4 were all within +/- 250 lbs/hr of the hourly rates recorded in CAMD. Based on this information it appears that actual hourly emission rates were properly input into the modeling analysis.

Table 3.5. Table showing the difference between modeled and CAMD hourly emission rates (pounds per hour) for Exelon - Eddystone.

Exelon – Eddystone Stack 1 (Units 3 & 4)	
Bin	**Frequency**
-500	0
-250	0
0	125
250	26,179
500	0
750	0
More	0

[8] http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facilityemissions.aspx

3.3.2.6. Modeling Parameter: Meteorology and Surface Characteristics

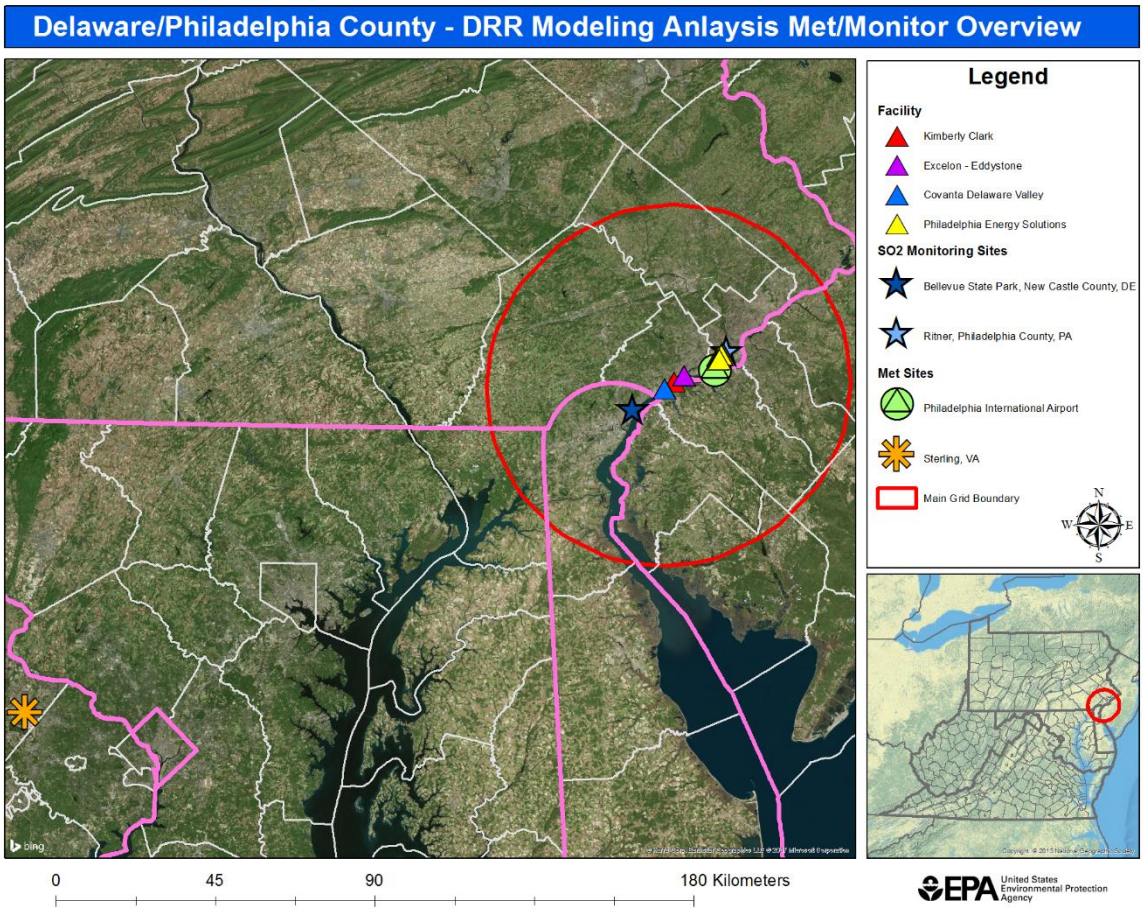
As noted in the Modeling TAD, the most recent three (3) years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness 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 Delaware Co.-Philadelphia Co. area, the Commonwealth selected the surface meteorology from the Philadelphia International Airport (PHL) located near the border of Delaware and Philadelphia Counties along the western side of the Delaware River and coincident upper air observations from Sterling, VA, as best representative of meteorological conditions within the area of analysis. The Philadelphia International Airport is located approximately 11.7 km northeast of Kimberly Clark, the largest SO_2 emitter in the source cluster. Sterling, VA, is approximately 205 km southwest of Kimberly Clark.

Pennsylvania used AERSURFACE version 13016 using data from the Philadelphia International Airport to estimate the surface characteristics of the area of analysis. The Commonwealth estimated values for twelve (12) spatial sectors out to 1.0 km at a seasonal temporal resolution. No documentation was provided regarding the AERMET processing though the files were apparently processed by the PA DEP. Information regarding missing surface data was also provided and showed data completeness was well over 90%. Pennsylvania also estimated values for albedo (the fraction of solar energy reflected from the earth back into space), the Bowen ratio (the method generally used to calculate heat lost or heat gained in a substance), and the surface roughness (sometimes referred to as “Zo”).

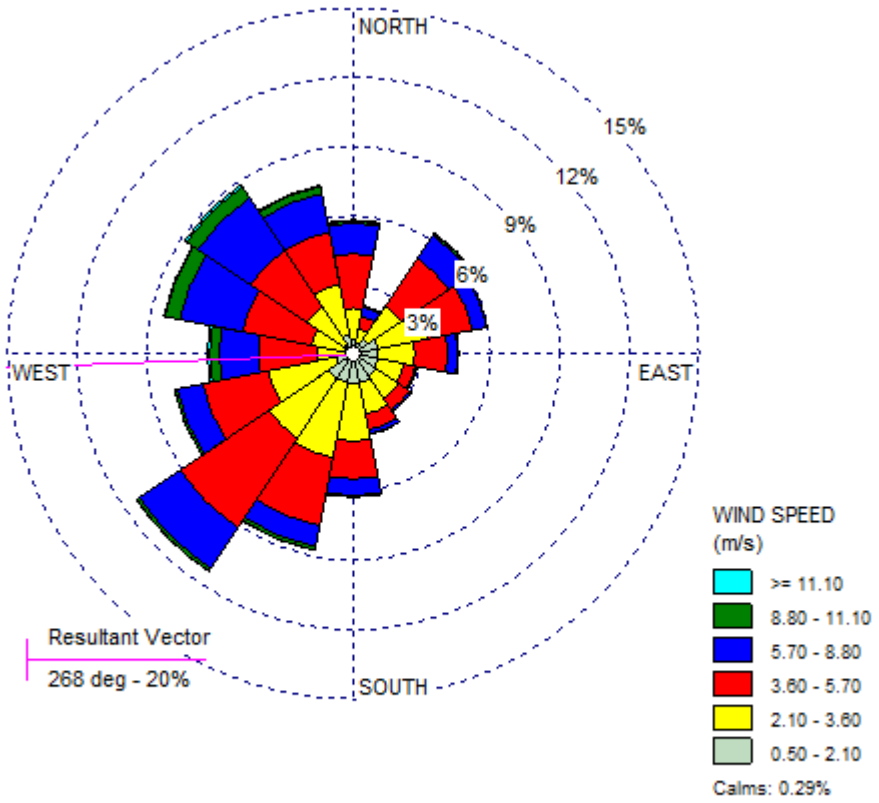
In the figure below, generated by the EPA, the location of this NWS stations (and air monitoring stations) are shown relative to the area of analysis.

Figure 3.8. Area of Analysis and the NWS stations in the Delaware Co.-Philadelphia Co., PA Area



As part of its recommendation, the state provided the 3-year surface wind rose for the Philadelphia International Airport site for 2012-14. In Figure3.9the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose was produced using the final processed AERMET sfc file in Lakes Environmental' s WRPLOT program. Winds were somewhat distributed in the northwest, southwest and northeast quadrants. A resultant wind vector of all hours was from a westerly direction. The anemometer height used to generate the AERMET-ready files matched the height listed for the Philadelphia International Airport (26 ft, 7.92 m).

Figure 3.9. Delaware Co.-Philadelphia Co., PA 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. The state followed the methodology and settings presented in Modeling TAD and associated guidance in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics. As noted earlier, the PA DEP processed and provided the AERMET-ready file used in the modeling analysis.

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 Philadelphia 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.

Details of the AERMET processing stages were missing from the analysis since PA DEP provided the AERMET-ready files used in the modeling analysis. EPA concludes that the files were processed correctly and reflect surface condition such as soil moisture and seasonal snow cover for the area of analysis.

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

The terrain in the area of analysis is best described as a combination of generally flat terrain to the south and east of the source cluster and gently rolling terrain to the west and north. The Delaware River in southeast Pennsylvania marks the division of the Atlantic Coastal plain that covers southern New Jersey and portions of southern Delaware and the eastern shore of Maryland and the low hilly Piedmont terrain to the west and north. Most terrain would reside below stack heights except as one moves further to the west and north. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The terrain elevation for each receptor, building, and emission source was determined using USGS 1/3 arc second National Elevation Data (NED). The NED, obtained from the USGS[9], has terrain elevations at 30-meter intervals. EPA concludes that the receptor grid information was properly processed.

[9] http://www.mrlc.gov/viewerjs/

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. Background concentrations for this analysis used the tier 2 approach. The Chester monitor is located in close proximity to both Kimberly Clark and Covanta Delaware Valley such that, based on the wind rose from the Philadelphia International Airport, the monitor is expected to capture concentrations from both of these sources so, therefore, it was excluded from further consideration in the analysis. Two (2) other nearby SO_2 monitors were identified as possible background sites; the Bellevue State Park site in New Castle County, DE, (10-003-1013) and the Ritner site located in Philadelphia County, PA, (42-101-0055).

With respect to the Bellevue State Park monitor, the monitor is located upwind, based on the predominant wind direction, and would therefore be expected to reasonably account for SO_2 concentrations being transported from the west and south. The Ritner monitor is located to the northeast of the entire source cluster, but within close proximity to Philadelphia Energy Solutions. However, when winds are from the north and east, the concentration monitored should not reflect significant contributions from the source cluster, including Philadelphia Energy Solutions. Background concentrations were assigned in AERMOD on an hourly basis using directionally based background concentrations. Seasonally and temporally varying background concentrations were used from Bellevue for the 0 to 135 sector (winds towards the North and Southeast). The Ritner monitor seasonally and temporally background concentrations were used for all other directions.

Seasonally and temporally varying background concentrations were based on the 99th percentile monitored concentrations by hour of day and season. Each season has a 24-hour sequence of concentrations used for every hour and day in the appropriate season. As noted previously, seasonally and temporally varying background concentrations from Bellevue were used for winds from the 0 to 135° sector (winds towards the North and Southeast) and seasonally and temporally background concentrations were used from Ritner for all other directions. Bellevue's background concentrations for this area of analysis were determined by the state to vary from 19.2 micrograms per cubic meter ($\mu g/m^3$), equivalent to 7.33 ppb when expressed in 3 significant figures[10], to 2.28 $\mu g/m^3$ (0.87ppb), with an average value of 8.48 $\mu g/m^3$ (3.24 ppb). Ritner's background concentrations for this area of analysis were determined by the state to vary from 23.4 micrograms per cubic meter ($\mu g/m^3$), equivalent to 8.9 ppb, to 5.2 $\mu g/m^3$ (2 ppb), with an average value of 20.3 $\mu g/m^3$ (7.8 ppb).

[10] 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 $\mu g/m^3$.

EPA concludes that this dual approach to gauging background concentrations based on wind direction is appropriate for this modeling analysis because it provides an "upwind" background concentration to the modeling analysis.

3.3.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Delaware Co.-Philadelphia area of analysis are summarized below in Table 3.4.

Table 3.4: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Delaware Co.-Philadelphia Co. Area

Input Parameter	Value
AERMOD Version	15181 Default
Dispersion Characteristics	Urban (Different populations used for each facility modeled)
Modeled Sources	4
Modeled Stacks	56
Modeled Structures	145
Modeled Fence Lines	11
Total receptors	87,389
Emissions Type	Actual
Emissions Years	2012-14
Meteorology Years	2012-14
NWS Station for Surface Meteorology	Philadelphia International Airport (PHL)
NWS Station Upper Air Meteorology	Sterling (Dulles Airport), Virginia (IAD)
NWS Station for Calculating Surface Characteristics	Philadelphia International Airport (PHL)
Methodology for Calculating Background SO_2 Concentration	Temporal Varying, Seasonal, Multiple Monitors via Wind Sectors
Calculated Background SO_2 Concentration	0.87 - 8.93 ppb or 2.28 – 23.39 µg/m3

The results presented below in Table 3.5 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

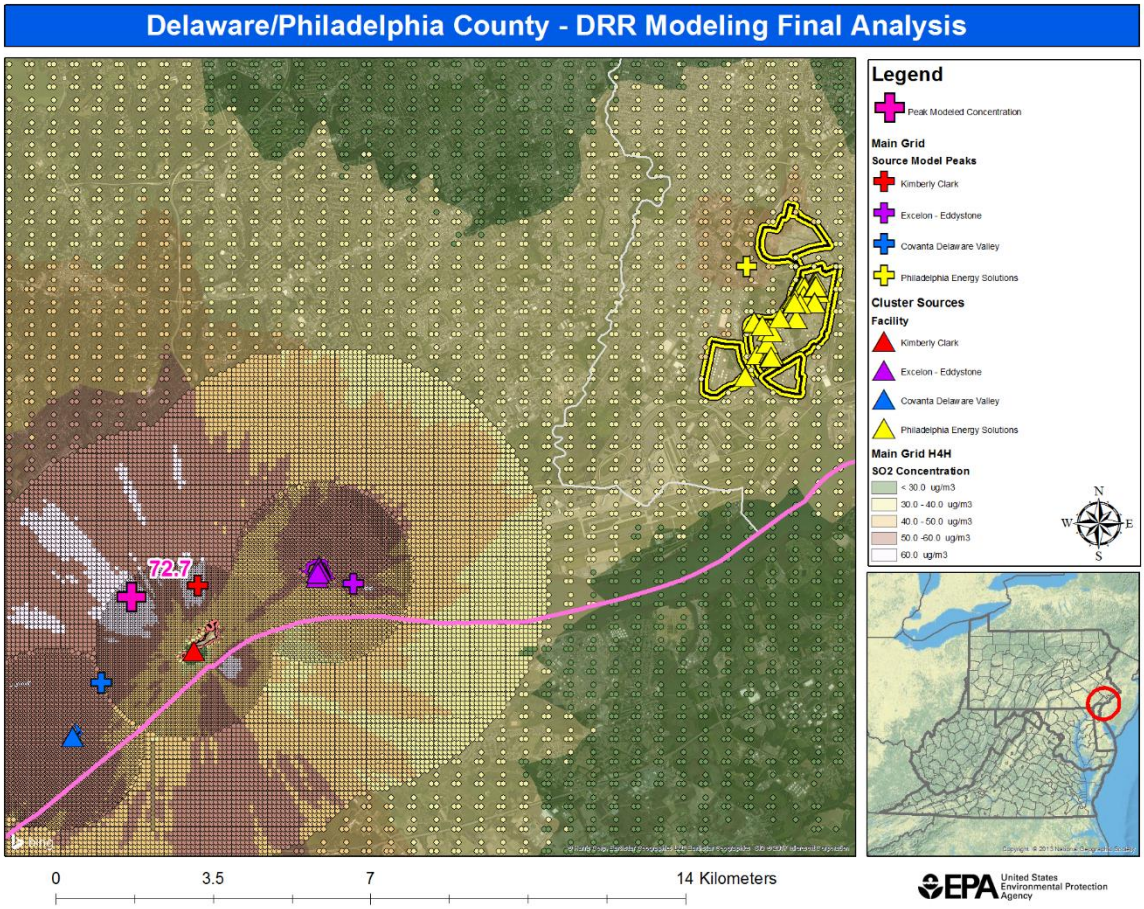
Table 3.5. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the e Delaware Co.-Philadelphia Area

		Receptor Location [UTM zone 18]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
Averaging Period	**Data Period**	**UTM**	**UTM**	**Modeled concentration (including background)**	**NAAQS Level**
99th Percentile 1-Hour Average	2012-14	4411600.4	467956.4	72.7	196.4*

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

Pennsylvania's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 72.7 $\mu g/m^3$, equivalent to 27.8 ppb. This modeled concentration included a seasonal and temporally varying background concentration of SO_2, and is based on actual emissions from the four (4) facilities included in the cluster. Figure 3.10 below was generated using GIS software by EPA, and indicates that the predicted value occurred northwest of Kimberly Clark, the largest emitting source. The Commonwealth's receptor grid is also shown in the figure.

Figure 3.10: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Delaware Co.-Philadelphia Co. Area



The modeling submitted by the state does not indicate that the 1-hour SO_2 NAAQS is 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

Pennsylvania's modeling analysis for the source cluster in southeast Pennsylvania indicates that model concentrations in the vicinity of the four (4) facilities included in the analysis do not violate the SO_2 NAAQS. This result was based on actual modeled emissions that closely resemble emissions reported in EPA's CAMD database, PA DEP's eFACTS system, and the 2014 NEI. An estimate of upwind background concentrations was added to the final modeled result. Peak model concentrations for Kimberly Clark, Covanta Delaware Valley, Exelon – Eddystone and Philadelphia Energy Solutions were 72.7 $\mu g/m^3$, which is approximately 37% of the 1-hour SO_2 NAAQS.

Our review did not uncover any substantial issues with Pennsylvania's modeling analysis. We therefore conclude that the modeling analysis supports Pennsylvania's finding that emissions from Kimberly Clark, Covanta Delaware Valley, Exelon – Eddystone, and Philadelphia Energy Solutions do not cause violations of the 1-hr SO_2 NAAQS. The nearest 1-hour SO_2 nonattainment area, the Baltimore, MD nonattainment area, is located over 100-km southwest of the modeled area. Given this distance and predominant wind directions, the modeled sources in this source cluster are not expected to contribute to air quality in any nearby nonattainment areas.

3.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Delaware Co.-Philadelphia Co., Pennsylvania 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.

3.5. Jurisdictional Boundaries in the Delaware Co.-Philadelphia Co., Pennsylvania Area

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

The modeling receptor grid in this analysis covered the entirety of the jurisdiction, in this case the entirety of Delaware and Philadelphia Counties, and the modeling analysis did not show any violations of the NAAQS in these jurisdictions.

3.6. Other Information Relevant to the Designations for the Delaware Co.-Philadelphia Co., Pennsylvania 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 Delaware Co.-Philadelphia Co. area of analysis. The nearest nonattainment area is the Baltimore, MD nonattainment area located approximately 100 km southwest of this source cluster.

3.7. The EPA's Assessment of the Available Information for the Delaware Co.-Philadelphia Co., Pennsylvania Area

The EPA finds that available air quality monitoring data and air dispersion modeling results show that the Delaware Co.-Philadelphia Co. area of analysis is in attainment of the 1-hour SO_2 NAAQS and does not contribute to a violation of the NAAQS in a nearby area. Design values from the monitor located within this area of analysis are well below the standard of 75 ppb (9

ppb). However, EPA does not have information indicating this monitoring data is in an area of maximum concentration, so this data cannot be used as the basis for designation.

Pennsylvania's modeling analysis for the source cluster in southeast Pennsylvania indicates that model concentrations in the vicinity of the four (4) facilities included in the analysis do not violate the SO_2 NAAQS. This result was based on actual modeled emissions that closely resemble emissions reported in EPA's CAMD database, PA DEP's eFACTS system, and the 2014 NEI. An estimate of upwind background concentrations was added to the final modeled result. Peak model concentrations for Kimberly Clark, Covanta Delaware Valley, Exelon – Eddystone, and Philadelphia Energy Solutions were 72.7 $\mu g/m^3$, which is approximately 37% of the 1-hour SO_2 NAAQS.

The EPA's review did not uncover any substantial issues with Pennsylvania's modeling analysis. We therefore conclude that the modeling analysis supports Pennsylvania's finding that emissions from Kimberly Clark, Covanta Delaware Valley, Exelon – Eddystone, and Philadelphia Energy Solutions do not cause violations of the 1-hr SO_2 NAAQS and does not contribute to any nearby areas that violate the NAAQS.

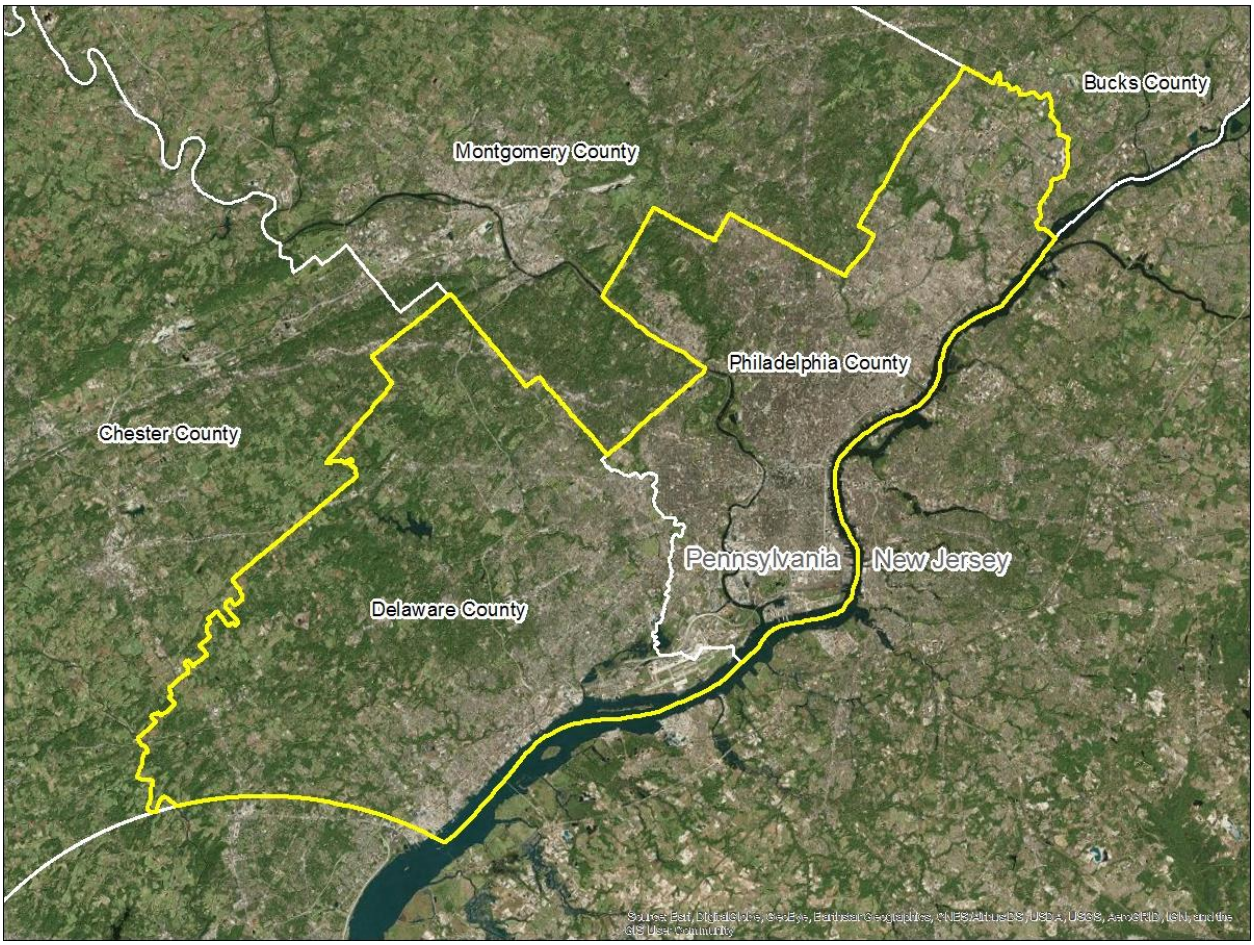
The EPA concludes that our intended unclassifiable/attainment area, bounded by the county jurisdictional boundaries, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area.

3.8. Summary of Our Intended Designation for the Delaware Co.-Philadelphia Co, Pennsylvania Area

After careful evaluation of the Commonwealth's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the Delaware Co.-Philadelphia Co. area as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of the jurisdictional boundaries for Philadelphia County and Delaware County.

Figure 3.11 shows the boundary of this intended designated area.

Figure 3.11 Boundary of the Intended Delaware Co.-Philadelphia Co. Unclassifiable/attainment Area



At this time, our intended designations for the Commonwealth only apply to this area and the other areas presented in this technical support document.

4. Technical Analysis for the Montour County Area

4.1. Introduction

The EPA must designate the Montour County, Pennsylvania area by December 31, 2017, because the area has not been previously designated and Pennsylvania 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 Montour County. Pursuant to the DRR (*see* 40 CFR part 51, subpart BB), states had the option to characterize large sources of SO_2 by either monitoring, modeling or capping emissions below 2,000 tons of SO_2 per year. Pennsylvania elected to conduct modeling for the Montour Steam Electric Station that emits more than 2,000 tons of SO_2 per year.

4.2. Air Quality Monitoring Data for the Montour County, Pennsylvania Area of Analysis

There are no air quality monitors located in the Montour County, Pennsylvania area of analysis.

4.3. Air Quality Modeling Analysis for the Montour County Area Addressing Montour Steam Electric Station

This section 4.3 presents all the available air quality modeling information for a portion of Montour County that includes the Montour Steam Electric Station. (This portion of Montour County will often be referred to as "the Montour County area" within this section 4.3). This area contains the following SO_2 source around which Pennsylvania 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 Montour Steam Electric Station facility emits 2,000 tons or more annually. Specifically, the Montour Steam Electric Station emitted 10,980 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 Pennsylvania has chosen to characterize it via modeling.

In Pennsylvania's original recommendation on June 23, 2011, Pennsylvania recommended that the area surrounding the Montour Steam Electric Station, specifically the entirety of Montour County, be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the Montour Steam Electric Station but did not update their recommendation. This modeling assessment and characterization of air quality 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 intends to modify the Commonwealth's recommendation for the area, and 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 the Commonwealth has assessed via air quality modeling is located in north central Pennsylvania north of Sunbury where the Susquehanna River divides into the east and west

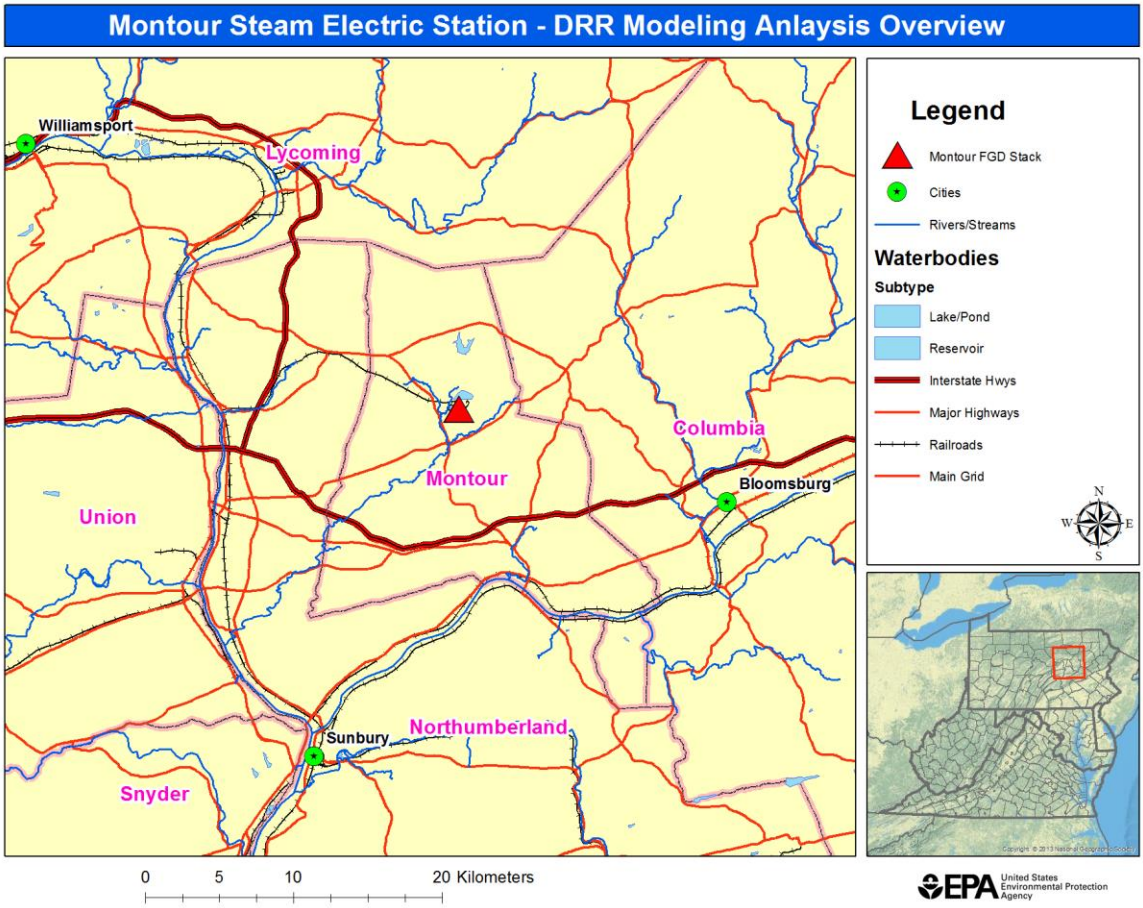
branches and north of I-80. The modeling domain covers all of Montour (where the Montour Steam Electric Station is located) and neighboring Columbia counties along with portions of Centre, Clinton, Dauphin, Juniata, Luzerne, Lycoming, Northumberland, Schuylkill, Snyder, Sullivan, Union, and Wyoming counties.

Figure 4.1 below shows the location of the Montour Steam Electric Station along with nearby population centers, major roads, rail roads, and significant water bodies, streams, and rivers. There are no other sources of SO_2 greater than 50 tpy currently operating within 20 km of the Montour Steam Electric Station. The closest coal-fired power plant, Sunbury Generation, ceased operations in 2014 and is currently scheduled to be repowered as a combined cycle gas-fired power plant in 2018,[11] Additionally, coal boilers at Bloomsburg University are scheduled to be replaced with natural gas boilers in 2017.[12]

The EPA's intended designation boundary for the Montour County area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

[11] http://www.powermag.com/coal-fired-sunbury-power-plant-gives-way-to-gas/
[12] http://www.bloomu.edu/planning-construction-plans

Figure 4.1. Map of the Montour County, Pennsylvania Area Addressing the Montour Steam Electric 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, which was submitted by Pennsylvania.

4.3.1. Modeling Analysis Provided by the State

4.3.1.1. 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

PA DEP delivered its modeling analysis to EPA Region 3 on May 26, 2017. On January 17, 2017, EPA published its revision to Appendix W – Guideline to Air Quality Models.[13]. Since the publication of Appendix W the current version of AERMOD is version 16216r. The modeling analysis for the Montour Steam Electric Station was submitted using AERMOD version 16216, the version released upon publication of EPA's revised Appendix W. This version had corrected the bug fix in the previous version (15181), which lead to model under predictions. Pennsylvania's modeling submittal included both the default version and the Adjust U* low wind option. On March 14, 2017, the effective date for implementation of Appendix W was extended until May 22, 2017. This date has since passed means the revised Appendix W is currently in effect. There were no updates from 16216 to 16216r that would significantly affect the concentrations predicted here. A discussion of the Commonwealth's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

4.3.1.2. 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 state determined that it was most appropriate to run the model in rural mode. An examination of the 2011 USGS National Land Cover Database imagery indicated over 80% of the land classifications within 3 km of the Montour Steam Generating Station consisted of croplands and vegetation supporting a rural classification. EPA agrees with this assessment.

4.3.1.3. 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 source of SO_2 emissions subject to the DRR in this area is described in the introduction to this section. For the Montour County area, Pennsylvania has included no other emitters of SO_2 within 30 km of Montour Steam Electric Station. As noted previously, coal-fired boilers at Sunbury Generating Station and Bloomsburg University have been or are being replaced with natural gas units and are not currently operating. 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 violations in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. No other sources beyond 30 km were determined by the state 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 Pennsylvania is as follows:

- Multiple fence lines surrounding portions of the Montour Steam Electric Station (approximately 3.6 and 3.9 km in length) with receptor placement at approximately 25-m intervals.
- a 100-m Cartesian receptor grid extending from the ambient boundary (fence line) to 5 km from the Montour Steam Electric Station FGD stack.
- a 250-m Cartesian receptor grid extending from 5 km to 10 km from the Montour Steam Electric Station FGD stack.
- a 500-m Cartesian receptor grid extending from 10 km to 20 km from the Montour Steam Electric Station FGD stack.
- a 1,000-m Cartesian receptor grid extending from 20 km to 50 km from the Montour Steam Electric Station FGD stack.
- A 10-m 21 by 21 Cartesian grid centered on the peak receptor from the main grid (see discussion below)

The main model receptor network contained 28,651 receptors, and the network covered all of Montour and Columbia counties along with portions of Centre, Clinton, Dauphin, Juniata, Luzerne, Lycoming, Northumberland, Schuylkill, Snyder, Sullivan, Union, and Wyoming counties. An additional 10-m refined grid was centered of the peak model receptor from the main grid simulation. This 21 by 21 Cartesian grid (441 model receptors) was located about 4 km north of the Montour Steam Electric Station.

Figures 4.2,4.3, and 4.4 produced by EPA, show the Commonwealth's chosen area of analysis surrounding the Montour Steam Electric Station, including several views showing the receptor grid for the area of analysis. Building information is displayed in the immediate vicinity of the Montour Steam Electric Station. The building structures to the west southwest of the FGD stack

are attributed to the US Gypsum/Washingtonville Plant, which processes the FGD scrubber liquor waste into gypsum board.

Consistent with the Modeling TAD, Pennsylvania 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. No areas outside the facility property boundary were excluded from model receptor placement for the modeling analysis. Receptor boundaries were generally verified using GIS software using aerial overviews.

Figure 4.2: Area of Analysis for the Montour County Area

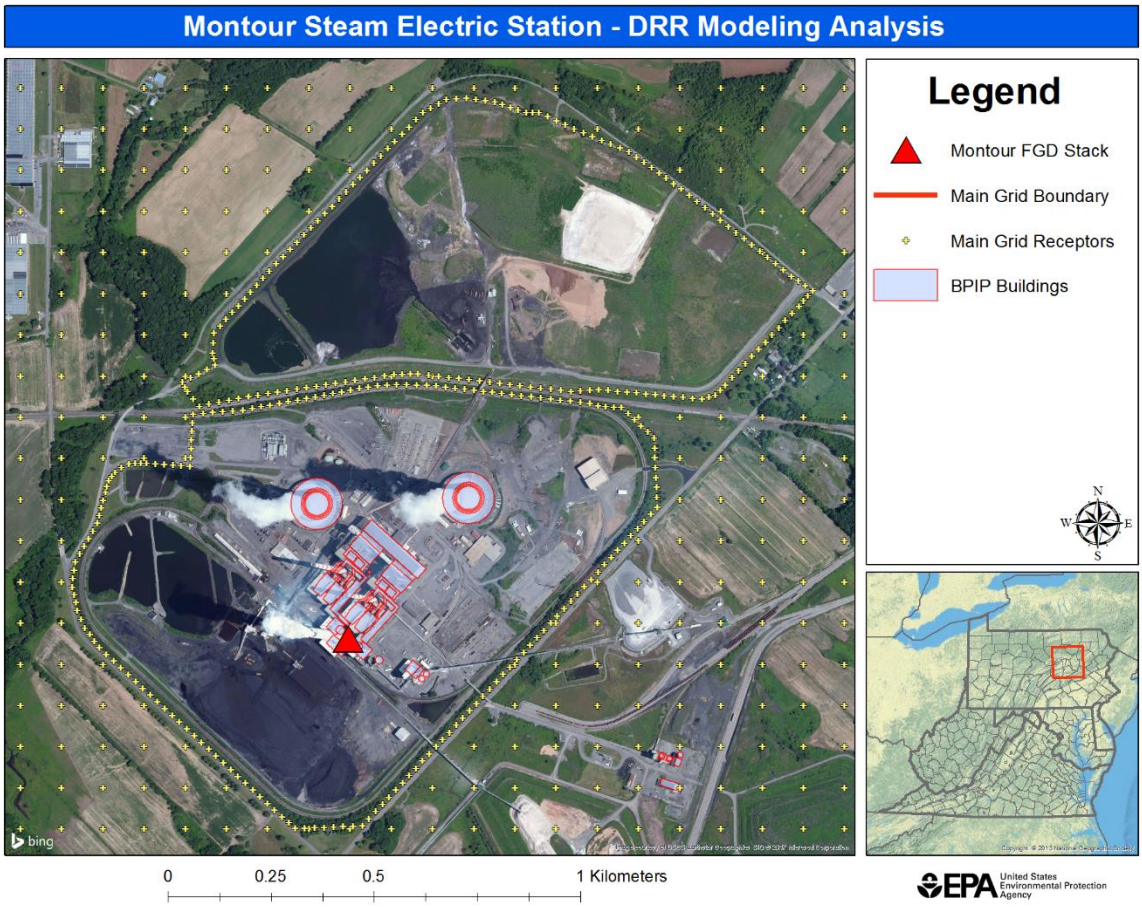


Figure 4.3: Area of Analysis for the Montour County Area

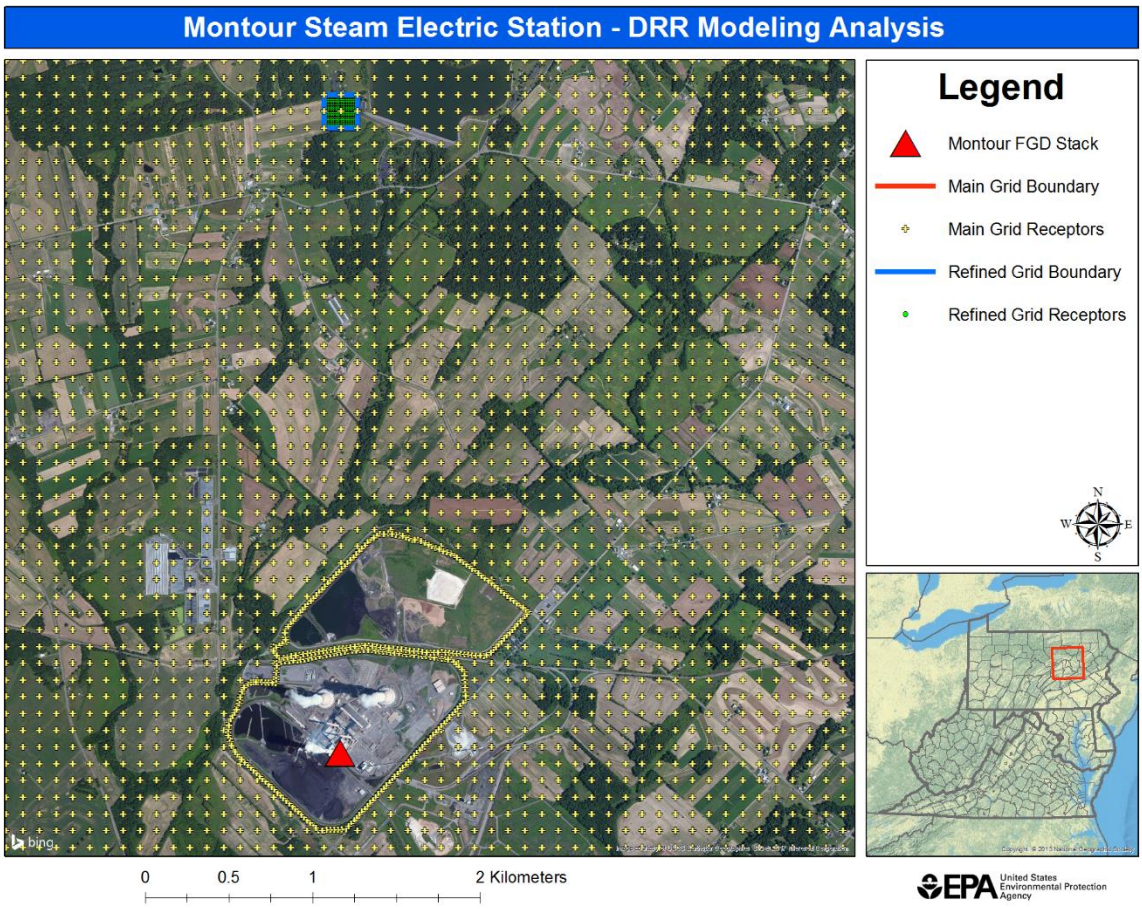
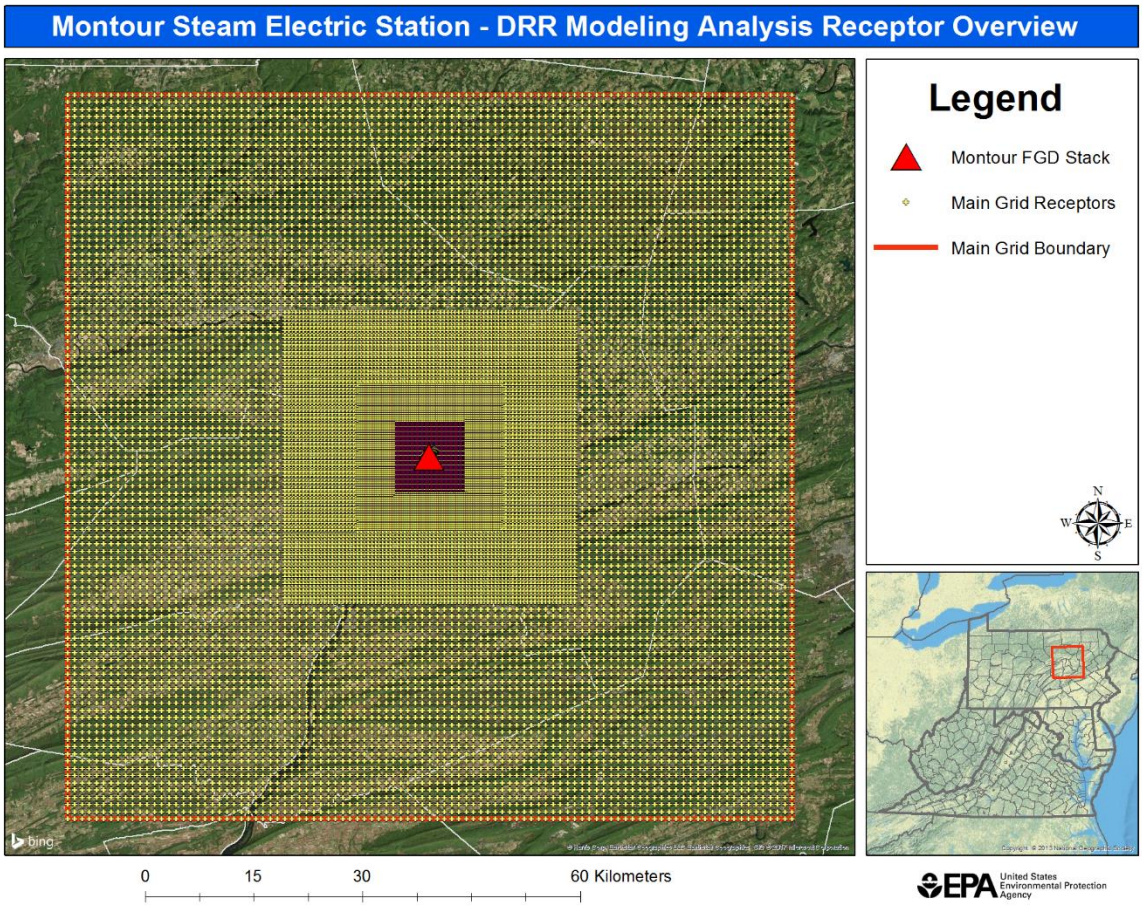


Figure 4.4: Receptor Grid for the Montour County Area



The EPA examined property boundaries for each facility using GIS software. Model results include building downwash and show each facility's peak model concentration occurs well away from the property boundaries meaning proper boundary delineation is not a critical component of the modeling analysis. EPA concludes that the model receptor grid is adequate to capture the maximum modeled concentrations.

4.3.1.4. 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 or following GEP policy with allowable emissions.

Pennsylvania characterized this source 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 actual emissions. Pennsylvania 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.

The main FGD stack is multi-flued with a separate exhaust chimney for each of the two (2) units at the Montour Steam Electric Plant. When both units were on simultaneously, the modeling analysis utilized EPA's merged stack policy outlined in Model Clearinghouse Memos 91-II-01 and 96-V-10. Modeled stack velocities and temperatures were scanned for any unusual values. Some hourly stack temperatures were modeled below 273 K, which is not consistent with coal-fired units. In all likelihood, hourly stack temperatures below 273 K are occurring when the modeled emission rate is zero (based on a quick check of the hourly file).

After reviewing the source characterization information provided by Pennsylvania, EPA concludes the modeling analysis adequately characterizes the Montour Steam Generating Station.

4.3.1.5. 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 three (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 concludes 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, Pennsylvania included Montour Steam Generating Station and no other emitters of SO_2 within 30 km in the area of analysis. Only emissions from the main boilers were modeled; other SO_2 emissions were noted but there were determined to be too small or intermittent in nature and not included in the final modeling analysis. This is generally consistent with EPA's March 1, 2011 Clearinghouse Memo, which allows for exclusion of sources not expected to contribute significantly to the annual distribution of daily maximum 1-hour

concentrations. The Commonwealth has chosen to model this facility using actual emissions. The facility in the Pennsylvania's modeling analysis and its associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.

For the Montour Steam Generating Station, the Commonwealth provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 4.1. A description of how Pennsylvania obtained hourly emission rates is given below this table.

Table 4.18. Actual SO_2 Emissions Between 2012 – 2014 from Facilities in the Montour County Area

Modeled Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Montour Unit 1	1,655.2	243.1	530.3
Montour Unit 2	1,572.7	1,385.9	726.3
Montour Merged Stack Units 1 & 2	9,210.8	9,355.2	9,587.9
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**12,438.6**	**10,984.2**	**10,844.4**
EPA Clean Air Markets Division Emissions for Montour Steam Generating Station			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Montour Unit 1	5,996.4	4,778.8	5,562.9
Montour Unit 2	6,439.6	6,201.0	5,338.2
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**12,435.9**	**10,979.8**	**10,901.2**
eFACTS[14] Emissions (State Reported)			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Montour	12,435.9	10,979.8	10,901.1
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**12,435.9**	**10,979.8**	**10,901.1**

014 NEI Emissions	
Facility	**2014 NEI SO_2 Emissions (tpy)**
Montour	10,979.82
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**10,979.82**

[14] http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facilityemissions.aspx

For the Montour Steam Electric Station, the actual hourly emissions were derived from data submitted by Talen Energy to PA DEP through the CEMS database and included in the modeling documentation. Stack temperature and flow rates were examined to obtain modeled hourly values and vary for each hour of the simulation. As noted previously, when both units were simultaneously operated, a merged stack was utilized. To model a merged stack, calculations were performed to determine the equivalent parameters needed for modeling. Emissions for the merged stack are the sum of both units' emissions. Merged stack temperatures were calculated using a weighted average based on stack flow data. Computing the merged stack exit velocity is a multi-step process. Generally, CEMs do not measure exit velocity directly, but rather determine the volumetric flow rate based on standard atmospheric conditions. Because standard flow rate is rarely representative of the flow rate based on actual atmospheric conditions, standard flow rate is converted to actual flow rate using the exit temperature and a pressure correction that accounts for the stack top elevation. Once the actual flow rate is determined, the exit velocity is computed by dividing the volumetric flow rate by the area of the merged stack.

The stack flow rate and exit temperature data include several periods of missing data. For short time periods of missing flow or temperature data, the average of the valid hours before and after the missing hour's data were used. Longer periods of missing flow data were filled using a polynomial relationship determined by plotting MW on the x-axis and flow rate on the y-axis in a spreadsheet program, where the best fit curve was selected. The calculations were provided as part of the modeling archive submitted as part of the modeling submittal.

Hourly emissions for units 1 and 2 were downloaded and compared with the hourly emission file used in the modeling analysis. When both units were operated simultaneously, a merged stack profile was created from the CAMD data to compare with the merged stack modeled emission rate. Annual emission shown in the previous tables indicate modeled emissions closely match emissions reported in CAMD, PA DEP's eFACTS system and the 2014 NEI. A comparison of hourly modeled and publicly available CAMD emission rates was also conducted. Results of the modeled hourly emission rates minus the CAMD hourly emission rates shows very good agreement with most hours in the simulation falling within +/- 250 lbs/hr. This result suggests the modeling analysis captures the actual emissions from the Montour Steam Electric Station.

Table 4.2. Summary showing the difference between modeled and CAMD hourly emission rates (Bin = lbs/hour for Montour Steam Electric Station's Unit 1, 2 and Merged stacks.

Montour Steam Electric Station					
Unit 1		**Unit 2**		**Merged**	
Bin	**Frequency**	**Bin**	**Frequency**	**Bin**	**Frequency**
-500	0	-500	0	-500	0
-250	0	-250	0	-250	5
0	24,545	0	23,612	0	16,400
250	1,703	250	2,636	250	9,854
500	1	500	4	500	9
750	2	750	5	750	8
More	29	More	23	More	4

4.3.1.6. Modeling Parameter: Meteorology and Surface Characteristics

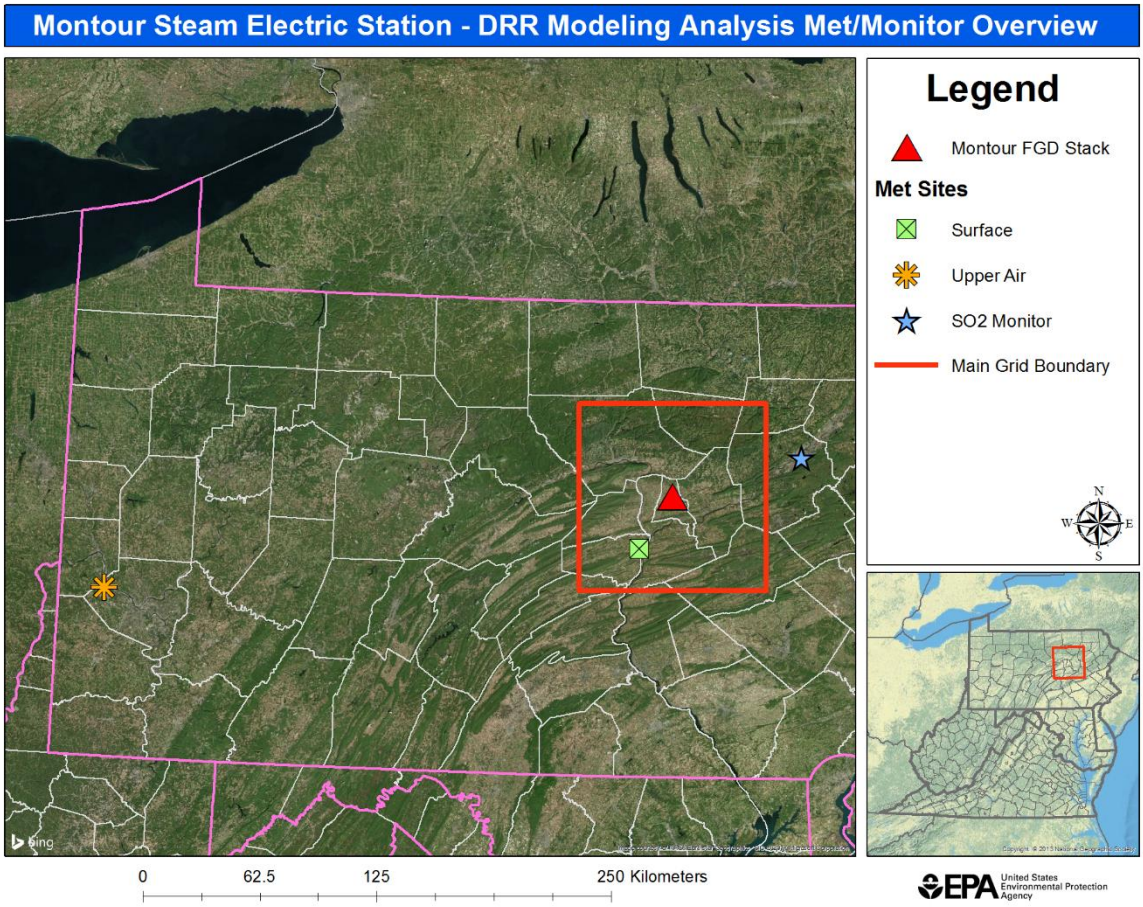
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of 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 Montour County area, Pennsylvania selected the surface meteorology from the Penn Valley/Selinsgrove Airport located in Northumberland County, PA, approximately 32.5 km southwest of the Montour Steam Electric Station, and coincident upper air observations from Pittsburgh International Airport located in Allegheny County, PA, located 306 km west-southwest of the Montour Steam Electric Station as best representative of meteorological conditions within the area of analysis.

Pennsylvania used AERSURFACE version 13016 using data from the Penn Valley/Selinsgrove Airport to estimate the surface characteristics of the area of analysis. The state estimated values for 12 spatial sectors out to 1.0 km at a default seasonal temporal resolution for dry, wet, average conditions based on local precipitation values. 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"). Seasonal snow cover for the area was also incorporated into the AERSURFACE determined surface characteristics.

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

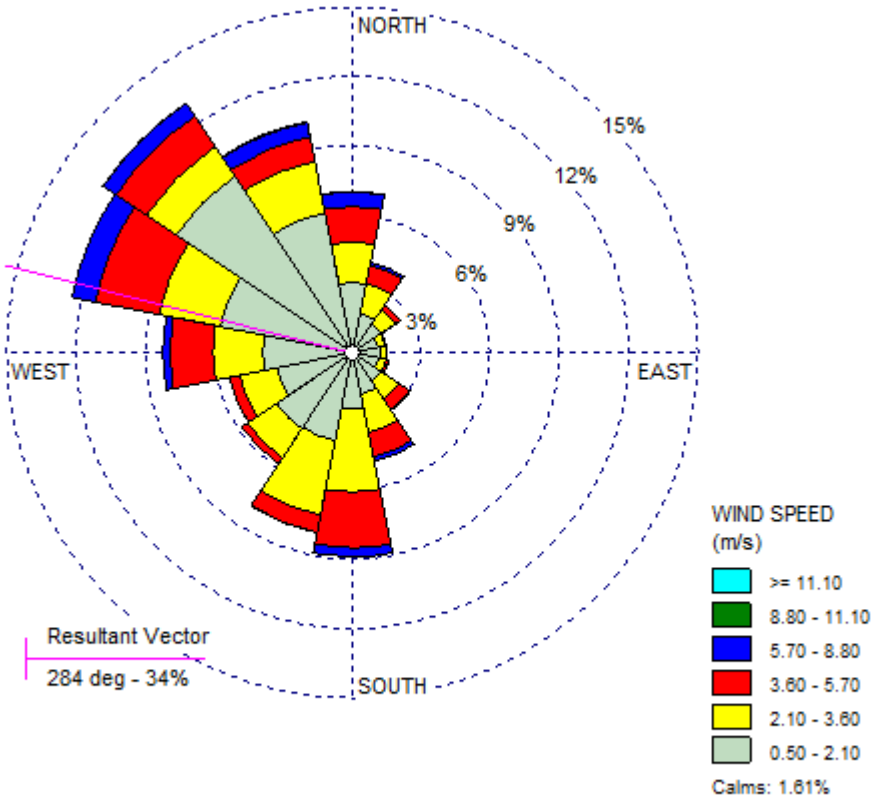
Figure 4.5. Area of Analysis and the NWS stations in the Montour County Area



As part of its recommendation, the Commonwealth provided the 3-year surface wind rose for the Penn Valley/Selinsgrove Airport site for 2013-15. In Figure 4.6 the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose was produced using the final processed AERMET sfc file in Lakes Environmental's WRPLOT program.[15] Winds were somewhat restricted with the bulk of the wind directions from the west, north, and south. A resultant wind vector of all hours was from a west-northwesterly direction. The anemometer height used to generate the AERMET-ready files matched the height listed for the Penn Valley/Selinsgrove Airport (33 ft, 10 m).

[15] WRPLOT View™ is the intellectual property of Lakes Environmental Software and is used herein under license. Copyright © 1998 – 2016 Lakes Environmental Software. All rights reserved.

Figure 4.6 Montour County, Pennsylvania 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. Pennsylvania followed the methodology and settings presented in Modeling TAD and associated guidance in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics. As noted earlier, the PA DEP processed and provided the AERMET-ready file used in the modeling analysis.

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 (only) was provided from Penn Valley/Selinsgrove 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.

EPA concludes that the files were processed correctly and reflect surface condition such as soil moisture and seasonal snow cover for the area of analysis.

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

The terrain in the area of analysis is best described as hilly and somewhat complex. The Montour Steam Electric Station is located in the Ridge and Valley province of the Appalachian Mountains. The plant itself sits in a broad valley along the Chillisqueque Creek with the nearest elevated terrain more than 4 km to the south and over 8 km to the north. 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 1-arc-second, or 30-meter, NED data that were obtained from the Multi-Resolution Land Characteristics Consortium (MRLC). EPA concludes that the receptor grid information was properly processed.

4.3.1.8. 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, the state used seasonally varying background concentrations from the Wilkes-Barre (42-079-1101) SO_2 monitor located approximately 72 km northeast of the Montour Steam Electric Station. The background concentrations for this area of analysis were determined by the state to vary from 19.21 micrograms per cubic meter ($\mu g/m^3$), equivalent to 7.3 ppb when expressed in 2 significant figures,[16] to 2.62 $\mu g/m^3$ (1.0 ppb), with an average value of 9.52 $\mu g/m^3$ (3.6 ppb).

Given the isolated location of the Montour Steam Electric Station, the background concentration used from the Wilkes-Barre, PA, monitor is a reasonable estimate of background SO_2 concentrations in Montour County. It would be reasonable to assume SO_2 concentrations would be slightly higher at the Wilkes-Barre monitor than Montour County due to higher population density and greater area source category emissions.

4.3.1.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Montour County area of analysis are summarized below in Table 4.3

[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 4.3: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Montour County Area

Input Parameter	Value
AERMOD Version	16216 Default and Adjust U*
Dispersion Characteristics	Rural
Modeled Sources	1
Modeled Stacks	1
Modeled Structures	37
Modeled Fencelines	2
Total receptors	29,092
Emissions Type	Actual
Emissions Years	2013-15
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Penn Valley/Selinsgrove Airport, PA
NWS Station Upper Air Meteorology	Pittsburgh International Airport, PA
NWS Station for Calculating Surface Characteristics	Penn Valley/Selinsgrove Airport, PA
Methodology for Calculating Background SO_2 Concentration	Tier 2: Seasonal, Hourly Varying
Calculated Background SO_2 Concentration	2.62 $\mu g/m^3$ to 19.21 $\mu g/m^3$

The results presented below in Table 4.4 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

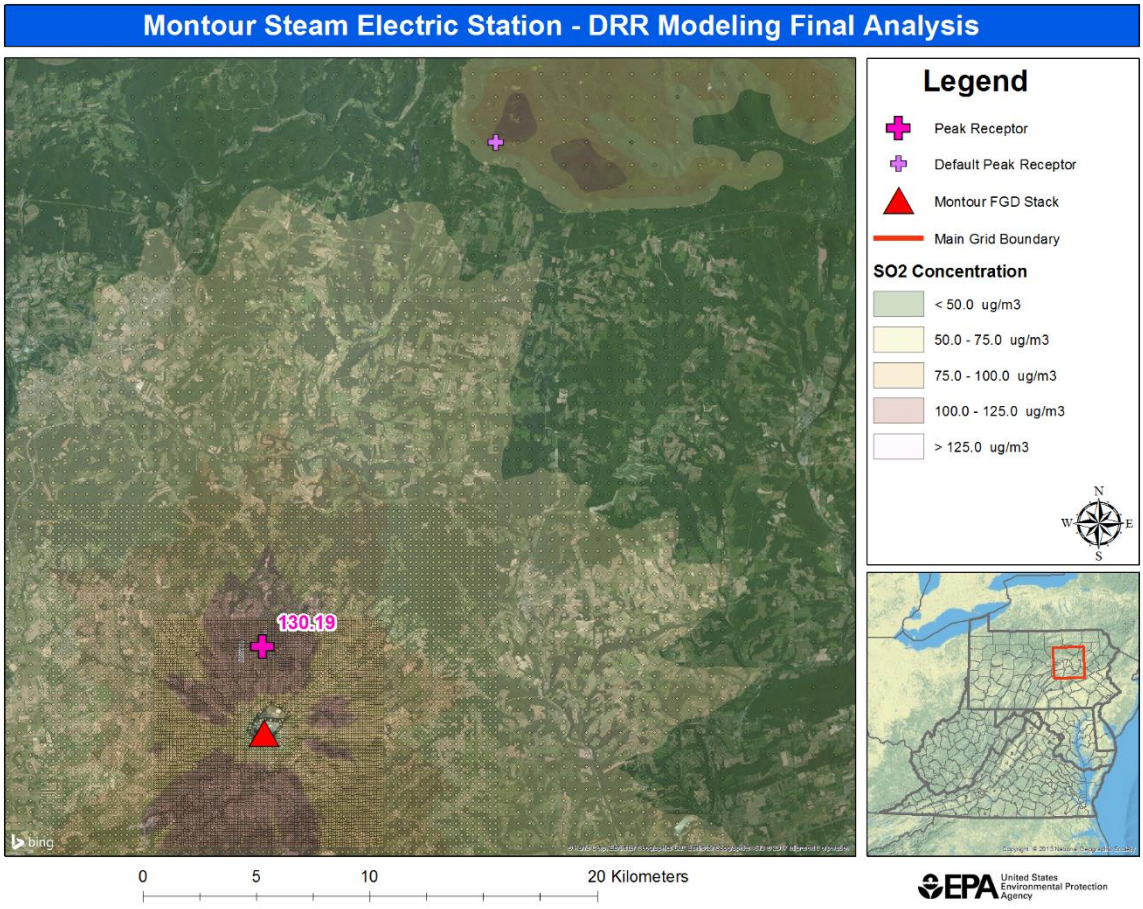
Table4.4. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Montour County Area. Results are from the adjust U* low wind option runs

Averaging Period	Data Period	Receptor Location [UTM zone 18]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM Easting	UTM Northing	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-15	359998	4551536	130.19	196.4*

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

The Commonwealth's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 130.19 µg/m^3, equivalent to 49.7 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facility. Figure 4.7below was created by EPA using the modeled output files provided by Pennsylvania, and indicates that the predicted value occurred approximately 3.8 km north of the Montour Steam Electric Station. The Commonwealth's receptor grid is also shown in the figure.

Figure 4.7: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Montour County Area



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

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

Pennsylvania submitted modeling using AERMOD version 16216 with both the Default and Adjust U* option for the Montour Steam Electric Generating facility located near Washingtonville, PA, in Montour County. No other large sources within 30 km of this facility were included in the modeling analysis. Two (2) nearby coal-fired sources were noted but operations at these sources will or have been converted to natural gas. Other minor SO_2 sources were noted at the Montour Steam Electric Station but they were not included in the final modeling analysis since they were determined to be too small or intermittent in nature to contribute. The final modeling analysis used representative meteorological data and a suitable background concentration.

The final model concentration was 130.19 $\mu g/m^3$, sufficiently below the standard to show actual operation at the Montour Steam Electric Plant does not violate the 1-hour SO_2 standard.

4.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Montour County, Pennsylvania 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.

4.5. Jurisdictional Boundaries in the Montour County, Pennsylvania Area

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

The modeling receptor grid in this analysis covered the entirety of the jurisdiction, in this case the entirety of Montour County, and the modeling analysis did not show any violations of the NAAQS in this jurisdiction.

In Pennsylvania's original recommendation on June 23, 2011, Pennsylvania recommended that the area surrounding the Montour Steam Electric Station, specifically the entirety of Montour County, be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the Montour Steam Electric Station but did not update their recommendation.

4.6. Other Information Relevant to the Designations for the Montour County, Pennsylvania 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 Montour County area of analysis.

4.7. The EPA's Assessment of the Available Information for the Montour County, Pennsylvania Area

The EPA finds that available air dispersion modeling results show that the Montour County area of analysis is meeting the 1-hour SO_2 NAAQS. Based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined that the Montour County area meets the 2010 SO_2 NAAQS, and does not contribute to ambient air quality in a nearby area that does not meet the NAAQS. No air quality monitors are in the area analysis. Pennsylvania's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 130.19 μg/m3, equivalent to 49.7 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the Montour Steam Electric Generating facility. No other sources within 30 km of this facility were included in the modeling analysis. The final modeling analysis used representative meteorological data and a suitable background concentration.

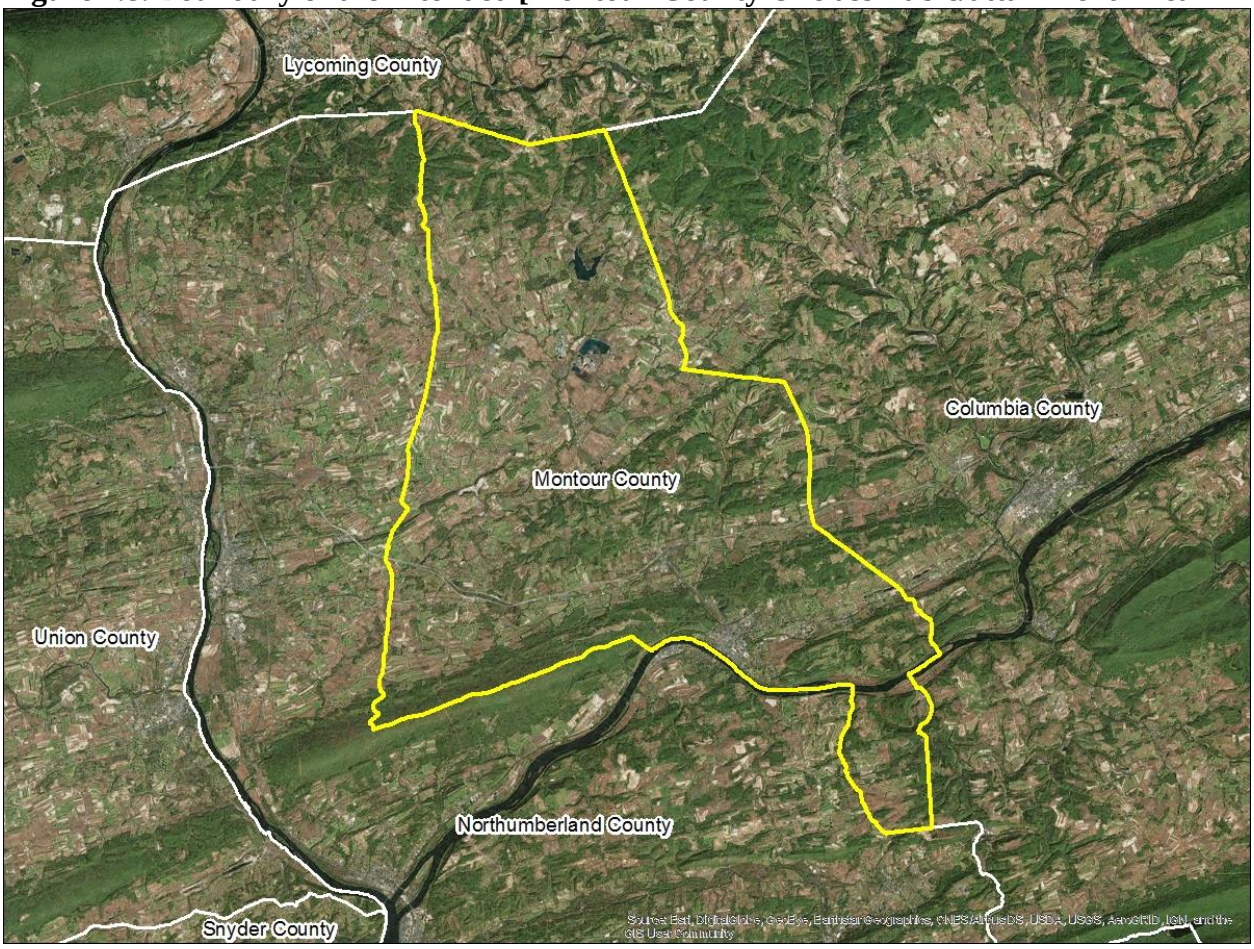
Pennsylvania has recommended that the entire county be designated as a stand-alone area. The EPA agrees with Pennsylvania's jurisdiction and boundary selections and concludes that our intended unclassifiable/attainment area, bounded by the county jurisdictional boundaries, will have clearly defined legal 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 Montour County, Pennsylvania Area

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, the EPA intends to modify the state's recommendation and designate Montour County area as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of the jurisdictional boundary for Montour County, Pennsylvania.

Figure 4.8 shows the boundary of this intended designated area.

Figure 4.8. Boundary of the Intended [Montour County Unclassifiable/attainment Area



At this time, our intended designations for the Commonwealth only apply to this area and the other areas presented in this technical support document.

5. Technical Analysis for the Remaining Undesignated Portion of Allegheny County

5.1. Introduction

The EPA must designate the remaining portion of the Allegheny County area by December 31, 2017, because the area has not been previously designated and Pennsylvania has not installed and begun timely operation of a new, approved SO_2 monitoring network to characterize air quality in the vicinity of the Cheswick Generating Station in the undesignated portion of Allegheny County. Pursuant to the DRR (*see* 40 CFR part 51, subpart BB), states had the option to characterize large sources of SO_2 by either monitoring, modeling or capping emissions below 2,000 tons of SO_2 per year. Although there are existing SO_2 monitors in Allegheny County, Pennsylvania submitted modeling for the Cheswick Generating Station that emits more than 2,000 tons of SO_2 per year.

5.2. Air Quality Monitoring Data for the Remaining Undesignated Portion of Allegheny County Area

This factor considers the SO_2 air quality monitoring data in the remaining undesignated portion of Allegheny County where Cheswick Generating Station is located. Although the Commonwealth did not provide specific monitoring data, EPA reviewed available monitoring data in this portion of Allegheny County. The maximum 2014-2016 DV in this portion of the county is found at AQS #42-003-0002 and is 30 ppb. This monitor is located approximately 24 km southwest of the Cheswick Generating Station. All valid DVs in this portion of the county are below the 75 ppb standard. However, EPA does not have information indicating this data is in an area of maximum concentration, so this data cannot be used as the basis for designation. Note that the asterisk (*) indicates the design value is incomplete/invalid.

Table 5.1: Air Quality Monitoring Data for the Allegheny County Area

County	AQS Monitor ID	Latitude	Longitude	2011-2013 Design Value	2012-2014 Design Value	2013-2015 Design Value	2014-2016 Design Value
Allegheny	42-003-0002	40.499767	-80.071337	40	37	38	30
Allegheny	42-003-0008	40.46542	-79.960757	26	21	21*	17*
Allegheny	42-003-0010	40.445577	-80.016155	24	25*	28*	-
Allegheny	42-003-0067	40.375644	-80.169943	22	20	20	16

*indicated incomplete/invalid design value

5.3. Air Quality Modeling Analysis for the Remaining Undesignated Portion of Allegheny County Area Addressing the Cheswick Generating Station

5.3.1. Introduction

This section 6.3 presents all the available air quality modeling information for a portion of Allegheny County that includes the Cheswick Generating Station located on an 82-acre site in the borough of Springdale, approximately 18 miles northeast of Pittsburgh. (This remaining undesignated portion of Allegheny County will often be referred to as "the Cheswick area" within this section 6.3.).

This area contains the following SO_2 source around which Pennsylvania 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 Cheswick Generation Station facility emitted 2,000 tons or more annually. Specifically, this facility emitted 4,445 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 Pennsylvania has chosen to characterize it via a modeling analysis.

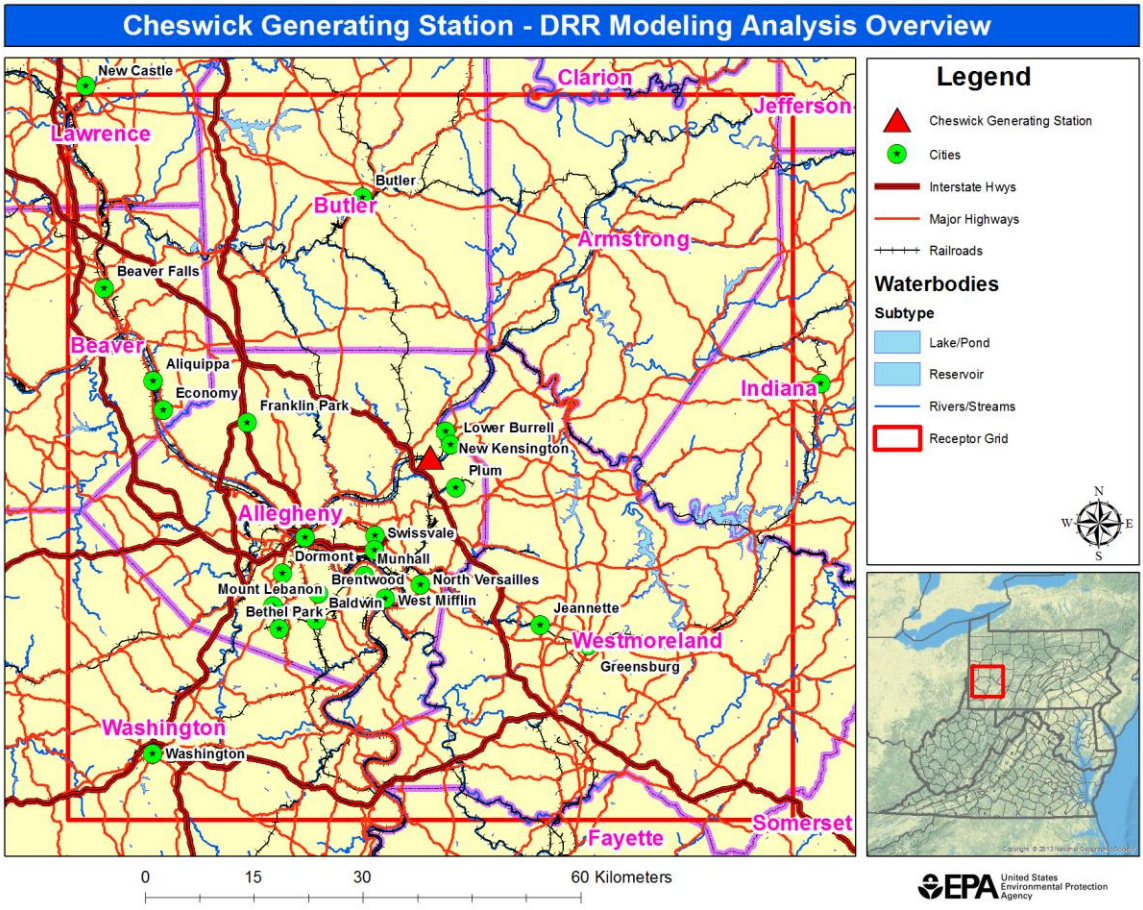
In Pennsylvania's original recommendation of June 23, 2011, Pennsylvania recommended that all of Allegheny County be designated nonattainment. However, in a letter of April 8, 2013, Pennsylvania requested that only a portion of the area be nonattainment, but did not indicate whether the remaining portions of the county should be unclassifiable or unclassifiable/ attainment. On August 5, 2013, (see 78 FR 47191) EPA designated a portion of Allegheny County as nonattainment. For detailed information about the nonattainment area and its related boundary see Pennsylvania TSD for Round 1 (https://www.epa.gov/sites/production/files/2016-03/documents/pa-tsd.pdf). The Cheswick Generating Station is located in the remaining portion of the county that has yet to be designated. On May 26, 2017, Pennsylvania submitted modeling for the Cheswick Generating Station but did not update their recommendations. As a result, there is no applicable recommendation for the remaining undesignated portion of Allegheny County from Pennsylvania. The modeling assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing critical emission values. After careful review of the Commonwealth's assessment, supporting documentation, and all available data, the EPA intends to designate the area as unclassifiable. Our reasoning for this conclusion is explained in a later section of this TSD.

The area that the Commonwealth has assessed via air quality modeling is located in southwest Pennsylvania in Allegheny County along the Allegheny River north of Pittsburgh.

As seen in Figure 5.1 below, the Cheswick Generating Station facility is located in southwest Pennsylvania. No other sources of SO_2 were included in the modeling analysis. The modeling domain extends 50 km from the Cheswick Generating Station and includes portions of twelve (12) counties in Pennsylvania including Allegheny, Armstrong, Beaver, Butler, Clarion, Fayette, Indiana, Jefferson, Lawrence, Somerset, Washington, and Westmorland.

The EPA's intended unclassifiable designation boundary for the Cheswick Area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

Figure 5.1. Map of the Remaining Undesignated Portion of Allegheny County Area Addressing Cheswick Generating 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 one modeling assessment from the Commonwealth of Pennsylvania.

5.3.2. Modeling Analysis Provided by the State

The Commonwealth of Pennsylvania submitted a modeling analysis for the region surrounding the Cheswick Generating Station on May, 26 2017.

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

PA DEP delivered its modeling analysis to the EPA on May 26, 2017. On January 17, 2017, EPA published its revision to Appendix W – Guideline to Air Quality Models. 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. This date has since passed and the revised Appendix W is in effect.

The modeling analysis submitted by Pennsylvania for the Cheswick Generation Station used AERMOD version 15181 in default mode. A wet flue gas desulphurization (FGD) system was put in-service and commenced operations in June 2010. Operations with the wet FGD system resulted in a substantial reduction in SO_2 emissions. An air dispersion modeling study was completed for the SO_2-emitting sources at the Cheswick Generating Station, the results of which indicate the short-term SO_2 emission rate required to demonstrate compliance with the health-based 1-hour SO_2 NAAQS.

A refined source characterization approach was used in the Cheswick Generating Station's analysis that accounts for latent heating from the wet FGD unit's near saturated plume. This latent heating could provide additional plume rise beyond what is currently calculated in AERMOD. This is done through the hourly emissions file in which the stack temperature is adjusted to account for the effects of moisture on final plume rise. This approach, referred to as "AERMOIST", is thought to result in a more accurate plume rise calculation. This source characterization approach has not currently undergone a thorough regulatory review and is not, at this time, an acceptable methodology to employ. The modeling submitted to support the final emission rate for the Cheswick Generating Station's critical emission value to meet the 1-hr SO_2 NAAQS, therefore, cannot be accepted as demonstrating compliance. A discussion of the Commonwealth'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.

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. This decision was based on a review of land use classification following the Auer method. Using the Auer method, the 3-km area surrounding Cheswick Generating Station is rural. Further support for the rural classification was given by reviewing the USGS National Land Cover Database (NLCD) (2011) data within a 3-km radius of the facility. The 2011 NLCD data show well over 50% of the area can be classified as rural land use which supports using rural dispersion in the modeling analysis. EPA reviewed this methodology and agrees with the rural determination.

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 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 are described in the introduction to this section. For the Cheswick Area, the state has included no other emitters of SO_2 within 50 km of Cheswick Generation 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 violations in the area of analysis. No other sources beyond 50 km were determined by the state to have the potential to cause concentration gradient impacts within the area of analysis. The modeling grid extends into the Allegheny, PA, 1-hour SO_2 nonattainment area, located in the southern portion of Allegheny County.

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

- a 50-m spaced Cartesian grid out to a distance of 2 km
- a 100-m spaced Cartesian grid between 2 and 5 km
- a 250-m spaced Cartesian grid between 5 km and 7.5 km
- a 500-m spaced Cartesian grid between 7.5 km and 10 km
- a 1,000-m spaced Cartesian grid between 10 km and 30 km
- a 2,000 meters between 30 km and 50 km

There were four (4) fence lines covering various portions of the Cheswick Generating Station. Receptors were spaced approximately every 25-m along the fence lines. This included the main complex, an area along the river with barge delivery, a small area directly west of the main plant, and a larger area northwest of the plant.

The receptor network contained 22,903 receptors, and the network covered a 50 by 50 km area that covers portions of Allegheny, Armstrong, Beaver, Butler, Clarion, Fayette, Indiana, Jefferson, Lawrence, Somerset, Washington, and Westmorland in Pennsylvania.

Figures 5.2 and 5.3, produced by EPA, show the Commonwealth's chosen area of analysis surrounding the Cheswick Generating 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. No areas outside the facility property boundary were excluded from model receptor placement for the modeling analysis.

Figure 5.2: Area of Analysis for the Cheswick Area

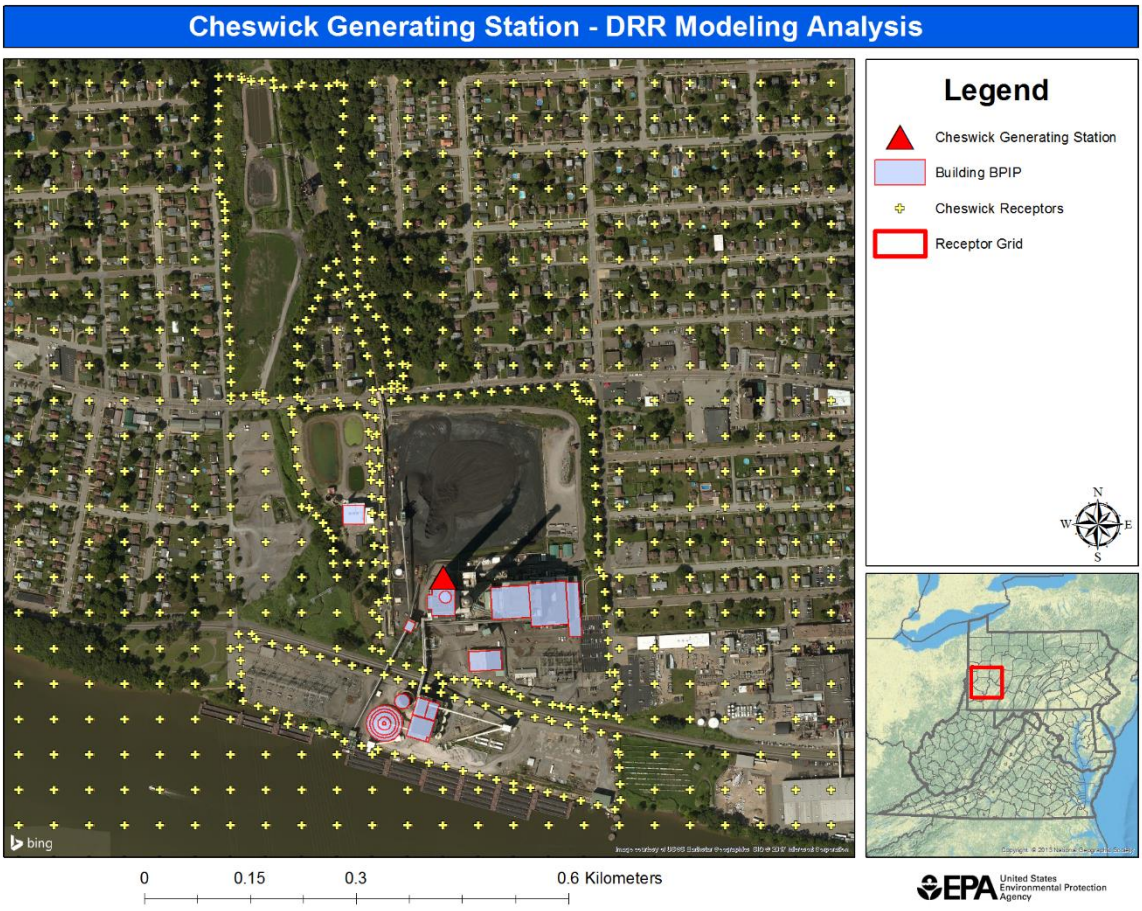
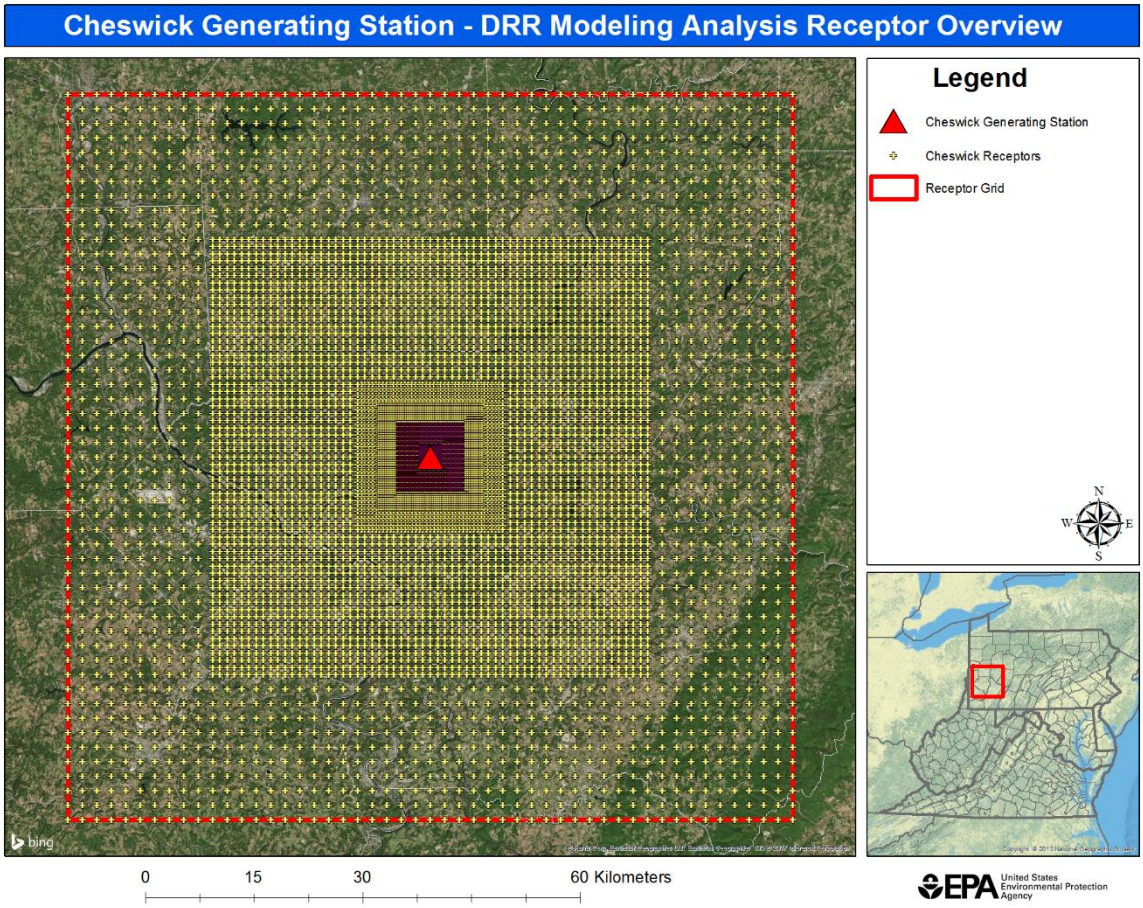


Figure 5.3: Receptor Grid for the Cheswick Area



EPA examined facility property boundaries for each facility using GIS software. Model results include building downwash and show each facility's peak model concentration occurs well away from the facility property boundaries meaning proper boundary delineation is not a critical component of the modeling analysis. EPA concludes that the model receptor grid is adequate to capture the maximum modeled concentrations.

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.

The Cheswick Generating Station has one (1) main coal-fired boiler unit that was put into service in 1970. The boiler was retrofitted with a wet flue gas desulphurization (FGD) system which commenced service in June 2010 and resulted in a substantial reduction in SO_2 emissions. In

addition to the main unit, there is an auxiliary boiler powered by No. 2 fuel oil, two (2) diesel fuel-fired air compressors, and various temporary diesel fuel-fired water pumps. Only the main boiler was included in the modeling analysis. The other sources historical emissions and operations were reviewed and it was determined that their operations were too infrequent and their emissions were too small to be expected to contribute significantly to the annual distribution of daily maximum 1-hour concentrations. This is in accordance with EPA's March 1, 2011 Clarification Memo.

The main coal-fired boiler unit at the Cheswick Generating Station exhausts through a 168.4 m FGD stack. Construction of the current FGD system stack was completed in July 2009, so its creditable height for modeling is subject to the stack height regulations. Stack and building parameters were entered into BPIP to calculate downwash parameters for the modeling analysis. BPIP calculated that the stack GEP height is 168.4 m based on the height and projected width of the boiler house building.

Cheswick Generating Station first conducted an analysis to identify which boiler load scenario causes the highest modeled SO_2 impacts. The load scenarios of minimum sustainable load, mid load, and maximum load were evaluated. Exit velocity and exit temperatures for each case were selected based on the median values of continuous emission monitor (CEM) data for each load scenario. The loading analysis determined that the maximum modeled load case was the controlling case and this scenario was used to determine the critical emission value.

Wet FGD systems, such as the one installed at the Cheswick Generating Station, result in a flue gas stream that is typically saturated at the flue gas temperature (normally > 100 deg. F) and pressure. Upon discharge to the atmosphere, water vapor in the flue gas stream condenses to form water droplets, with a corresponding release of (latent) heat of condensation. This heat release acts to make the plume gases warmer and gives the plume a higher buoyant vertical velocity. Some of the initial boost is lost as the droplets eventually evaporate on mixing (i.e., a cooling effect). However, the heating/cooling process, like that of an updraft in a cloud, is asymmetric and in the bulk sense a net gain in plume rise is realized. The largest net rise is realized for the situation where the ambient air itself is close to saturation.

A refined source characterization approach that appropriately accounts for this process can be conducted through the use of an hourly emissions file for which the stack temperature is adjusted to account for the effects of moisture in the exhaust plume. The resultant hourly emissions file is then input to AERMOD. This approach, referred to as "AERMOIST," does not change the model, but is intended by the Commonwealth to result in more accurate plume rise calculations. This source characterization approach was in the modeling analysis to determine the critical emission value for the Cheswick Generating Station.

The AERMOD hourly emission file was examined to determine the range of stack temperature adjustments made by AERMOIST. Table 5.2 indicates the stack temperature "boost" over the maximum load stack temperature (327.15 K). AERMOIST appears to have increased stack temperature by at least 15 K for nearly every hour of the model simulation. The maximum increase in stack temperature was over 150 K yielding a maximum hourly stack temperature of

over 480 K, which is generally unrealistic for coal-fired boilers that have wet FGD units. Similar results (using AERMOIST) were documented in Round 2 SO_2 designations for Texas.[17]

Table 5.2 temperature "boost" differences in the hourly stack temperatures for the Cheswick Generating Station from AERMOIST

Stack Temperature Increase (K)	# of Hours
0.0	2
7.5	0
15.0	15,668
22.5	4,054
30.0	2,275
37.5	1,305
45.0	818
52.5	576
60.0	410
67.5	402
75.0	233
More	537

EPA concludes that the source characterization for the Cheswick Generating Station is generally correct outside the hourly stack temperature adjustments made using the AERMOIST processor. Stack temperature adjustments appear to be, at a minimum, 15 K with AERMOIST boosting stack temperatures by over 100 K in some instances. This temperature boost to account for additional lift due to the saturated plume exiting the wet FGD unit seems to produce much higher temperatures than what would be expected from a coal-fired boiler. At this time, this process has not been given adequate review by EPA and Pennsylvania and cannot be used to justify a modeled critical emission value to ensure compliance with the 1-hour SO_2 NAAQS.

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 concludes 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).

[17] https://www.epa.gov/sites/production/files/2016-11/documents/texas_4_deferred_luminant_tsd_final_docket.pdf

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 that 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 the Cheswick Generating Station and no other emitters of SO_2 are located within 50 km in the area of analysis. The Commonwealth did not model actual emissions. The Commonwealth had intended to model this facility to develop a critical emission value that would be made into a federally enforceable PTE limit for SO_2 emissions. The facility in the Commonwealth's modeling analysis, its actual emissions from 2013-15, and its modeled critical emission value emission rate are summarized below.

For the Cheswick Generating Station, the Commonwealth provided the modeled critical emission value to show compliance with the 1-hour SO_2 NAAQS. This information along with past actual emission values are summarized in Table 5.3. A description of how the state obtained hourly emission rates is given below this table.

Table 5.3. SO_2 Emissions based on PTE from Facilities in the Cheswick Area

Modeled Critical Emission Values	
Facility Name	**SO_2 Emissions (tons per year, based on PTE)**
Cheswick (3,936 lbs/hr/495.93 g/s)	17,239.7
Not to be exceeded > 500 hours per year	
24-hr Limit 3,109.4 lb/hr	
Total Emissions from All Facilities in the Area of Analysis	**17,239.7**

CAMD Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**

Cheswick	1,686.3	4,445.3	1,690.0
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	1,686.3	4,445.3	1,690.0

eFACTS[18] Emissions (State Reported)			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Cheswick	1,686.4	4,445.4	1,690.2
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**1,686.4**	**4,445.4**	**1,690.2**

2014 NEI Emissions	
Facility	**2014 NEI SO_2 Emissions (tpy)**
Cheswick Generating Station	4,445.4
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**4,445.4**

The critical emission value for the main coal-fired unit in pounds per hour/grams per second for the Cheswick Generating Station was determined by the state based on its modeling analysis. However, the limit that was modeled is not yet federally enforceable. In addition, this critical emission value relied on the AERMOIST processor and may not be protective of the 1-hour SO_2 NAAQS. A longer (24 hour) averaging time was also calculated following steps in the procedure for determining the longer-term emission limit are included in Appendix C of the EPA's April 23, 2014 guidance.[19] The hourly critical emission limit could also be exceeded for up to 500 hours per year as noted in Pennsylvania's submission. The modeled critical emission values are not currently part of the Cheswick Generating Station's formal emission limits.

[18] http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facilityemissions.aspx
[19] https://www.epa.gov/sites/production/files/2016-06/documents/20140423guidance_nonattainment_sip.pdf

5.3.2.6. Modeling Parameter: Meteorology and Surface Characteristics

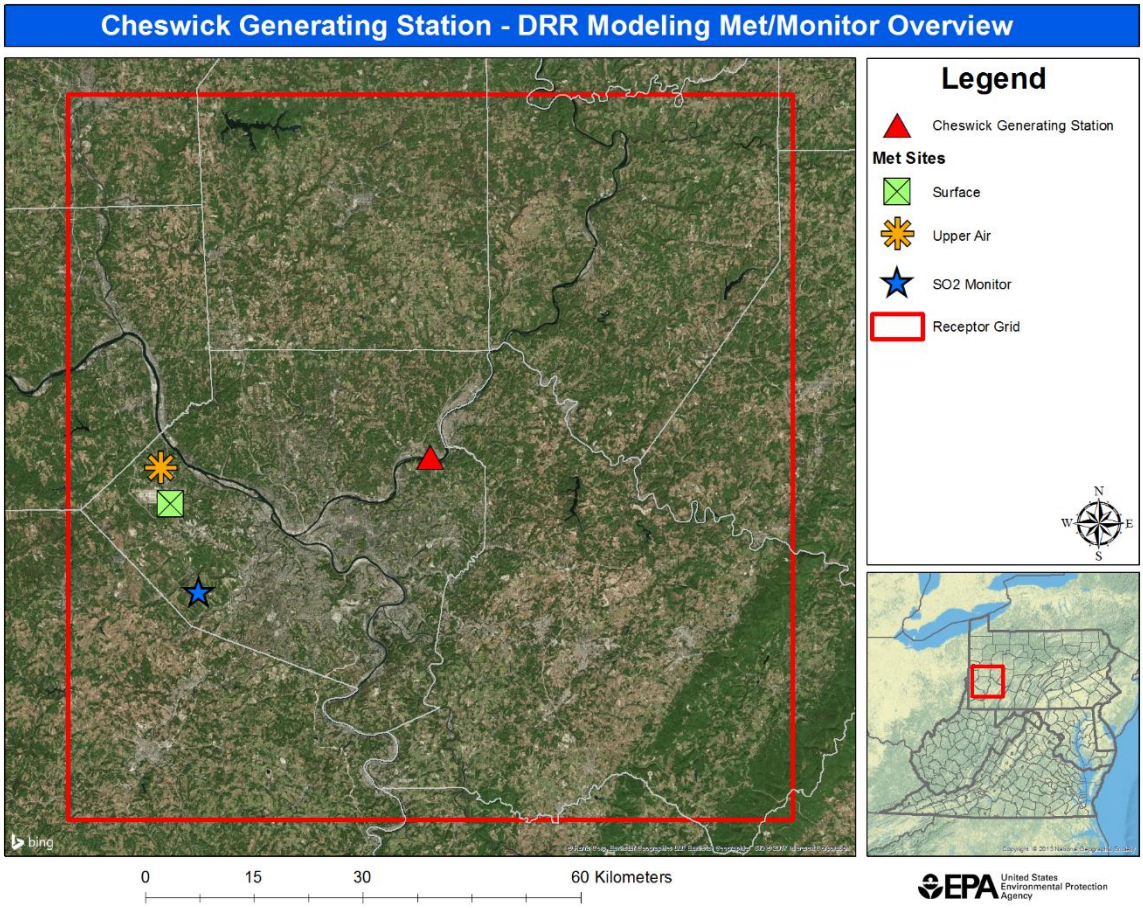
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of 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 Cheswick Area, the Commonwealth selected the surface meteorology from the Pittsburgh International Airport located in Allegheny County, PA, along with coincident upper air observations also from the Pittsburgh International Airport as the best representative of meteorological conditions within the area of analysis. The PA DEP provided the final processed meteorological data used in the modeling analysis. While both sets of meteorological data were collected at the Pittsburgh International Airport, they are not collected in the same place. Surface measurements are located approximately 36 km west of the Cheswick Generating Station while upper air measurements are collected approximately 37 km west of the Cheswick Generating Station.

The Commonwealth used AERSURFACE version 13016 using data from Pittsburgh International Airport ASOS site to estimate the surface characteristics of the area of analysis. The Commonwealth estimated values for twelve (12) spatial sectors out to 1.0 km at a seasonal temporal resolution for dry, wet, average conditions based on local climatological data. 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”).

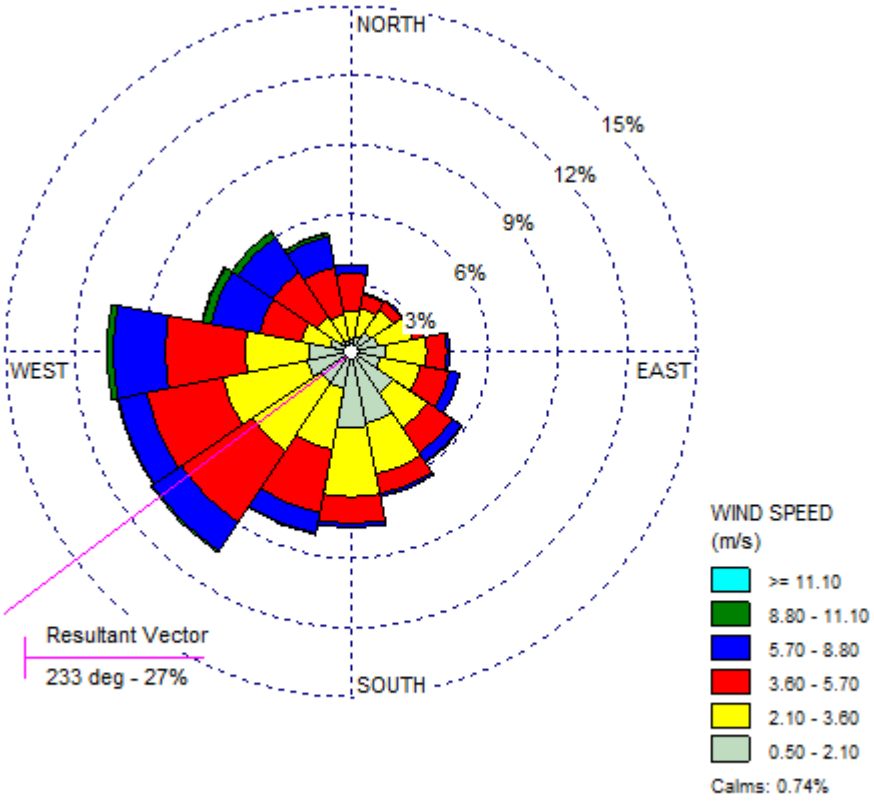
In the figure below, generated by the EPA, the location of the NWS stations and SO_2 monitoring site are shown relative to the area of analysis. All of the NWS and monitoring sites lie within the modeling domain.

Figure 5.4. Cheswick Area of Analysis and the NWS station in the Cheswick Area



As part of its recommendation, the Commonwealth provided the 3-year surface wind rose for the Pittsburgh International Airport site for 2013-15. In Figure 5.5, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose was produced using the final processed AERMET sfc file in Lakes Environmental's WRPLOT program. Winds were primarily from the west-southwest. A resultant wind vector of all hours was from a southwesterly direction. The anemometer height used to generate the AERMET-ready files matched the height listed for the Pittsburgh International Airport (33 ft, 10 m).

Figure 5.5 Cheswick 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. The state followed the methodology and settings presented in EPA's Modeling TAD and related guidance 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 Pittsburgh 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.

AERMOD ready meteorological data was produced using the default version of AERMET version 15181 for the modeling analysis used to establish the critical emission value that is protective of the 1-hour SO_2 NAAQS. As noted previously, the modeling analysis for the Cheswick Generating Station utilized the AERMOIST processor. It should be noted that AERMOIST uses NWS relative humidity measurements to adjust the hourly stack temperatures. Relative humidity measurements are taken at 2 meters and may not necessarily always be representative of ambient relative humidity levels at the stack release height, in this case 168.4 meters.

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

The terrain in the area of analysis is best described as hilly. The Cheswick Generating Station sits inside the Allegheny Plateau physiographic province of the Appalachian Mountains. 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 terrain elevations from 1-arc second, or 30-meter, National Elevation Data (NED) from USGS were used to develop the receptor terrain elevations required by AERMOD. EPA concludes the terrain was properly accounted for in the modeling analysis.

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, the state used a (Tier 2) seasonal, hourly varying background concentration from the South Fayette (42-003-0067) monitor located in Allegheny County, PA. The background concentrations for this area of analysis were determined by the state to vary from 7.86 micrograms per cubic meter ($\mu g/m^3$), equivalent 3.0 ppb when expressed in two significant figures,[20] to 28.82 $\mu g/m^3$ (11.0 ppb), with an average value of 16.35 $\mu g/m^3$ (6.2 ppb). The South Fayette monitor is located approximately 37 km southwest of the Cheswick Generating Station and probably provides an adequate representative background concentration.

5.3.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Cheswick Area of analysis are summarized below in Table 5.4.

[20] 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 5.4 Summary of AERMOD Modeling Input Parameters for the Cheswick Area of Analysis

Input Parameter	Value
AERMOD Version	15181 with AERMOIST Hourly Stack Temp Adjustment
Dispersion Characteristics	Rural
Modeled Sources	1
Modeled Stacks	1 (Stack meets GEP)
Modeled Structures	12
Modeled Fencelines	4 Separate Areas
Total receptors	22,903
Emissions Type	Emission Limit
Emissions Years	2013-2015 [Effective year of new limits for PTE]
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Pittsburgh International Airport, PA
NWS Station Upper Air Meteorology	Pittsburgh International Airport, PA
NWS Station for Calculating Surface Characteristics	Pittsburgh International Airport, PA
Methodology for Calculating Background SO_2 Concentration	Seasonal Temporal Varying
Calculated Background SO_2 Concentration	7.86 to 28.86 $\mu g/m^3$

The results presented below in Table 5.5 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

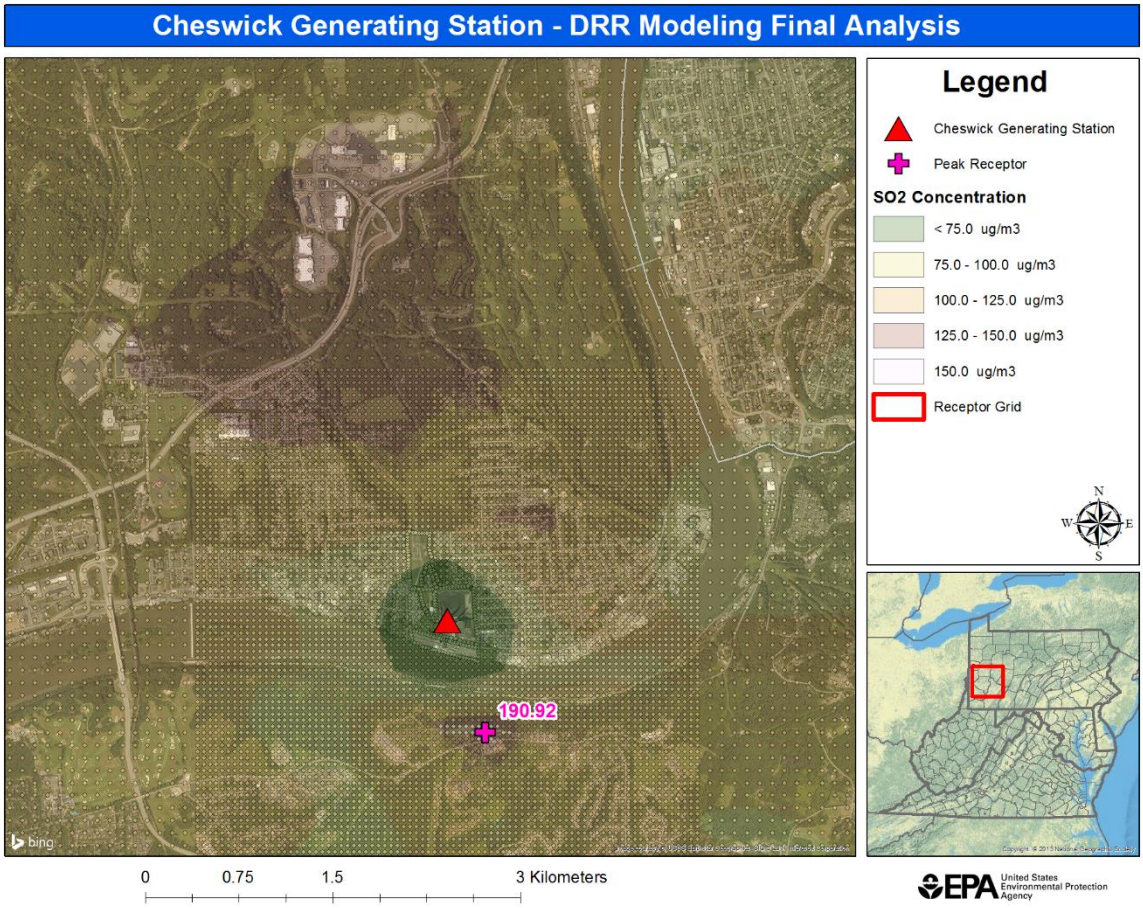
Table 5.5 Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Cheswick Area of Analysis

Averaging Period	Data Period	Receptor Location [UTM zone 17, if applicable]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM	UTM	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-15	602,667	4,487,354	190.92	196.4*

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

The Commonwealth's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 190.92 µg/m^3, equivalent to 72.9 ppb. This modeled concentration included the background concentration of SO_2, and is based on the modeled critical emission value calculated for the facility. Figure 5.6 below was produced from the state's modeling submittal, and indicates that the predicted value occurred approximately 1 km south-southeast of the Cheswick Generating Station in Allegheny County, PA. A portion of the Commonwealth's receptor grid is also shown in the figure.

Figure 5.6: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Cheswick Area



The modeling submitted by the Commonwealth does not show that the 1-hour SO_2 NAAQS would be violated at the receptor with the highest modeled concentration using a critical emission value for the Cheswick Generating Station. Pennsylvania's modeling analysis determined a critical emission value -hour emission rate of 3,936 lb/hr. A longer-term 24-hr limit was determined following Appendix C of the EPA's April 23, 2014 1-hour SO_2 nonattainment guidance based on the modeled critical emission value. However, as previously indicated, the limit that was modeled is not federally enforceable and cannot be relied upon for designating the area.

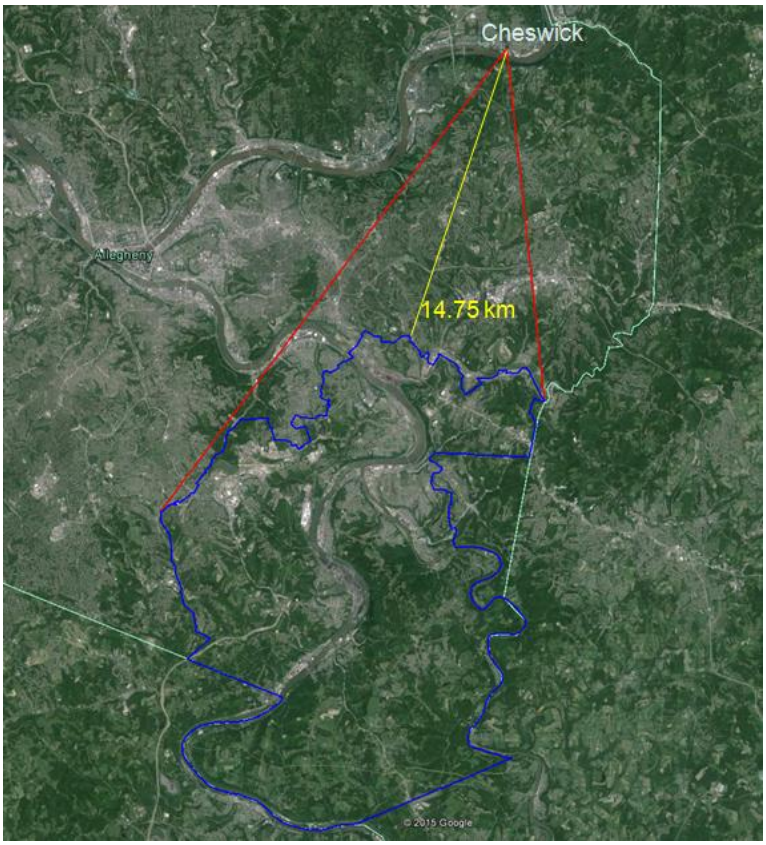
5.3.2.10. The EPA's Assessment of the Modeling Information Provided by the State

As noted previously, the use of the AERMOIST stack temperature adjustment process has not, at this time, been fully analyzed by EPA for validity and applicability to sources such as the Cheswick Generating Station. AERMOIST stack temperature adjustments to account for the impacts of latent heating of the wet FGD saturated plumes on final plume rise can exceed 100 K. Temperature adjustments exceeding 100 K were noted in this modeling analysis. Given that AERMOIST has currently not received a proper evaluation, the use of this plume adjustment does not, in EPA's opinion, support that the modeled critical emission value presented in this modeling analysis is necessarily protective of the health based 1-hour SO_2 NAAQS. Also since the emission limit modeled is not currently federally enforceable, the analysis cannot be used to determine the designation for the area.

Pennsylvania's analysis does not address potential impacts from sources inside the Allegheny, PA nonattainment area located ~15 km south of the Cheswick Generating Station (see Figure 5.7). A formal source screening analysis should be considered to determine if other sources in the vicinity of the Cheswick Generating Station should be included in the modeling analysis. This type of source screening analysis was performed as part of Allegheny County's 1-hour SO_2 SIP modeling analysis[21].

[21] See appendix E: http://www.achd.net/air/regulations.html

Figure 5.7: Map showing the Cheswick Generating Station and the Allegheny, PA 1-hour SO_2 nonattainment area (from Allegheny County 1-Hour SIP document, Appendix E)



EPA also notes that the proposed limit for the Cheswick Generating Station far exceeds current actual emission levels. Allegheny County's source screening analysis found little to no impact from the Cheswick Generating Station using current actual emission levels (since full installation of the wet FGD unit). The proposed limit is nearly ten (10) times higher than the Cheswick Generating Station's current actual emission levels. If emission levels would actually approach the proposed limit then the assumption that emissions from Cheswick Generating Station would not contribute to the Allegheny, PA nonattainment area would probably no longer be valid. In our opinion, the final permitted emission limit imposed on the Cheswick Generating Station should be made with some consideration to the nearby Allegheny, PA 1-hour SO_2 nonattainment area. Facility limits should ensure that emissions from the Cheswick Generating Station would not interfere with the Allegheny, PA nonattainment area's ability to meet the 1-hour SO_2 NAAQS.

5.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Remaining Undesignated Portion of Allegheny County Area Addressing the Cheswick Generating Station

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 Remaining Undesignated Portion of Allegheny County Addressing the Cheswick Generating Station

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

A portion of Allegheny County is already designated as nonattainment. The remaining portion where Cheswick is located did not receive a specific designation recommendation from the state. However, this portion of Allegheny County must receive a designation. The state originally recommended the entire county be nonattainment but later revised this recommendation, only indicating that a portion of Allegheny County be designated nonattainment.

5.6Other Information Relevant to the Designations for the Remaining Undesignated Portion of Allegheny County Area

The undesignated portion of the Allegheny County Area borders the Allegheny County, PA nonattainment area. Based on available information, it is unclear if the Cheswick Generating Station in the area of analysis is contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS.

5.6. The EPA's Assessment of the Available Information for the Remaining Undesignated Portion of Allegheny County Area

The EPA finds that available air quality monitoring data alone are unreliable to be considered representative of the area's air quality. Although the design values from the air quality monitors located within this area of analysis are well below the standard of 75 ppb (16 and 30 ppb), it is unclear if the monitors are located in areas of maximum concentration, and therefore, it is unclear if the monitoring data is representative of actual air quality in the area.

The EPA reviewed the modeling information submitted for this area. While the modeling analysis indicates the area would attain the NAAQS, the EPA found significant issues with the analyses such as the use of AERMOIST, and modeling emissions that do not reflect a current federally enforceable limit or actual emissions. Therefore, the modeling cannot be used as a basis for the designations nor can it be used to determine whether this area contributes to the nonattainment of a nearby area. As a result, the EPA intends to designated the area as unclassifiable.

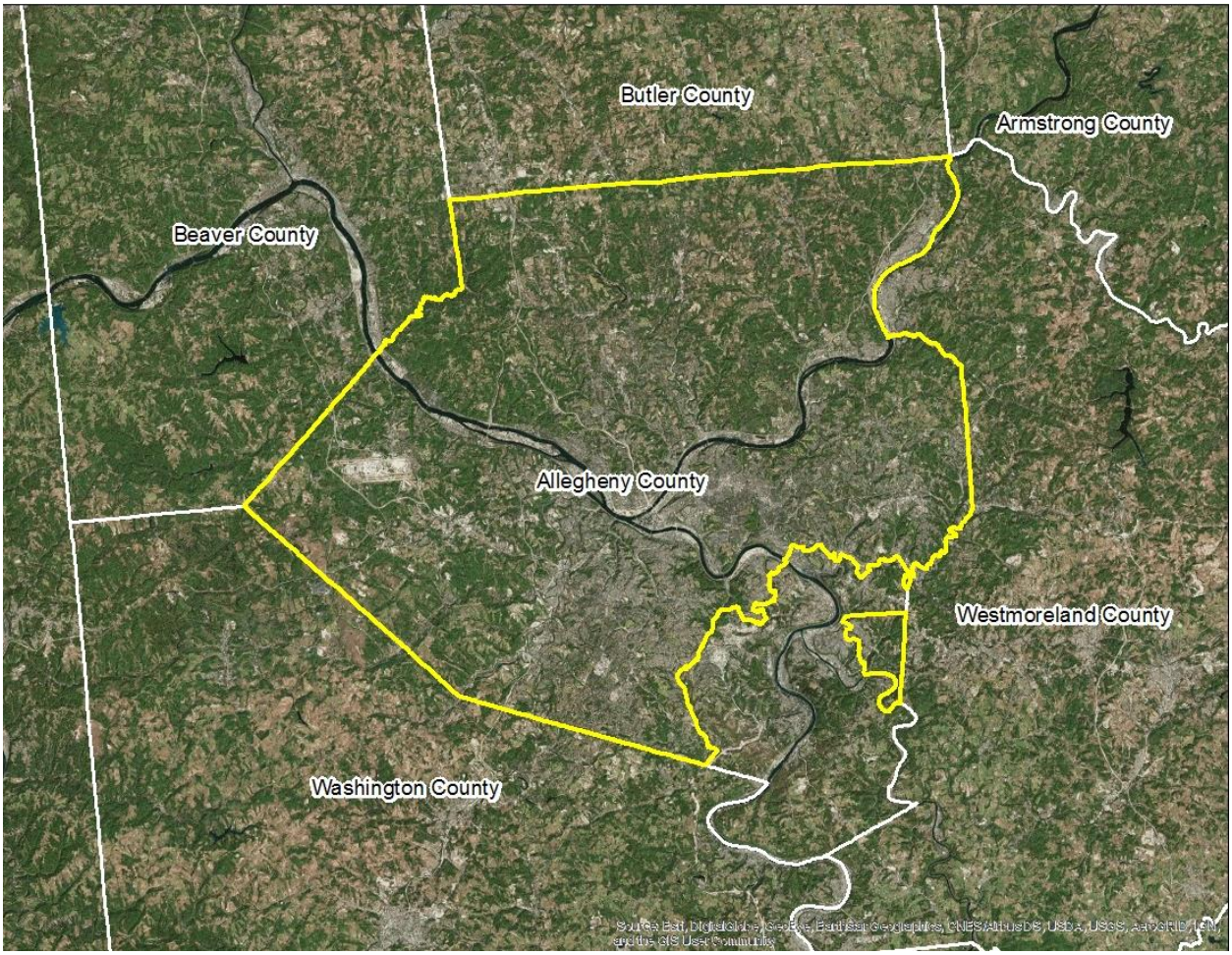
The EPA concludes that our intended unclassifiable area, bounded by the remaining undesignated portion of Allegheny County will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable area.

5.7. Summary of Our Intended Designation for the Remaining Undesignated Portion of Allegheny County Area

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the remaining portion of Allegheny County as unclassifiable for the 2010 SO_2 NAAQS. The remaining undesignated portion of Allegheny County unclassifiable 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 SO2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS. Specifically, the boundaries are comprised of all portions of Allegheny County that are not contained in the following areas: Borough of Braddock, Borough of Dravosburg, Borough of East McKeesport, Borough of East Pittsburgh, Borough of Elizabeth, Borough of Glassport, Borough of Jefferson Hills, Borough of Liberty, Borough of Lincoln, Borough of North Braddock, Borough of Pleasant Hills, Borough of Port Vue. Borough of Versailles, Borough of Wall, Borough of West Elizabeth, Borough of West Mifflin, City of Clairton, City of Duquesne, City of McKeesport, Elizabeth Township, Forward Township, and North Versailles Township.

Figure 5.8 shows the boundary of this intended designated area.

Figure 5.8. Boundary of the Intended Remaining Portion of Allegheny County] Unclassifiable] Area



At this time, our intended designations for the state only apply to this area and the other areas presented in this technical support document.

6. Technical Analysis for the Lawrence County Area

6.1. Introduction

The EPA must designate the Lawrence County, Pennsylvania, area by December 31, 2017, because the area has not been previously designated and Pennsylvania 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 Lawrence County. Pursuant to the DRR (*see* 40 CFR part 51, subpart BB), states had the option to characterize large sources of SO_2 by either monitoring, modeling or capping emissions below 2,000 tons of SO_2 per year. Although there is an existing SO_2 monitor in Lawrence County, Pennsylvania submitted modeling for the New Castle Generating Station that emits more than 2,000 tons of SO_2 per year.

6.2. Air Quality Monitoring Data for the Lawrence County, PA Area of Analysis

This factor considers the SO_2 air quality monitoring data in the area of Lawrence County where New Castle Generating Station is located. Although the state did not provide specific monitoring data, EPA reviewed available monitoring data in Lawrence County. The 2014-2016 DV in this county is found at AQS #42-073-0015 and is 31 ppb. This monitor is located approximately 6 km north of the New Castle Generating Station. All valid DVs in this portion of the county are below the 75 ppb standard. However, the EPA does not have information indicating this data is in an area of maximum concentration, so this data cannot be used as the basis for designation. Note that * is incomplete/invalid design value.

Table 6.1: Air Quality Monitoring Data for the Lawrence County Area

County	AQS Monitor ID	Latitude	Longitude	2011-2013 Design Value	2012-2014 Design Value	2013-2015 Design Value	2014-2016 Design Value
Lawrence	42-073-0015	40.995848	-80.346442	40*	30*	36	31

6.3 Air Quality Modeling Analysis for the Lawrence County Area Addressing the New Castle Generating Station

6.3.1 Introduction

This section 6.3 presents all the available air quality modeling information for Lawrence County, Pennsylvania that includes the New Castle Generating Station. The New Castle Generating Station is located on a 270-acre site four miles south of New Castle, PA in Taylor Township, West Pittsburg, Lawrence County, Pennsylvania. (This portion of Lawrence County will often be referred to as "the Lawrence County area" within this section 6.3.)

A gas conversion project was scheduled to be completed in 2016, allowing the facility to operate on cleaner burning natural gas and significantly reduce emissions[22]. Coal-firing capabilities were retained to allow fuel flexibility. Modeling was proposed to establish limits that would be protective of the health-based 1-hr SO_2 NAAQS. These limits would need to be federally enforceable by incorporation into a construction permit or the Pennsylvania SIP.

This area contains the following SO_2 source, which is the only source in the area around which Pennsylvania 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 New Castle Generating station facility emitted 2,000 tons or more annually. Specifically, this source emitted 3,960 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 Pennsylvania has chosen to establish emission limit and use that limit in a modeling analysis to show compliance with the 1-hr SO_2 NAAQS.

In its original recommendations dated June 23, 2011, Pennsylvania recommended that Lawrence County, an area that includes the area surrounding the New Castle Generating Station, be designated as unclassifiable. Subsequently, Pennsylvania submitted a modeling assessment and characterization of air quality impacts from this facility. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, to attempt to establish emission rates that are protective of the 1-hr SO_2 NAAQS. After careful review of the Commonwealth's assessment, supporting documentation, and all available data, the EPA agrees with the Commonwealth'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.

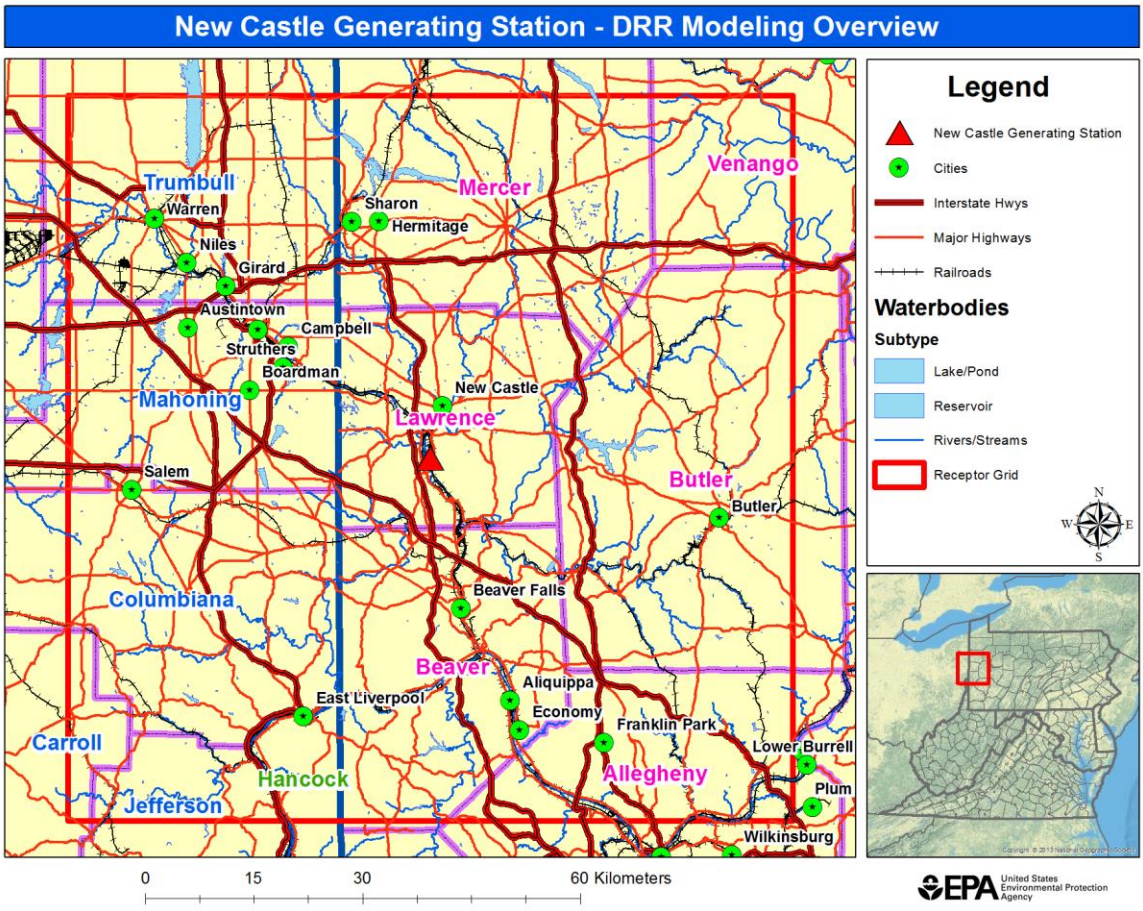
The area that the state has assessed via air quality modeling is located in western Pennsylvania in Lawrence County along the Beaver River.

As seen in Figure 6.1 below, the New Castle Generating Station facility is located in western Pennsylvania. No other sources of SO_2 were included in the modeling analysis. The modeling domain extends 50 km from the New Castle Generating Station and includes portions of counties in Pennsylvania, Ohio, and West Virginia. The Pennsylvania counties include Allegheny, Armstrong, Beaver, Butler, Lawrence, Mercer, and Venango County. The Ohio counties include Carroll, Columbiana, Jefferson, Mahoning, and Trumbull. A portion of Hancock county in West Virginia is also included in the modeling domain.

The EPA's intended unclassifiable designation boundary for the Lawrence County area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

[22] http://maps.nrg.com/media/attachments/PLA.2016_New_Castle_v1_0c1LKM5.pdf

Figure 6.1. Map of the Lawrence County Area Addressing New Castle Generating 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 one modeling assessment from the Commonwealth of Pennsylvania.

6.2.1.1. 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

PA DEP delivered its modeling analysis to EPA on May 26, 2017. On January 17, 2017, EPA published its revision to Appendix W – Guideline to Air Quality Models. 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. This date has since passed and the revised Appendix W is in effect.

The modeling analysis completed by Pennsylvania for the New Castle Generation Station was submitted using AERMOD version 15181 with the Adjust U* option. EPA released a memo dated March 8, 2017, entitled *Clarification on the AERMOD Modeling System Version for Use in SO_2 Implementation Efforts and Other Regulatory Actions*[23] which states:

> "*[B]ecause the use of AERMET version 15181 with the ADJ_U* beta option contains a known and corrected formulation bug that leads to concentration under predictions, the associated AERMOD modeling results would be unreliable as a basis for determinations of SO_2 air quality in the modeled area*."

Given this technical deficiency, the modeling submitted cannot be used to support a designation of unclassifiable/attainment. A discussion of the Commonwealth's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

6.2.1.2. 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 mode. This decision was based on a review of land use classification following the Auer method. Using the Auer method, the 3-km area surrounding New Castle Generating Station is rural. Further support for the rural classification was given by reviewing the USGS National Land Cover Database (NLCD) (2011) data within a 3-km radius of the facility using the Auer method. The 2011 NLCD data show well over 50% of the area can be classified as rural land use which supports using rural dispersion in the modeling analysis. EPA reviewed this methodology and agrees with the rural determination.

6.2.1.3. 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

[23] https://www3.epa.gov/ttn/scram/guidance/clarification/SO2_DRR_Designation_Modeling_Clarificaiton_Memo-03082017.pdf

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 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 are described in the introduction to this section. For the Lawrence County area, the state has included no other emitters above 100 tpy of SO_2 within Lawrence County. 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 violations in the area of analysis. No other sources beyond 50 km were determined by the state 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:
- a 50-m spaced Cartesian grid out to a distance of 2 km
- a 100-m spaced Cartesian grid between 2 and 5 km
- a 250-m spaced Cartesian grid between 5 km and 7.5 km
- a 500-m spaced Cartesian grid between 7.5 km and 10 km
- a 1,000-m spaced Cartesian grid between 10 km and 30 km
- a 2,000 meters between 30 km and 50 km

There was only one fence line surrounding the New Castle Generating Station. Receptors were spaced approximately every 25-m along the fence line.

The receptor network contained 23,254 receptors, and the network covered portions of counties in Pennsylvania, Ohio, and West Virginia. The Pennsylvania counties included Allegheny, Armstrong, Beaver, Butler, Lawrence, Mercer, and Venango. In Ohio, the network included portions of Carroll, Columbiana, Jefferson, Mahoning, and Trumbull counties. A portion of Hancock County in West Virginia is also included in the modeling domain.

Figures 6.2 and 6.3, included in the state's recommendation, show the state's chosen area of analysis surrounding the New Castle Generating 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 n. No areas outside the facility property boundary were excluded from model receptor placement for the modeling analysis.

Figure 6.2: Area of Analysis for the Lawrence County Area

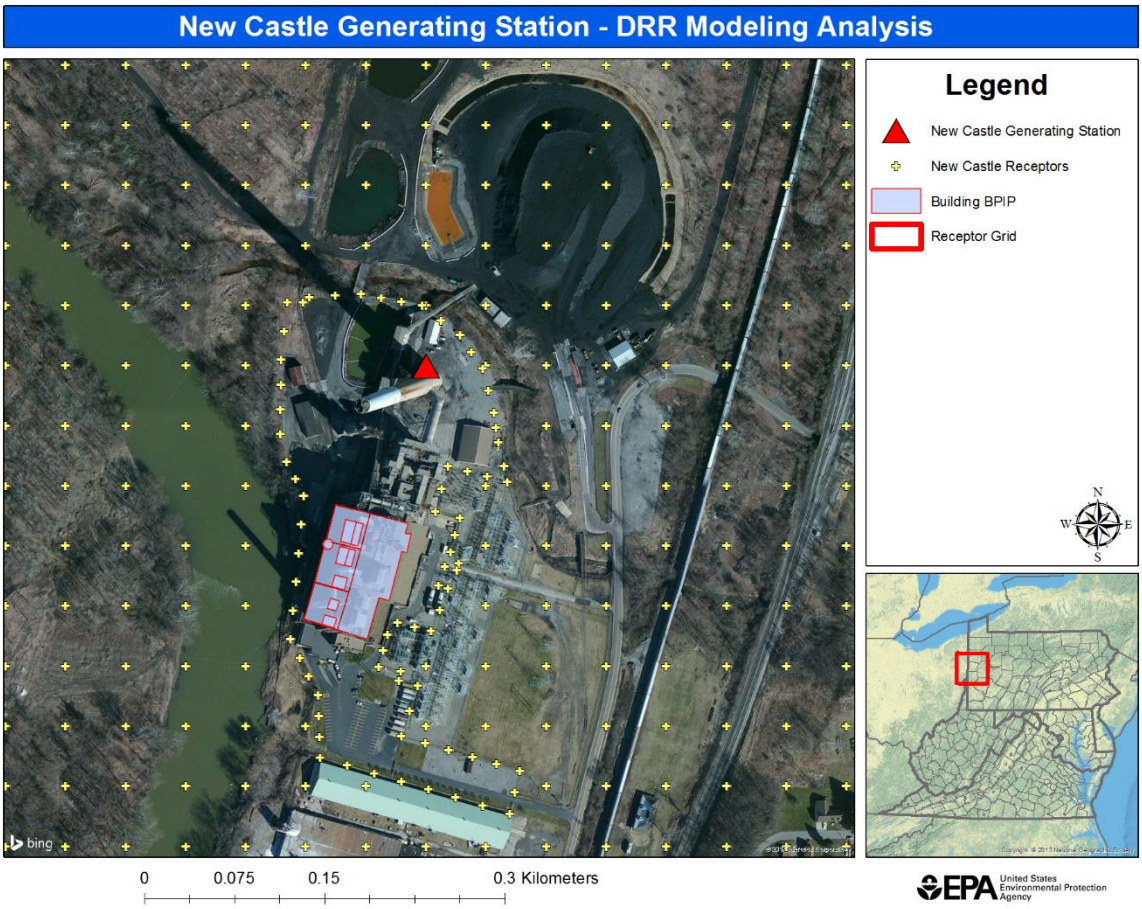
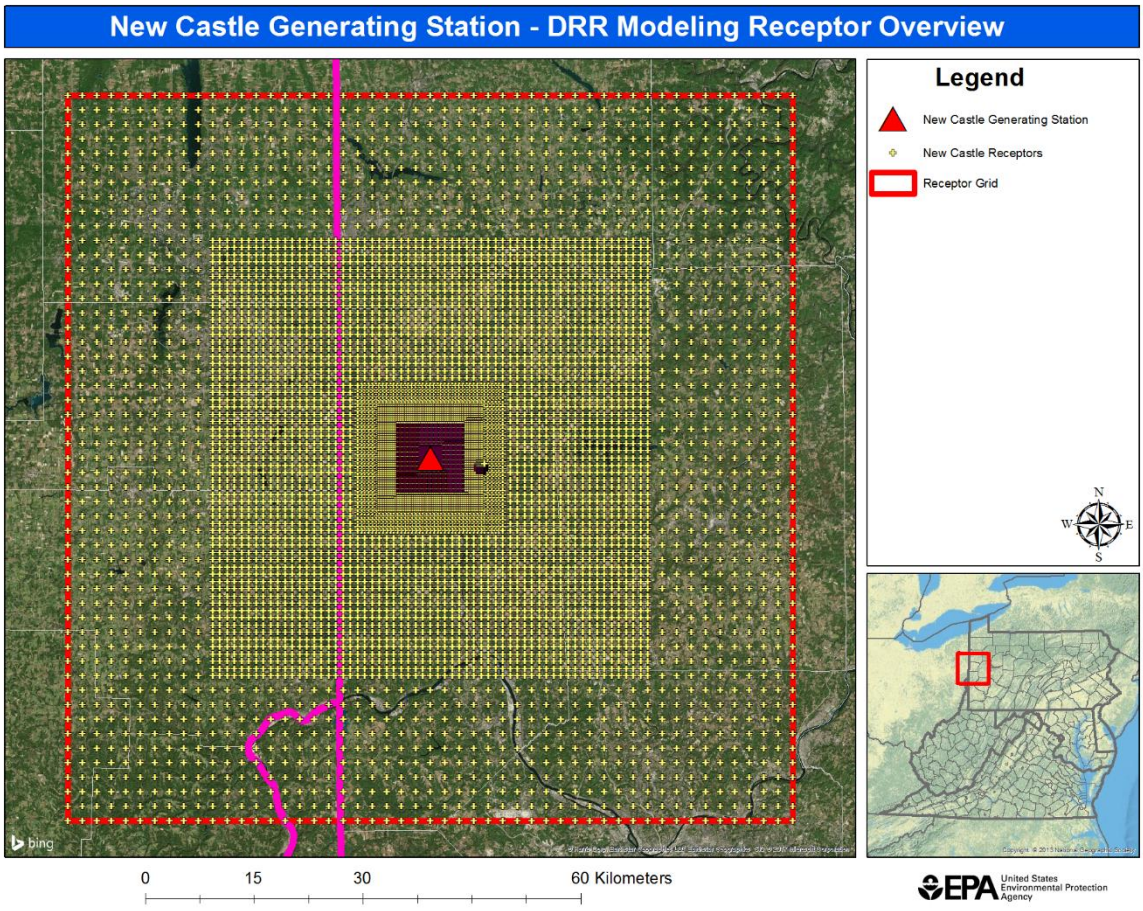


Figure 6.3: Receptor Grid for the Lawrence County Area



EPA examined facility property boundaries for each facility using GIS software. Model results include building downwash and show each facility's peak model concentration occurs well away from the boundaries meaning proper boundary delineation is not a critical component of the modeling analysis. EPA also concludes that the model receptor grid is adequate to capture the maximum modeled concentrations.

6.2.1.4. 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 or following GEP policy with allowable emissions.

The New Castle Generating Station has three (3) main boiler units capable of burning natural gas, back up fuel oil or coal. In addition to these main units, there is an auxiliary boiler powered by back up fuel oil, an electromotive diesel generator, and two (2) emergency diesel generators. Only the main boilers were used in the modeling analysis. The other sources historical emissions and operations were reviewed and it was determined that their operations were too infrequent

and their emissions were too small to be expected to contribute significantly to the annual distribution of daily maximum 1-hour concentrations. This is consistent with EPA's March 1, 2011 Clarification Memo.

Flue gases from the three (3) boilers merge in a common header, and then are manifolded into two parallel flues, each with internal diameter of 13.5 feet, that are within the same chimney. For the purposes of the air modeling analysis, it is assumed that the exhaust gas stream flow from the manifold is equally distributed between the two chimney flues. The two flue gas streams merge upon discharge to the atmosphere and were modeled as one merged stack with an equivalent inner stack diameter. This is consistent with EPA Model Clearinghouse Memos 91-II-01 and 96-V-10 where multi-flued stacks (or multiple stacks with less than 1 stack diameter of separation) are generally treated as a single source.

The three (3) units at the New Castle Generating Station exhaust through a common 228.6 m stack. The current stack was built in 1977, so its creditable height for modeling is subject to the GEP stack height regulations. Stack and building parameters were entered into BPIP to calculate downwash parameters for the modeling analysis. BPIP calculated that the stack GEP height is 99.84 m based on the height and projected width of the boiler house building. The modeled stack height was set to this height since the modeling analysis was used to determine a critical emission value that is compliant with the 1-hour SO_2 NAAQS. The modeled exhaust gas temperatures and velocities were based on a review of actual data collected during the period from 2010 through 2015 (coal-firing operations). It is projected that the boiler heat inputs and exhaust gas stream parameters (stack temperatures and exit velocities) will be similar for natural gas-firing operations.

Modeling for the full load case for boilers 1 through 3 was conducted to determine the critical emission value that results in 1-hour SO_2 NAAQS compliance. The resulting SO_2 critical emission value for the New Castle Generating Station's main boilers combined emission rate was 1,885 lbs/hr. This proposed limit is in the form of 1-hour limit not to be exceeded and was included in the New Castle Generating Station's Plan Approval (No. 37-023G) effective January 10, 2017. However, the revised permit does not include monitoring, reporting, or recordkeeping requirements related to the emission limit, therefore, the emission limit is not practically enforceable and as such is not federally enforceable.

EPA has reviewed the modeling analysis and concludes that the New Castle Generating Station's source characteristics are correct.

6.2.1.5. 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 three (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 concludes 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 three (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 Commonwealth included the New Castle Generating Station and no other emitters of SO_2 within 50 km in the area of analysis. The Commonwealth has chosen to model this facility to develop a critical emission value that will be made into a federally enforceable PTE limit for SO_2 emissions. The facility in the Commonwealth's modeling analysis, its actual emissions from 2013-2015, and its modeled critical emission value emission rate are summarized below.

For the New Castle Generating Station, the Commonwealth provided the modeled critical emission value (also included in the facility's plan approval) to show compliance with the 1-hour SO_2 NAAQS. This information along with past actual emission values are summarized in Table 6.2. A description of how the Commonwealth obtained hourly emission rates is given below this table.

Table 6.2. SO_2 Emissions based on PTE from Facilities in the Lawrence County Area

Modeled Critical Emission Values	
Facility Name	**SO_2 Emissions (tons per year, based on PTE)**
New Castle Plant PAL (1885.7 lbs/hr/237.594203 g/s)	8,259.37
Total Emissions from All Facilities in the Area of Analysis	**8,259.37**

CAMD Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
New Castle Plant Unit 3	1,366.1	1,142.7	940.8
New Castle Plant Unit 4	1,646.1	630.9	1,195.0
New Castle Plant Unit 5	2,347.8	2,186.4	1,610.4
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**5,360.0**	**3,960.0**	**3,746.1**

eFACTS[24] Emissions (State Reported)			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
New Castle Plant	5,359.8	3,960.1	3,746.1
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**5,359.8**	**3,960.1**	**3,746.1**

2014 NEI Emissions	
Facility	**2014 NEI SO_2 Emissions (tpy)**
New Castle Generating Station	3,960.1
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**3,960.1**

[24] http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facilityemissions.aspx

The combined critical emission value for the three (3) units in pounds per hour/grams per second for the New Castle Generating Station was determined by the state based on its modeling analysis. This critical emission value represents a plant-wide combined limit for the facility's three (3) main units and is included in the facility's current plan approval. Based on actual hourly emission rates in EPA's CAMD system over the 2013-2015 time period (coal as the primary fuel), it appears that the New Castle Generating Station's actual combined hourly emission rates exceeded the plant wide limit for over 15% of the hours.

6.2.1.6. Modeling Parameter: Meteorology and Surface Characteristics

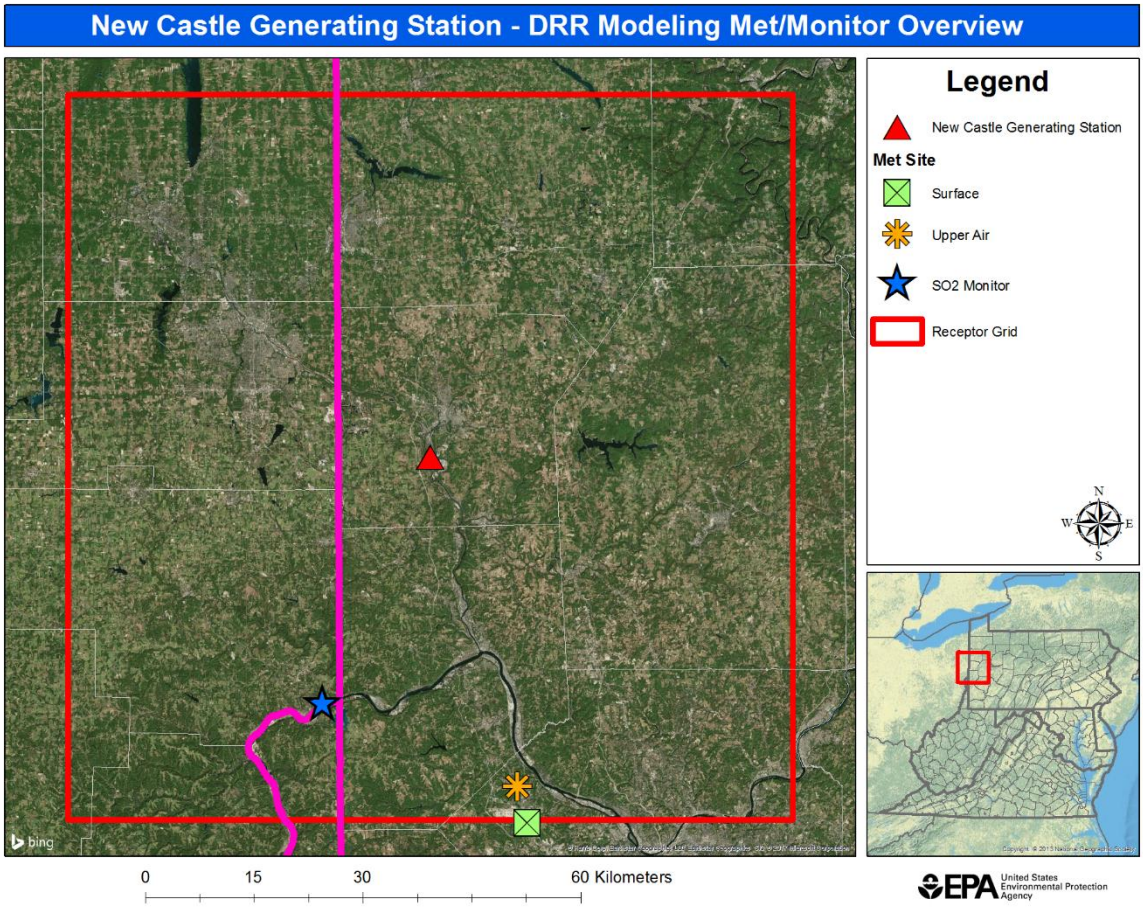
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of 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 Lawrence County area, the Commonwealth selected the surface meteorology from the Pittsburgh International Airport located in Allegheny County, PA, along with coincident upper air observations also from Pittsburgh International Airport as the best representative of meteorological conditions within the area of analysis. The PA DEP provided the final processed meteorological data used in the modeling analysis. While both sets of meteorological data were collected at the Pittsburgh International Airport, they are not collected in the same place. Surface measurements are located approximately 52 km south of the New Castle Generating Station while upper air measurements are collected approximately 47 km south of the New Castle Generating Station.

The Commonwealth used AERSURFACE version 13016 using data from Pittsburgh International Airport ASOS site to estimate the surface characteristics of the area of analysis. The Commonwealth estimated values for twelve (12) spatial sectors out to 1.0 km at a seasonal temporal resolution for dry, wet, average conditions based on local climatological data. 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”).

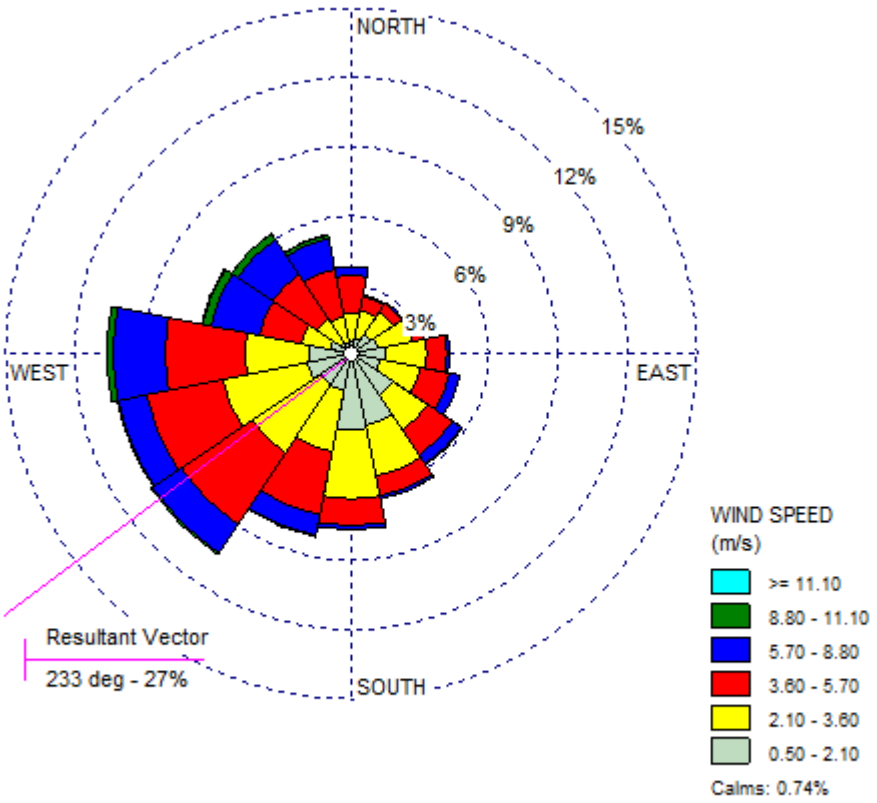
In the figure below, generated by the EPA, the location of the NWS stations and SO_2 monitoring site are shown relative to the area of analysis. The NWS and monitoring sites generally lie within or close to the border of the modeling domain.

Figure 6.4. Area of Analysis and the NWS station in the Lawrence County Area



As part of its recommendation, the state provided the 3-year surface wind rose for the Pittsburgh International Airport site for 2013-15. In Figure 6.5, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose was produced using the final processed AERMET sfc file in Lakes Environmental's WRPLOT program. Winds were primarily from the west-southwest. A resultant wind vector of all hours was from a southwesterly direction. The anemometer height used to generate the AERMET-ready files matched the height listed for the Pittsburgh International Airport (33 ft, 10 m).

Figure 6.5: Lawrence County 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. The Commonwealth followed the methodology and settings presented in EPA's Modeling TAD and related guidance 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 Pittsburgh 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.

The final AERMOD ready meteorological input files originally utilized the Adjust U* option for version 15181. This version contains a known programing bug that will lead to an under estimation of model concentrations and not provide adequate protection to ensure the modeled critical emission value is protective of the NAAQS.

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

The terrain in the area of analysis is best described as hilly. The New Castle Generating Station resides inside the Allegheny Plateau physiographic province of the Appalachian Mountains. 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 terrain elevations from 1-arc second, or 30-meter, National Elevation Data (NED) from USGS were used to develop the receptor terrain elevations required by AERMOD. EPA concludes the terrain was properly accounted for in the modeling analysis.

6.2.1.8. 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, the state used a (Tier 2) seasonal, hourly varying background concentration from the East Liverpool monitor (39-029-0022) located in Columbiana County, OH[25]. The background concentrations for this area of analysis were determined by the state to vary from 2.62 micrograms per cubic meter ($\mu g/m^3$), equivalent 1.0 ppb when expressed in two significant figures,[26] to 45.41 $\mu g/m^3$ (17.3 ppb), with an average value of 18.41 $\mu g/m^3$ (7.0 ppb). The East Liverpool monitor is located approximately 33 km from the New Castle Generating Station and probably provides an adequate representative background concentration.

6.2.1.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Lawrence County area of analysis are summarized below in Table 6.3

[25] This monitor in not in OH EPA's current Monitoring Network Plan (http://www.epa.ohio.gov/dapc/ams/amsmain.aspx#126983982-air-monitoring-plan). Please provide additional documentation

[26] 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 6.3: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Lawrence County Area

Input Parameter	Value
AERMOD Version	15181 Adjust U*
Dispersion Characteristics	Rural
Modeled Sources	1
Modeled Stacks	1 (Stack set at GEP height)
Modeled Structures	1
Modeled Fencelines	1
Total receptors	23,254
Emissions Type	Emission Limit
Emissions Years	2013-2015 [3-year block Effective year of new limits for PTE]
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Pittsburgh International Airport, PA
NWS Station Upper Air Meteorology	Pittsburgh International Airport, PA
NWS Station for Calculating Surface Characteristics	Pittsburgh International Airport, PA
Methodology for Calculating Background SO_2 Concentration	Seasonal Temporal Varying
Calculated Background SO_2 Concentration	45.41 to 2.62 $\mu g/m^3$

The results presented below in Table 6.4 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

Table 6.4. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Lawrence County Area

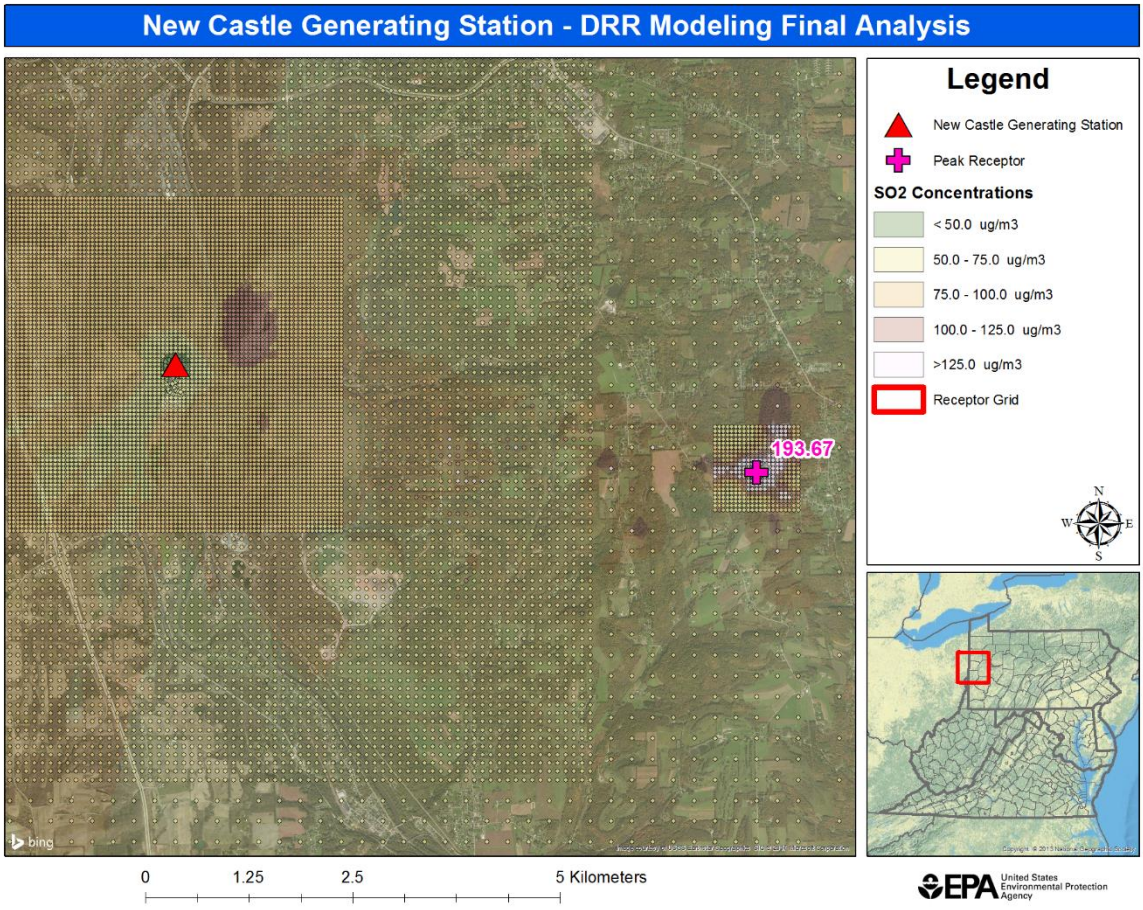
		Receptor Location [UTM zone 17]		**99th percentile daily maximum 1-hour SO_2 Concentration (µg/m^3)**	
Averaging Period	**Data Period**	**UTM**	**UTM**	**Modeled concentration (including background)**	**NAAQS Level**
99th Percentile 1-Hour Average	2013-15	4530895	560188.31	193.67	196.4*

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

The Commonwealth's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 193.67 µg/m^3, equivalent to 73.9 ppb. This modeled concentration included the background concentration of SO_2, and is based the modeled critical emission value calculated for the facility. Figure 6.6below was produced from the state's modeling submittal, and indicates that the predicted value occurred approximately 7 km east of the New Castle Generating Station in Lawrence County, PA. A portion of the state's receptor grid is also shown in the figure. Note that a small 50-m refined grid was placed over the area of the peak receptor to ensure proper grid resolution and capture of the maximum modeled concentration.

The peak receptor was located in elevated terrain well east of the facility. Typically, peak model concentrations usually occur within 10 stack heights distance from the source, in most cases within several kilometers. A further examination of the peak model receptor revealed the 99thº% concentrations for the three-year simulation all occurred during night time hours (hours 2, 23, and 19). This suggests that the controlling model concentrations are occurring during overnight stable conditions that are probably impacted by the Adjust U* low-wind option within AERMOD.

Figure 6.6: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Average Over Three Years for the Area of Analysis for the Lawrence County Area



The modeling submitted by the state does not show that the 1-hour SO_2 NAAQS would be violated at the receptor with the highest modeled concentration using a critical emission value for the New Castle Generating Station. Pennsylvania's modeling analysis determined a critical emission value based on a 1-hour emission rate of 1,885.7 lb/hr. This 1-hr limit was included in the New Castle Generating Station's plan approval document, which will be included in the facility's operating permit.

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

As noted previously, the final modeling analysis for the New Castle Generating Station utilized the Adjust U* low-wind option in AERMOD version 15181. This version of AERMOD has a known program bug that leads to an underestimation bias when Adjust U* is utilized. Given the peak model receptor in the analysis is in elevated terrain located well away from the New Castle Generating Station and the peak concentrations occur during the overnight hours it is highly likely that the final modeling analysis's controlling model concentration is being influenced by the Adjust U* option. The presence of a known program bug in the version of AERMOD used in this modeling analysis means the modeling analysis cannot be used to determine a designation. The lack of an appropriate modeling analysis using emission inputs as discussed in the TAD (i.e. actual emissions or a federally enforceable and effective limit) further limits the use of the analysis to support a designation for the area. Pennsylvania should also provide additional documentation regarding the background monitor used in the analysis. The East Liverpool monitor is not currently listed in Ohio EPA's Air Monitoring Network Plan.

6.4 Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Lawrence County, PA 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.

6.5 Jurisdictional Boundaries in the Lawrence County, PA Area

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

In Pennsylvania's original recommendation submitted on June 23, 2011, Pennsylvania recommended that all of Lawrence County be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the New Castle Generating Station in Lawrence County but did not update their recommendation.

6.6. Other Information Relevant to the Designations for the Lawrence County, Pennsylvania Area

There are no designated nonattainment areas or areas intended to be designated as nonattainment directly adjacent to any of the counties or cities modeled in the Lawrence County area of analysis.

6.7 The EPA's Assessment of the Available Information for the Lawrence County, PA Area

The EPA finds that available air quality monitoring data alone are unreliable to be considered representative of the area's air quality, Although the design value from the air quality monitor located within this area of analysis is well below the standard of 75 ppb (31 ppb), it is unclear if this monitor is located in areas of maximum concentration, and therefore, it is unclear if the monitoring data is representative of actual air quality in the area.

The EPA finds that Pennsylvania's modeling analysis for the Lawrence County area is not sufficient to determine whether the area is attaining the 2010 SO2 NAAQS or not. The final modeling analysis for the New Castle Generating Station utilized the Adjust U* low-wind option in AERMOD version 15181. This version of AERMOD has a known program bug that leads to an underestimation bias. Given the peak model receptor in the analysis is in elevated terrain located well away from the New Castle Generating Station and the peak concentrations occur during the overnight hours it is highly likely that the final modeling analysis's controlling model concentration is being influenced by the Adjust U* option. The presence of a known program bug in the version of AERMOD used in this modeling analysis means the modeling analysis cannot be used to determine a designation. In addition, not using emission inputs as discussed in the TAD (i.e., actual emissions or a federally enforceable effective limit) makes the modeling analysis not reliable to support a designation for the area nor to determine if the area is contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS.

In Pennsylvania's original recommendation submitted on June 23, 2011, Pennsylvania recommended that all of Lawrence County be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the New Castle Generating Station in Lawrence County but did not update their recommendation.

The EPA concludes that our intended unclassifiable area, bounded by the boundary of Lawrence County, PA, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable area.

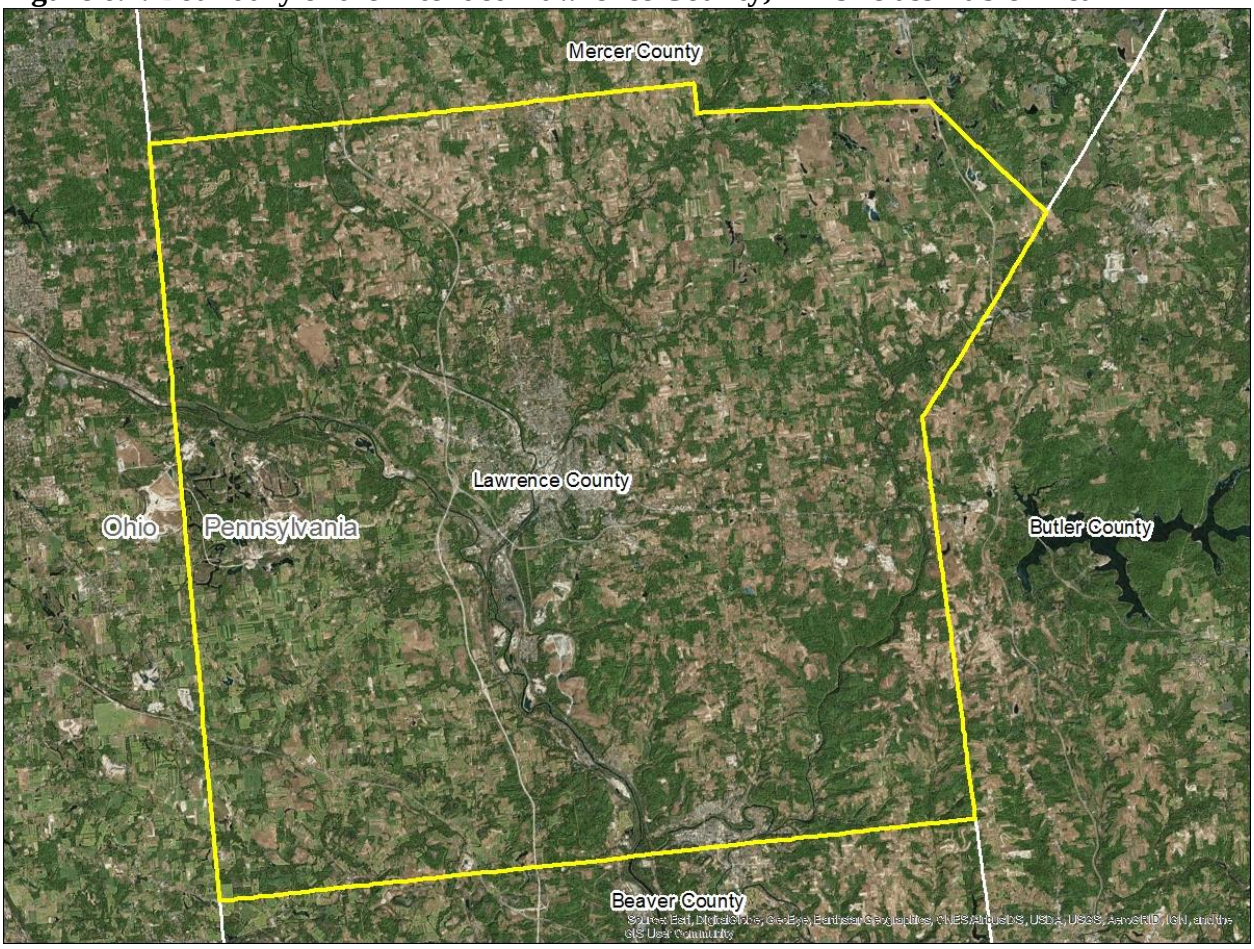
6.8 Summary of Our Intended Designation for the Lawrence County, PA Area

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate Lawrence County, PA as unclassifiable for the 2010 SO_2 NAAQS. The Lawrence County unclassifiable 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 SO2 NAAQS, or (ii) contributing or not contributing to ambient air quality

in a nearby area that does not meet the NAAQS. Specifically, the boundaries are comprised of the county boundary for Lawrence County, PA.

Figure 6.7 shows the boundary of this intended designated area.

Figure 6.7. Boundary of the Intended Lawrence County, PA Unclassifiable Area



At this time, our intended designations for the Commonwealth only apply to this area and the other areas presented in this technical support document.

7. Technical Analysis for the Cambria County Area

7.1. Introduction

The EPA must designate Cambria County, Pennsylvania, area by December 31, 2017, because the area has not been previously designated and Pennsylvania has not installed and begun timely operation of a new, approved SO_2 monitoring network to characterize air quality in the vicinity of a source in Cambria county. Pursuant to the DRR (*see* 40 CFR part 51, subpart BB), states had the option to characterize large sources of SO_2 by either monitoring, modeling or capping emissions below 2,000 tons of SO_2 per year. Although there is an existing SO_2 monitor in Cambria County, Pennsylvania elected to conduct modeling to characterize a cluster of sources subject to the DRR.

7.2. Air Quality Monitoring Data for the Cambria County Area

This factor considers the SO_2 air quality monitoring data in the area of Cambria County. Although the state did not include monitoring data, EPA evaluated available from the following monitor(s):

Table 7.1. Air Quality Monitoring Data for the Cambria County Area of Analysis

County	AQS Monitor ID	Latitude	Longitude	2011-2013 Design Value	2012-2014 Design Value	2013-2015 Design Value	2014-2016 Design Value
Cambria	42-021-0011	40.309722	-78.915	41	46	40	36

- Air Quality System monitor 42-021-0011. This monitor is located in Cambria County and is southwest of all three DRR sources which are analyzed for this area. Specifically, the monitor is 22 km, 26 km and 29 km from Ebensburg Power, Cambria Cogen, and Colver Power, respectively. 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 2014-2016 DV being 36 ppb. However, the EPA does not have information indicating this data is in an area of maximum concentration, so this data cannot be used as the basis for designation. .

Table 7.2. Air Quality Monitoring Data in Adjacent Counties for the Cambria County Area of Analysis

County	AQS Monitor ID	Latitude	Longitude	2011-2013 Design Value	2012-2014 Design Value	2013-2015 Design Value	2014-2016 Design Value
Blair	42-013-0801	40.535278	-78.370833	31	35	36	29
Indiana	42-063-0004	40.56333	-78.919972	68	69*	70*	61*

*Indicates incomplete/invalid design value

- Air Quality System monitor 42-013-0801. This monitor is located in Blair County and is east of all three DRR sources which are analyzed for this area. Specifically, the monitor is 33 km, 29 km and 37 km from Ebensburg Power, Cambria Cogen, and Colver Power, respectively. 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 2014-2016 DV being 29 ppb. The EPA does not have information indicating this data is in an area of maximum concentration, so this data cannot be used as the basis for designation.
- Air Quality System monitor 42-063-0004. This monitor is located in Indiana County and is west/northwest of all three DRR sources which are analyzed for this area. Specifically, the monitor is 19 km and 20 km northwest of Ebensburg Power and Cambria Cogen, respectively, and 10 km west of Colver Power. Indiana County was designated as nonattainment in Round 1 of 2010 SO_2 NAAQS designations. This monitor does not meet completeness criteria for 2014-2016 DV. The EPA does not have information indicating this data is in an area of maximum concentration, so this data cannot be used as the basis for designation.

7.3. Air Quality Modeling Analysis for the Cambria Area Addressing a Cluster of Sources

The PA DEP identified a cluster of emissions sources in Cambria County that were subject to the DRR for the 2010 1-hour SO_2 primary NAAQS.[27] This was outlined in a January 15, 2016, letter submitted to the EPA. The Commonwealth of Pennsylvania was required to submit a plan to the U.S. EPA with regards to the path forward for addressing the DRR. The three (3) sources identified within Cambria County were analyzed using a dispersion model to satisfy SO_2 DRR requirements. The modeling analysis approach was outlined in a modeling protocol submitted to the EPA in October of 2016.

This Section 7.3 presents all the available air quality modeling information for a portion of Cambria County that includes Cambria Cogeneration Company (Cambria Cogen), Colver Power, and Ebensburg Power. (This portion of Cambria County will often be referred to as "the Cambria County area" within this section 7.3.), This area contains the following SO_2 sources around which Pennsylvania 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 Cambria Cogen facility emits 2,000 tons or more annually. Specifically, Cambria Cogen emitted 3,199 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 Pennsylvania has chosen to characterize it via modeling.
- The Colver Power facility emits 2,000 tons or more annually. Specifically, Colver Power emitted 2,832 tons of SO_2 according to the 2014 NEI. This source meets the DRR criteria

[27] Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide (SO2) Primary National Ambient Air Quality Standard (NAAQS), FR 80, No. 162, pp 51052-51088, August 21, 2015.

and thus is on the SO_2 DRR Source list, and Pennsylvania has chosen to characterize it via modeling.

- The Ebensburg Power facility does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 1,914 tons of SO_2 according 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.

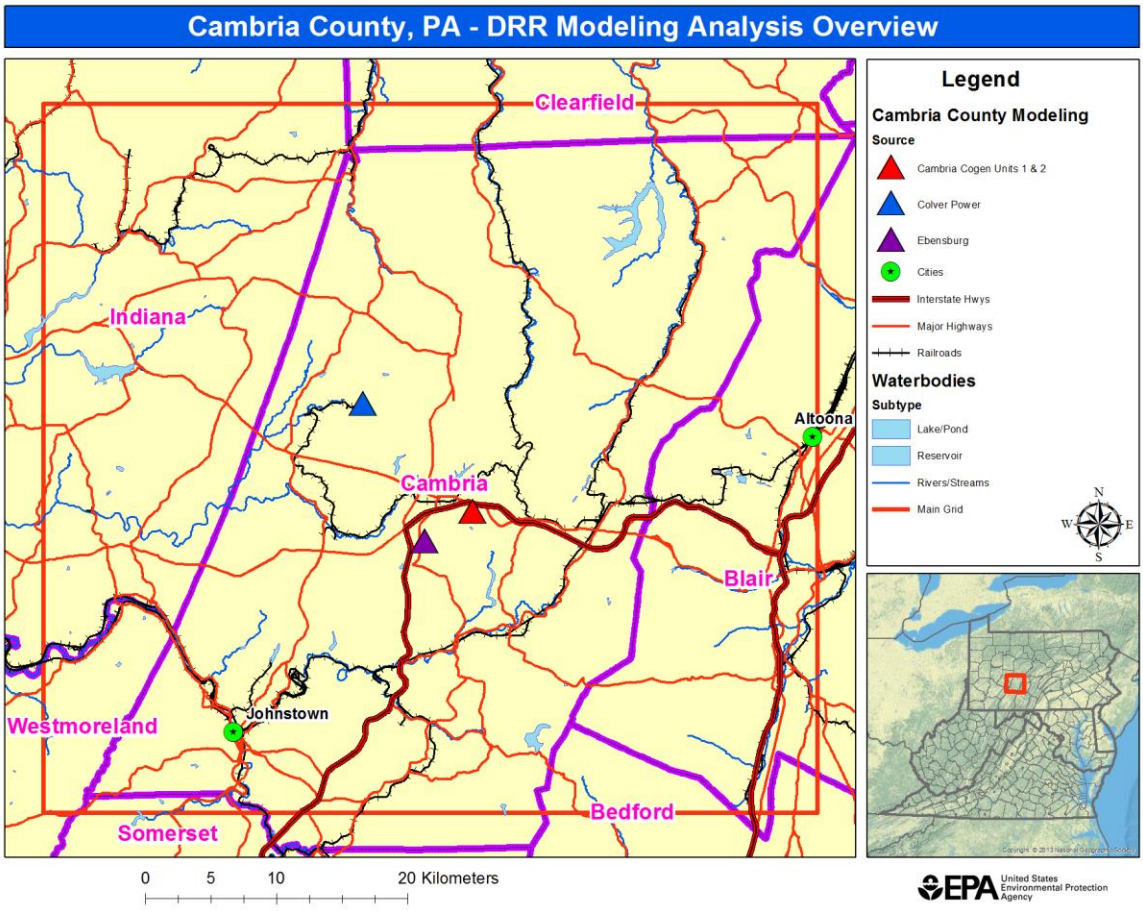
In Pennsylvania's original recommendation on June 23, 2011, Pennsylvania recommended that the area surrounding the Cambria Cogen, Colver Power, and Ebensburg Power, specifically the entirety of Cambria County, be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the Cambria Cogen, Colver Power, and Ebensburg Power but did not update their recommendation. This modeling assessment and characterization of air quality was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the Commonwealth'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. 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 covers most of Cambria County, which is located in west central Pennsylvania between the cities Pittsburgh and Harrisburg. The modeling domain covers portions of seven (7) counties including Bedford, Blair, Cambria, Clearfield, Indiana, Somerset, and Westmorland.

As seen in Figure 7.1 below, the three (3) Cambria County DRR sources included in the modeling analysis are located in the central part of the county. Cambria Cogen and Ebensburg Power are located near Ebensburg Borough, the county seat. Colver Power is located approximately 10 km northwest of Ebensburg Borough. No other SO_2 sources above 100 tpy were identified in the county. There are sources of SO_2 in the neighboring county of Indiana. The Commonwealth explained that the reason they decided to not include these sources in their modeling analysis was because Indiana County is part of a 1-hour SO_2 nonattainment area designated on October 4, 2013. Additionally, impacts from these Indiana County sources were accounted for via the modeled background concentration. Pennsylvania is currently preparing an SO_2 attainment plan for the Indiana County nonattainment area.

The EPA's intended unclassifiable designation boundary for the Cambria County area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

Figure 7.1. Map of the Cambria County, Pennsylvania Area Addressing a Three Sources



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 one modeling assessment, which was submitted by Pennsylvania.

7.3.1. Modeling Analysis Provided by the State

On May 26, 2017, Pennsylvania submitted a modeling analysis to EPA for three sources in Cambria County, Pennsylvania.

7.3.1.1. 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

Pennsylvania delivered its modeling analysis to EPA on May 26, 2017. On January 17, 2017, EPA published its revision to Appendix W – Guideline to Air Quality Models. 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. This date has since passed means the revised Appendix W is in effect.

The modeling analysis completed by Pennsylvania for the cluster of DRR sources in Cambria County was submitted using AERMOD version 15181 with the Adjust U* option. EPA released a memo dated March 8, 2017, entitled *Clarification on the AERMOD Modeling System Version for Use in SO_2 Implementation Efforts and Other Regulatory Actions*[28] which states:

> "*[B]ecause the use of AERMET version 15181 with the ADJ_U* beta option contains a known and corrected formulation bug that leads to concentration under predictions, the associated AERMOD modeling results would be unreliable as a basis for determinations of SO_2 air quality in the modeled area*."

Given this technical deficiency, the modeling submitted for the Cambria County DRR sources using actual emissions is not sufficient to determine whether the area is attaining or not attaining the 1-hour SO_2 NAAQS.

7.3.1.2. 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 mode. This was based on examining 1992 land used classifications within 3 km for each of the modeled sources. Land use classifications were overwhelmingly rural. Google Earth imagery from 1993 and 2015 were compared for each facility to ensure no major changes in land usage surrounding each facility had taken place. No significant land use changes were noted so the rural classification was used

[28] https://www3.epa.gov/ttn/scram/guidance/clarification/SO2_DRR_Designation_Modeling_Clarificaiton_Memo-03082017.pdf

in the modeling analysis. EPA reviewed this information using GIS aerial imagery and concludes the rural classification for the modeled sources is correct.

7.3.1.3. 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 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 Cambria County area, the Commonwealth has included a total of three (3) emitters of SO_2 within a rectangular modeling domain that is a little over 50 by 50 km centered on the Cambria Cogen facility near Ebensburg Borough. 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 violations in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. In addition to Cambria Cogen, the other emitters of SO_2 included in the area of analysis are Colver Power and Ebensburg Power. No other sources beyond 50 km were determined by the Commonwealth to have the potential to cause concentration gradient impacts within the area of analysis. Note that several large coal-fired units in neighboring Indiana County are part of the attainment plan modeling analysis for the Indiana, PA 1-hour SO_2 nonattainment area. These sources are accounted for by using background concentrations from the Indiana County monitor for hours when the winds would be transporting emissions from Indiana County to Cambria County.

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

- fenceline receptors placed at 25-m intervals along the ambient boundaries for each of the three (3) DRR sources.
- a 100-m Cartesian grid extending 1,750 meters from Cambria Cogen, 700 meters from Colver Power, and 750 meters from Ebensburg Power.
- a 500-m Cartesian grid in areas outside the areas previously described covering an area 39.5 km by 34 km roughly centered over the three (3) DRR sources.
- a 1,000-m Cartesian grid covering the areas outside the previously described area for the remaining portion of the modeling domain.

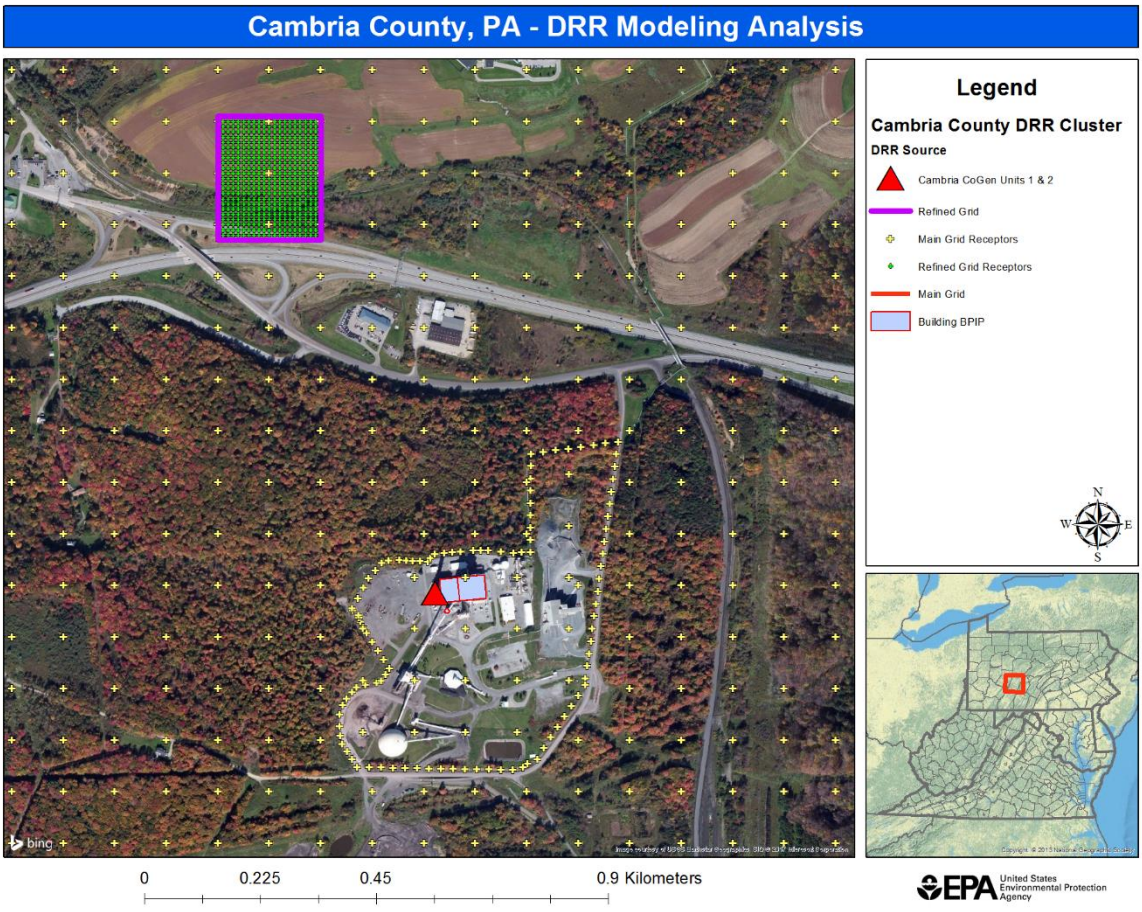
In addition, receptors were placed on each of the ambient boundaries for each of the three (3) DRR source to address impacts on each facility from the other two (2) sources (e.g., receptors were placed on Cambria Cogen to address impacts from Colver Power and Ebensburg Power). The controlling concentration from the main grid was resolved to a receptor density of 10 meters to ensure that the maximum modeled concentration was properly resolved.

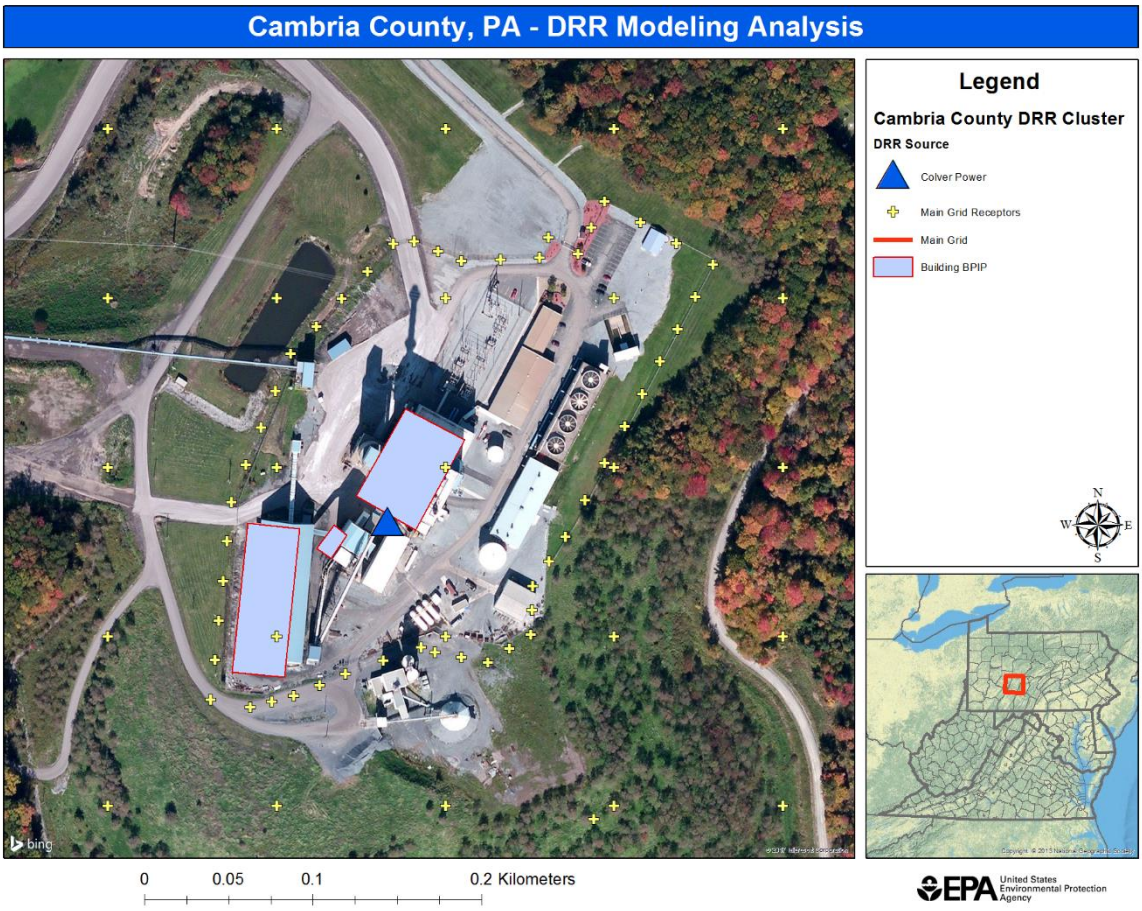
The receptor network contained 9,859 receptors, and the network covered portions of seven (7) counties including Bedford, Blair, Cambria, Clearfield, Indiana, Somerset, and Westmorland.

Figures 7.2and 7.3, created by EPA based on the modeling analysis files, show the state's chosen area of analysis surrounding the Cambria County DRR sources, 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 state also did not place receptors in other locations that it considered to not be ambient air relative to each modeled facility. Additional receptors, however, were placed inside each of the DRR sources to gauge the impact of the other two (2) DRR sources since the ambient air boundary is not applicable in relation to emissions from the remaining sources. This removes each individual source's impacts within its ambient own air boundary. Given the significant distances between the three (3) DRR sources, many kilometers in some instances, the peak model concentration was not located within any of the DRR source's property boundaries.

Figure Series 7.2: Area of Analysis for the Cambria County Area




Cambria County, PA - DRR Modeling Analysis
Legend
Cambria County DRR Cluster
DRR Source
Colver Power
Main Grid Receptors
Main Grid
Building BPIP
N
W
E
S
bing
0
0.05
0.1
0.2 Kilometers
EPA
United States
Environmental Protection
Agency

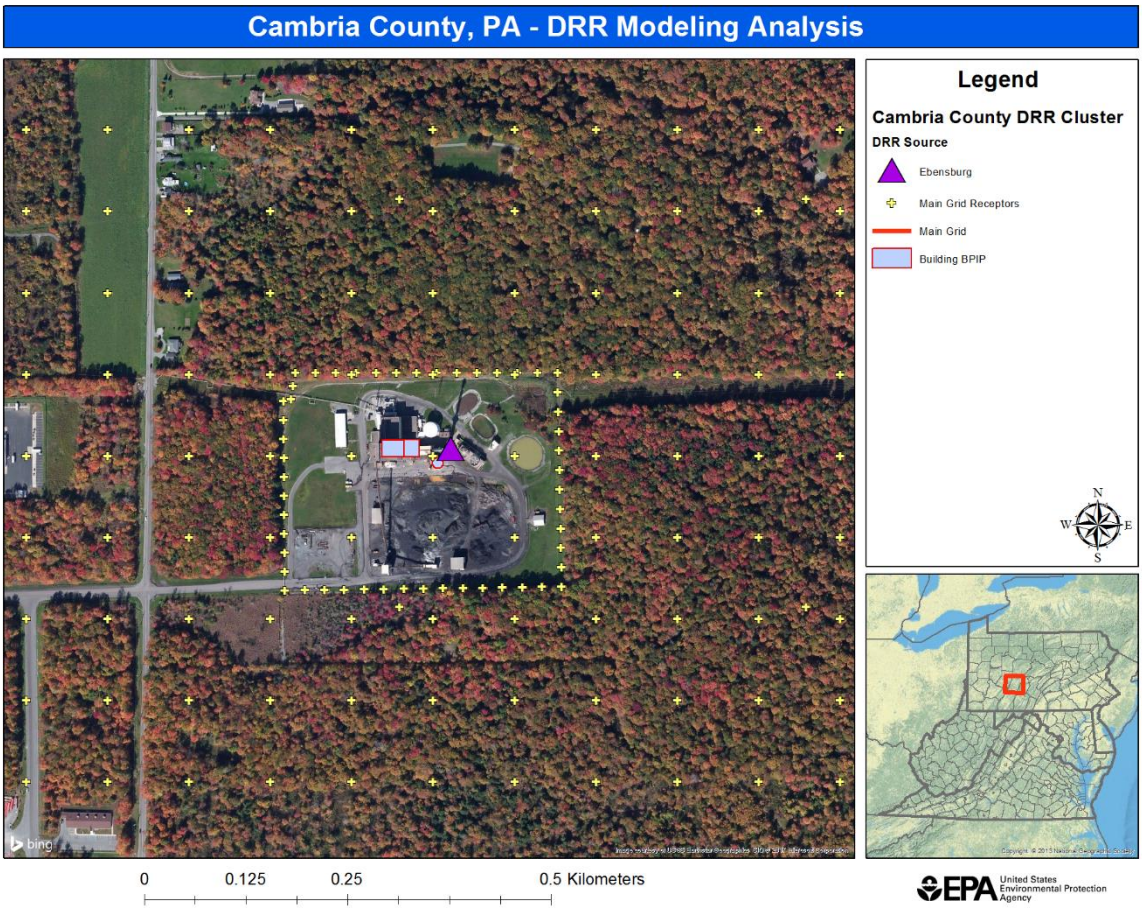
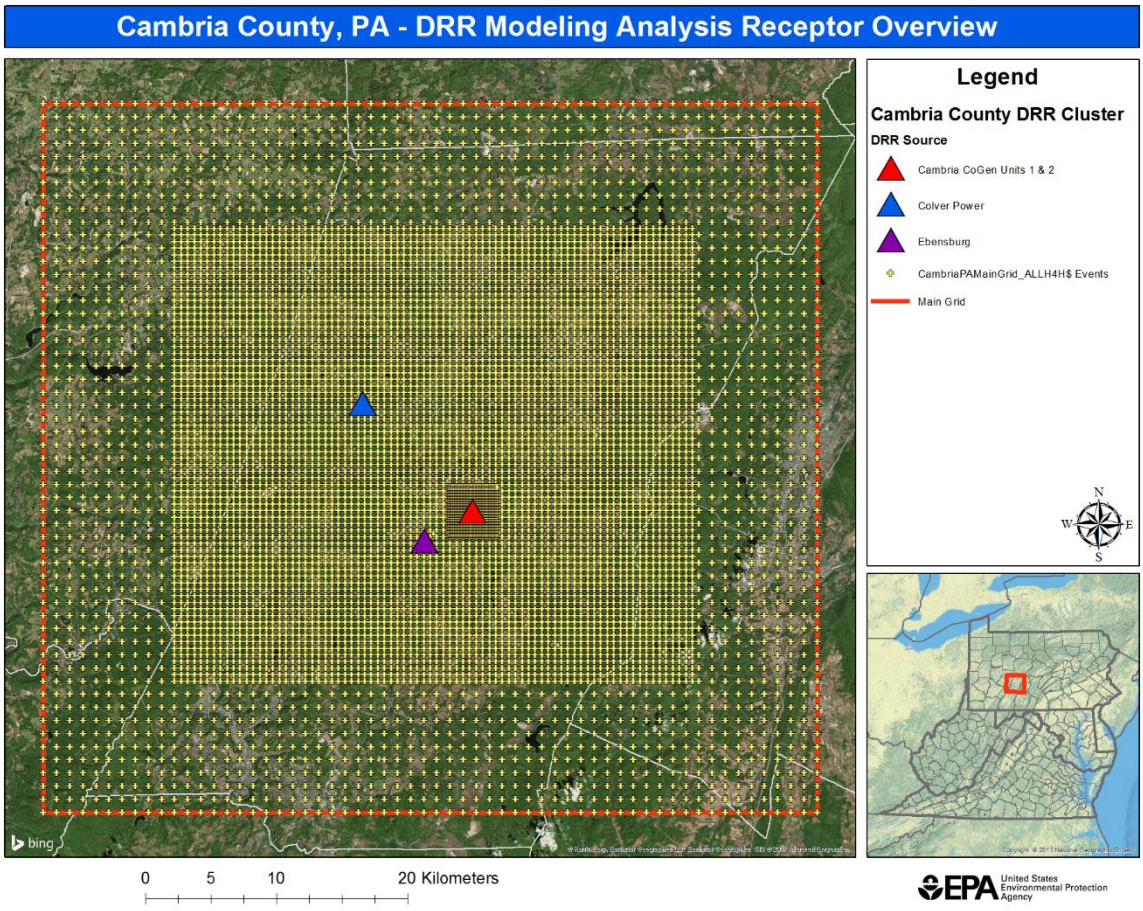

Cambria County, PA - DRR Modeling Analysis
Legend
Cambria County DRR Cluster
DRR Source
Ebensburg
Main Grid Receptors
Main Grid
Building BPIP
N
W
E
S
bing
0
0.125
0.25
0.5 Kilometers
EPA
United States
Environmental Protection
Agency

Figure 7.3: Receptor Grid for the Cambria County



EPA examined fence line boundaries for each facility using GIS software and concludes the boundaries are correctly delineated. Building locations for Colver Power appear to be off slightly. Model results include building downwash and show the peak model concentration occurs well away from the boundaries of the three (3) DRR sources meaning proper boundary delineation is not a critical component of the modeling analysis. EPA also concludes the model receptor grid is adequate to capture the maximum modeled concentrations.

7.3.1.4. 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 or following GEP policy with allowable emissions.

This section will briefly summarize the modeled emission sources at the three (3) DRR facilities in Cambria County that were identified as a cluster of possible contributing sources and included in the final modeling analysis:

Cambria Cogen: Is a 98 MW waste-coal plant with a circulating fluidized bed (CFB) that began commercial operations in March 1991. The waste coal burned by the plant helps eliminate sources of acid water run-off from waste coal piles in the area and the ash produced by the plant is used beneficially to restore the landscape after removal of the waste coal. Emissions of SO_2 are controlled using lime injection. Hourly-varying actual emissions of SO_2 (as well as exit temperature and exit velocity) were modeled based on Continuous Emissions Monitoring System (CEMS) data from the years 2013 – 2015, inclusive. Substitution for missing hourly emissions was fully documented.

The only Cambria Cogen source to be modeled in this analysis is the single stack for Boilers A and B. There are probably other sources of SO_2 emissions at the facility including emergency engines or auxiliary equipment but these sources are generally intermittent in nature and are probably not large enough to significantly impact the maximum modeled concentration in accordance with EPA's March 1, 2011 Clarification Memo.

Colver Power: Is a 105 MW Foster Wheeler's CFB steam generator that began commercial operations in March 1995. The very hot "fluidized" bed consists of crushed gob (waste coal), limestone to absorb sulfur, and ash. Crushed limestone is injected into the combustor with the waste coal, achieving a required 30-day rolling 92% average reduction of SOx. Colver Power fires more than 60,000 tons of gob annually, obtained from sites that include a major supply adjacent to the facility. Approximately 50% of the gob fired is trucked to the plant from more distant sources.

Hourly-varying actual emissions of SO_2 (as well as exit temperature and exit velocity) were modeled based on CEMS data from the years 2013 – 2015, inclusive. Substitution for missing hourly emissions was fully documented.

The only Colver Power source to be modeled in this analysis was the stack for the CFB boiler. There are probably other sources of SO_2 emissions at the facility including emergency engines or auxiliary equipment but these sources are generally intermittent in nature and are probably not large enough to significantly impact the maximum modeled concentration in accordance with EPA's March 1, 2011 Clarification Memo.

Ebensburg Power: Is a 50-megawatt power plant that burns waste coal to produce electricity. The plant began commercial operation in May 1991. The plant features a CFB boiler which was designed, fabricated, erected, and commissioned by Babcock & Wilcox. The process utilizes limestone for controlling the acid gases and a baghouse to collect the particulate matter including the oxidized mercury particles. It burns low-volatile waste coals which are found in refuse piles throughout central Pennsylvania. The plant encompasses approximately 32 acres.

Hourly-varying actual emissions of SO_2 (as well as exit temperature and exit velocity) were modeled based on CEMS data from the years 2013 – 2015, inclusive. Substitution for missing hourly emissions was fully documented.

> The only Ebensburg Power source that was modeled was the single stack for the CFB boiler. There are probably other sources of SO_2 emissions at the facility including emergency engines or auxiliary equipment but these sources are generally intermittent in nature and are probably not large enough to significantly impact the maximum modeled concentration in accordance with EPA's March 1, 2011 Clarification Memo.

The Commonwealth characterized these sources 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 actual emissions. The Commonwealth also adequately characterized the source's building layouts and locations, 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 concludes that the Commonwealth's source characterization is adequate.

7.3.1.5. 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 concludes 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, the Commonwealth included a cluster of three (3) DRR sources in Cambria County in their modeling analysis. The Commonwealth has chosen to model these facilities using actual emissions. The facilities in the Commonwealth's modeling analysis and their associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.

For Cambria Cogen, Colver Power, and Ebensburg Power, the state provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 7.3. A description of how the state obtained hourly emission rates is given below this table.

Table 7.3. Actual SO_2 Emissions Between 2013 – 2015 from Three Facilities in the Cambria Country Area

Modeled Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Cambria Cogen Unit 1 & 2	2,557.8	3,198.6	2,290.3
Colver Power	2,658.9	2,599.4	2,405.2
Ebensburg	1,800.0	1,800.9	888.1
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**7,016.7**	**7,598.9**	**5,583.6**
EPA Clean Air Markets Division Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Cambria Cogen Unit 1	1,256.6	1,575.6	1,155.9
Cambria Cogen Unit 2	1,301.3	1,623.0	1,134.7
Colver Power	2,755.7	2,831.2	2,604.8
Ebensburg	1,935.2	1,917.2	962.3
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**7,248.7**	**7,947.0**	**5,857.7**
eFACTS[29] Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Cambria Cogen Unit 1 & 2	2,557.9	3,199.0	2,291.6
Colver Power	2,755.8	2,831.8	2,604.9
Ebensburg	1,935.3	1,913.7	949.8
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**7,248.9**	**7,944.6**	**5,846.3**

2014 NEI Emissions	
Facility	**2014 NEI SO_2 Emissions (tpy)**
Cambria Cogen Unit 1 & 2	3,199.0

[29] http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facilityemissions.aspx

Colver Power	2,831.8
Ebensburg	1,913.7
Total Emissions from All Modeled Facilities in the State's Area of Analysis	**7,944.5**

Several sources of emissions information for the three (3) Cambria County DRR sources were examined and compared to the modeled emissions. These included EPA's CAMD website,[30] PA DEP's eFACTS system,[31] and the 2014 NEI. In general, the total modeled yearly emissions were within several hundred tons of the annual emissions reported to EPA's CAMD and Pennsylvania's eFACTS systems. This emissions difference may be due to how missing emissions are reported in CAMD. A closer look at the hourly emissions showed the three (3) DRR sources modeled hourly emissions were generally within +/- 250 lbs per hour of what was reported in CAMD (see Table 7.4 below). Hourly modeled stack temperatures and stack velocities were within expected values for the types of sources included in the modeling analysis though minimum modeled stack temperatures did fall below 273 K, which is much too low for coal-fired boiler units. Stack temperatures below 273 K, however, appeared to occur during hours when the units were not emitting.

Table 7.4. Table summarizing the difference between modeled and CAMD hourly emission rates (pounds per hour) for Cambria Cogen, Colver Power and Ebensburg Power.

Cambria CoGen		**Colver Power**		**Ebensburg Power**	
Bin	***Frequency***	***Bin***	***Frequency***	***Bin***	***Frequency***
-500	18	-500	7	-500	28
-250	120	-250	24	-250	191
0	15,621	0	25,243	0	23,449
250	10,412	250	944	250	2,551
500	106	500	45	500	52
750	2	750	15	750	9
More	1	More	2	More	0

EPA concludes Pennsylvania properly characterized emissions from the three (3) DRR sources included in the modeling analysis.

[30] https://ampd.epa.gov/ampd/
[31] http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facilityemissions.aspx

7.3.1.6. Modeling Parameter: Meteorology and Surface Characteristics

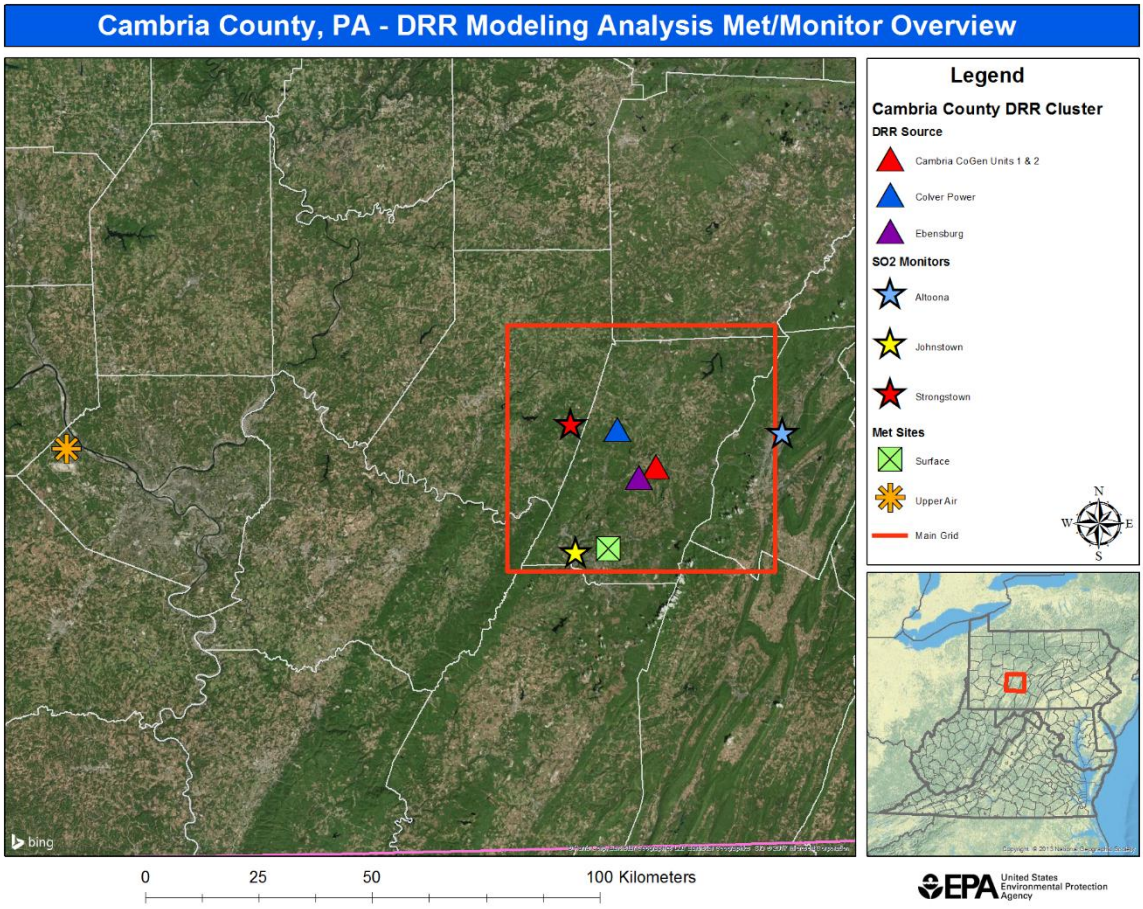
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of 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 Cambria County area, the Commonwealth selected the surface meteorology from the Johnstown/Cambria County Airport and concurrent upper air observations from Pittsburgh International Airport as best representative of meteorological conditions within the area of analysis. The Johnstown/Cambria County Airport is located approximately 18 km southwest of Cambria Cogen, the largest source in the DRR source cluster and approximately 121 km west of the Pittsburgh International Airport.

The state used AERSURFACE version 13016 using data from the Johnstown/Cambria County Airport to estimate the surface characteristics of the area of analysis. The Commonwealth estimated values for twelve (12) spatial sectors out to 1.0 km at a seasonal temporal resolution for dry, wet and average conditions. 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"). PA DEP provided the final processed meteorological data used in the modeling analysis but no documentation was formally provided regarding the AERSURFACE processing steps.

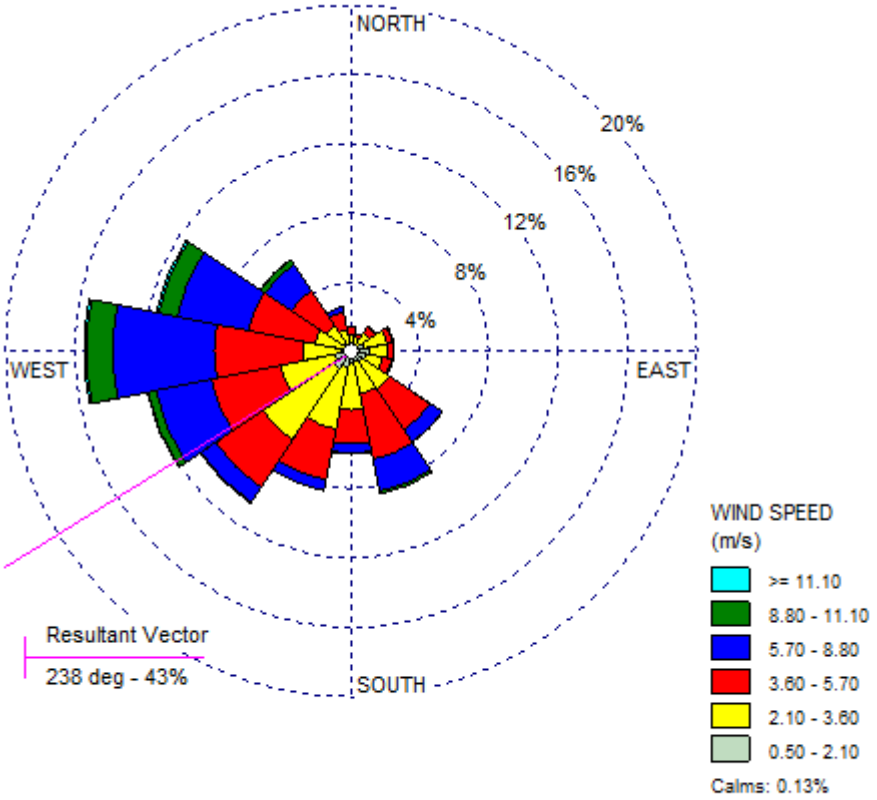
In the figure below, generated by the EPA, the locations of this NWS stations along with the three (3) SO_2 monitoring sites are shown relative to the area of analysis.

Figure 7.4. Area of Analysis and the NWS stations in the Cambria County Area



As part of its recommendation, the state provided the 3-year surface wind rose for the Johnstown/Cambria County Airport site for 2013-15. In Figure 7.4, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose was produced using the final processed AERMET sfc file in Lakes Environmental's WRPLOT program. Winds were somewhat distributed in the northwest to southeast quadrants. A resultant wind vector for all hours was from a southwesterly direction. The anemometer height used to generate the AERMET-ready files matched the height listed for the Johnstown/Cambria County Airport (26 ft, 7.92 m).

Figure 7.5: Cambria County, Pennsylvania 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. The state followed the methodology and settings presented in Modeling TAD and associated guidance in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics. As noted earlier, the PA DEP processed and provided the AERMET-ready file used in the modeling analysis.

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 Johnstown/Cambria 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 Commonwealth 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.

Details of the AERMET processing stages were missing from the analysis since PA DEP provided the AERMET-ready files used in the modeling analysis. EPA concludes the files were processed correctly and reflect surface condition such as soil moisture and seasonal snow cover for the area of analysis.

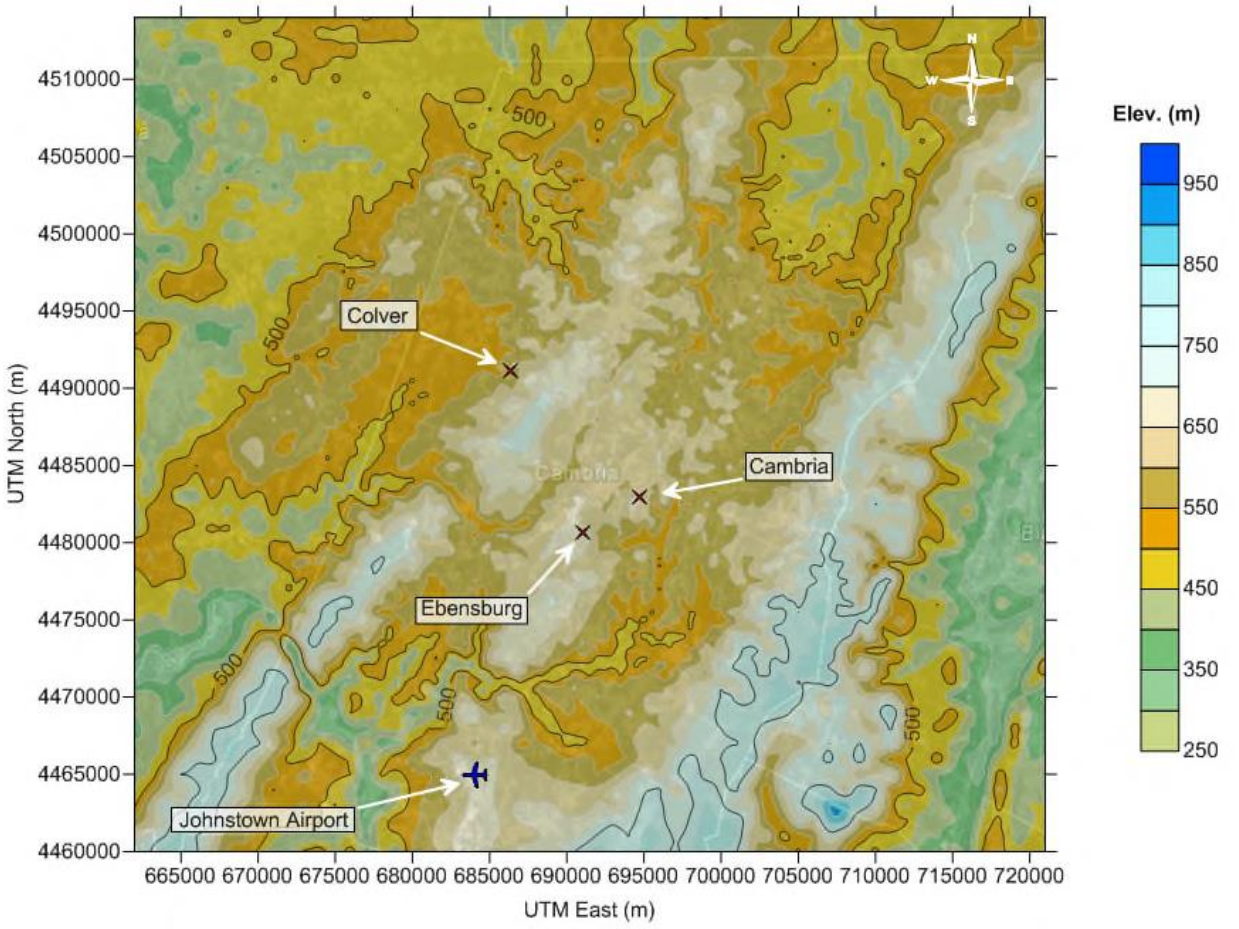
The modeling input file (BEE-Line Software) provided by Pennsylvania had a default setting in the AERMOD MODELOPT command line. This option would not have run using the EPA compiled version of AERMOD since the AERMET file was processed using the Adjust U* option, which requires the BETA option be utilized in the command line. As noted previously, using the Adjust U* option in version 15181 is not acceptable since this version of AERMOD has a known formulation bug that can lead to an under prediction.

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

All the DRR sources included in the modeling domain reside in the Allegheny Plateau province of the Appalachian Mountain system. To the southeast lies Bald Eagle Mountain, which marks the edge between the Allegheny Plateau and the Ridge and Valley provinces. Figure 7.6] was taken from Pennsylvania's submitted final modeling report and shows the terrain features included in the modeling analysis along with the location of the DRR sources and the Johnstown/Cambria County Airport. Note nearly all the modeled sources are located on the peaks or near the peaks of the local terrain features. Under these circumstances most of the modeling domain would be considered as simple terrain; terrain below stack top.

No formal documentation regarding the model receptor grid construction was given in the final modeling report or the initial modeling protocol. A more detailed description of the receptor grid processing via AERMAP should be provided by Pennsylvania to determine if the model receptor grid was correctly processed for the final modeling analysis.

Figure 7.6: **Cambria County, Pennsylvania Elevation layout of modeling domain; figure is taken from the final modeling report submitted to EPA**



7.3.1.8. 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, the Commonwealth used a tier 2 background concentration approach using three (3) monitoring sites in Blair, Cambria, and Indiana counties. Background concentration values were determined by hour of day and wind direction (flow vector) for that hour of the model simulation using the AERMOD BGSECTOR keyword. Wind sector (hourly) background concentrations were assigned as follows:

1 to 180° - Altoona SO_2 Monitor (Blair County)
181 to 255° - Johnstown SO_2 Monitor (Cambria County)
256 - 360° - Strongstown SO_2 Monitor (Indiana County)

The background concentrations for this area of analysis are summarized in the Table 7.5]. Overall, seasonal background concentrations used in this modeling analysis were significantly higher than background concentrations from other DRR analyses in Pennsylvania. The Indiana County monitor (Strongstown) is inside the Indiana, PA, 1-hour SO_2 nonattainment area. While this monitor is currently below the standard, its 2013-15 design values was 70 ppb, which is ~93% of the standard. Using a background concentration from this monitor in the modeling analysis is probably overstating the impact since SO_2 concentrations fall significantly as one moves eastward into Cambria County (note the difference between the Strongstown monitor in Indiana County and the Johnstown monitor in Cambria County). SO_2 controls were only recently fully installed (spring of 2016) at the Homer City Generating Station; SO_2 emissions were close to 100,000 tpy in 2015. Given the recent installation of controls, we expect SO_2 transport from the Indiana County sources to decline significantly in the future. Again, using the Strongstown monitor and other background monitors with unusually high SO_2 concentrations in the modeling analysis adds a conservative estimate of background contributions within the modeling domain.

Table 7.5. Table summarizing background concentration ranges (in µg/m^3) from the three (3) background monitors for the Cambria County, Pennsylvania Area

Background Monitor	Max	Min	Average
Altoona	81.01	3.48	30.93
Johnstown	54.88	13.07	21.60
Strongstown	128.05	13.94	59.26

After reviewing the input files and most recent AERMOD Users Guide for the BGSECTOR command (see section 3.3.8.1), the modeling analysis may have misinterpreted which hourly background concentration was assigned in the modeling analysis. Pennsylvania should review the background concentrations assignments and ensure that they are based on the flow vector, or downwind direction, based on the wind direction in the AERMET sfc (surface) file. It is assumed that the intended background monitor assignments were Altoona for winds blowing from 1 to 180° (generally towards the west), Johnstown for winds blowing from 181 to 256° (generally towards the northeast) and Strongstown for winds from 257 to 360° (generally towards the southeast). If these background concentration assignments are incorrect then the modeling analysis may not simulate the DRR sources correctly.

7.3.1.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Cambria County area of analysis are summarized below in Table 7.6

Table 7.6: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Cambria County Area

Input Parameter	Value
AERMOD Version	15181 with Adjust U*
Dispersion Characteristics	Rural
Modeled Sources	3
Modeled Stacks	3
Modeled Structures	7
Modeled Fencelines	3
Total receptors	9,859
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Johnstown/Cambria County Airport, PA
NWS Station Upper Air Meteorology	Johnstown/Cambria County Airport, PA
NWS Station for Calculating Surface Characteristics	Pittsburgh International Airport, PA
Methodology for Calculating Background SO_2 Concentration	Season, Temporal Varying, Wind Vector Varying
Calculated Background SO_2 Concentration	3.48 to 128.05 µg/m3

The results presented below in Table 7.7 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

Table 7.7. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Cambria County Area

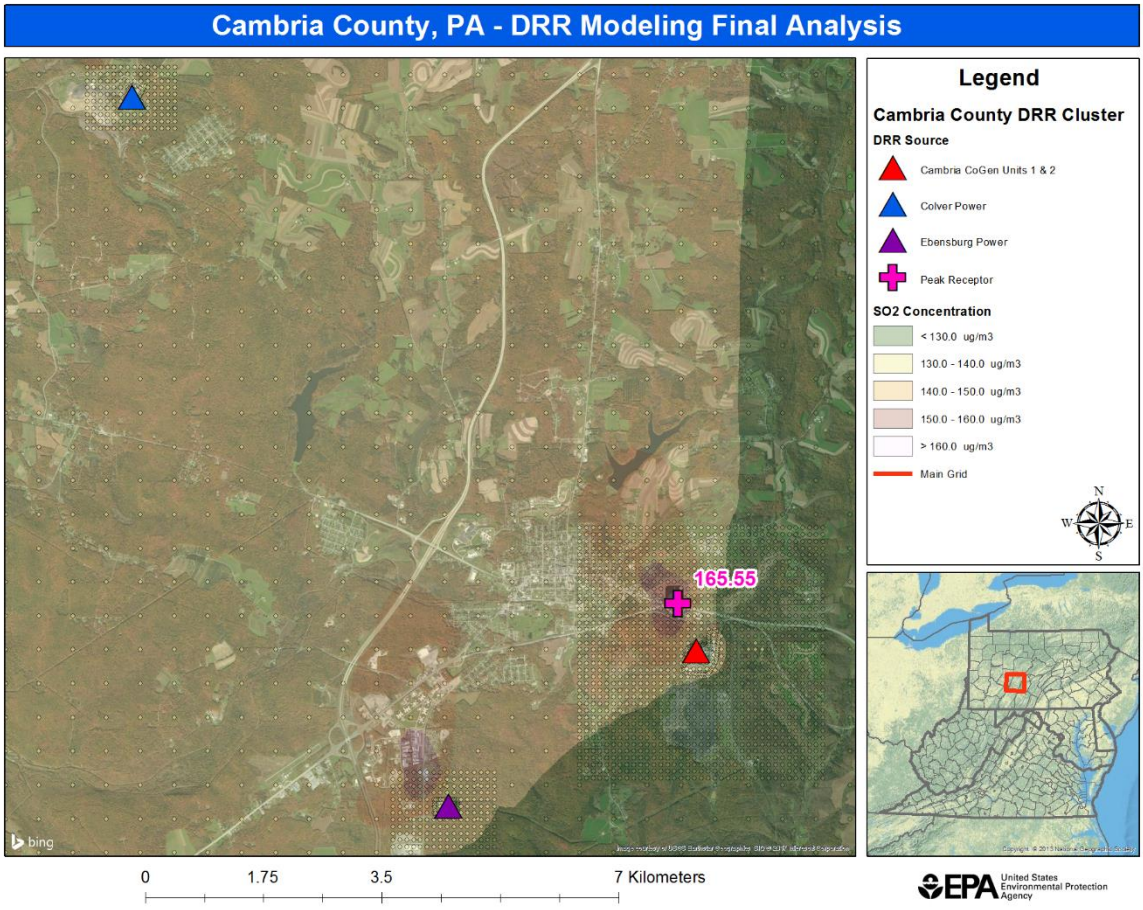
Averaging Period	Data Period	Receptor Location [UTM zone 17]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM Easting	UTM Northing	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013-15	694450	4483680	165.55	196.4*

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

The Commonwealth's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 165.55 $\mu g/m^3$, equivalent to 63.2 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the three (3) Cambria County DRR facilities. Figure 7.7below was generated using model output files, and indicates that the predicted max modeled value occurred approximately 750 meters north-northwest the Cambria CoGen facility, just east of Ebensburg Borough. Cambria CoGen is the largest emitter in the DRR cluster. Part of the state's receptor grid is also shown in the Figure 7.7.

Pennsylvania's modeling analysis also included receptor grids inside each DRR source's ambient air boundary. Consistent with the Modeling TAD, separate model runs were completed for each source to determine the impacts from the other two (2) DRR sources for areas inside its ambient air boundary. Results from these runs are not shown here but indicate on-site peak model concentrations were lower than the DRR sources' combined impacts (for the receptor grid that excluded receptors inside all the DRR sources' ambient air boundaries).

Figure 7.7: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Cambria County Area



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

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

Pennsylvania's modeling analysis for the DRR source cluster in Cambria County cannot be used to determine if the area is attaining or not attaining the 1-hour 2010 SO_2 NAAQS due to modeling deficiencies. First, Pennsylvania used the Adjust U* option within AERMOD version 15181. This version has a known formulation bug that can contribute to model under predictions. Peak model concentrations, however, appear to have occurred during well mixed (daytime) conditions when the impact of the Adjust U* option is probably limited. This formulation bug can be avoided by either reprocessing the met data using the most current version of AERMET or by running without using the Adjust U* option (default mode). The second modeling issue is how the modeling background concentration was incorporated into the final modeling analysis. Pennsylvania failed to note that the sector varying background concentration (via AERMOD's BGSECTOR keyword) is based on the flow vector and not the actual wind direction. This mistake is important because the added background concentration can potentially make up a significant fraction of the final model result. Hourly varying background concentrations can be over 60% of the 1-hour SO_2 NAAQS in some instances and were the highest of any DRR modeling analysis submitted for Pennsylvania. The background concentrations used in the Cambria County DRR cluster modeling analysis are probably overstating the amount of transported SO_2 emissions from some of the larger sources in neighboring Indiana County. Lastly, Pennsylvania's submission lacked information on the development of the model receptor grid, specifically, files associated with the AERMAP model receptor preprocessor.

7.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Cambria County, Pennsylvania 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.

7.5. Jurisdictional Boundaries in the Cambria County, Pennsylvania

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

In Pennsylvania's original recommendation on June 23, 2011, Pennsylvania recommended that the entirety of Cambria County be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the DRR listed facilities in Cambria County but did not update their recommendation.

7.6. Other Information Relevant to the Designations for the Cambria County Area

Indiana County which neighbors Cambria County to the west was designated nonattainment for the 2010 SO2 NAAQS, effective date October 4, 2013. Based on all available information, EPA cannot determine whether the Cambria County area is contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS.

7.7. The EPA's Assessment of the Available Information for the Cambria County, Pennsylvania Area

The EPA finds that available air quality monitoring data alone are unreliable to be representative of the area's air quality. Although the design value from the air quality monitor located within this area of analysis is well below the standard of 75 ppb (36 ppb), it is unclear if this monitor is located in areas of maximum concentration, and therefore, it is unclear if the monitoring data is representative of actual air quality in the area. This monitor is in Cambria County and is southwest of all three DRR sources which are analyzed for this area. Specifically, the monitor is 22 km, 26 km, and 29 km from Ebensburg Power, Cambria Cogen, and Colver Power, respectively. Winds were somewhat distributed in the northwest to southeast quadrants. A resultant wind vector for all hours was from a southwesterly direction.

EPA reviewed Pennsylvania's modeling analysis for the DRR source cluster in Cambria County and found several modeling deficiencies, such as the use of the Adjust U* option within AERMOD version 15181, and lack of documentation regarding the development of the model receptor grid. Therefore, the modeling analysis for the sources cluster in Cambria County cannot be used to determine if the area is attaining the 2010 1-hour SO2 NAAQS.

Pennsylvania originally recommended that the entirety of Cambria County be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the DRR listed facilities in Cambria County but did not update their recommendation.

The EPA concludes that our intended unclassifiable 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 area.

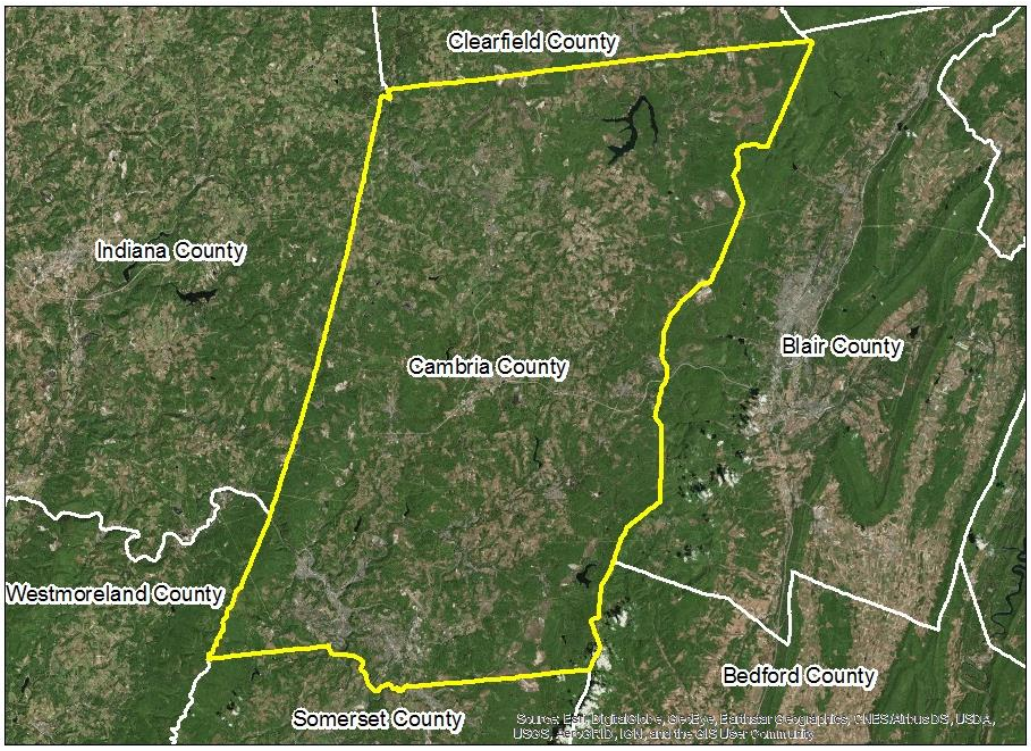
7.8. Summary of Our Intended Designation for the Cambria County, Pennsylvania Area

After careful evaluation of the Commonwealth's recommendation and supporting information, as well as all available relevant information, the EPA agrees with the Commonwealth's recommendation and intends to designate Cambria County area as unclassifiable for the 2010 SO_2 NAAQS. The Cambria County unclassifiable 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 SO2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS. Specifically, the boundaries are comprised of the county boundary for Cambria County.

Figure 7.8 shows the boundary of this intended designated area.

Figure 7.8. Boundary of the Intended the Cambria County Unclassifiable Area



At this time, our intended designations for the state only apply to this area and the other areas presented in this technical support document.

8. Technical Analysis for the Clearfield County Area

8.1. Introduction

The EPA must designate the Clearfield County area by December 31, 2017, because the area has not been previously designated and Pennsylvania 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 county. Pursuant to the DRR (*see* 40 CFR part 51, subpart BB), states had the option to characterize large sources of SO_2 by either monitoring, modeling or capping emissions below 2,000 tons of SO_2 per year. Pennsylvania submitted modeling for the Shawville Generating Station that emits more than 2,000 tons of SO_2 per year.

8.2. Air Quality Monitoring Data for the Clearfield County Area

There are no air quality monitors in the Clearfield County area of analysis.

8.3. Air Quality Modeling Analysis for the Clearfield County Area Addressing Shawville Generating Station

Section 8.3 presents all the available air quality modeling information for a portion of Clearfield County that includes the Shawville Generating Station located in Clearfield County, PA. (This portion of Clearfield County will often be referred to as "the Clearfield County area" within this section 8.3). This area contains the following SO_2 source, which is the only source around which Pennsylvania 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 Shawville Generation Station facility emitted over 2,000 tons or more annually. Specifically, Shawville Generating Station emitted 36,936 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. Pennsylvania has chosen to establish an emission limit and use that limit in a modeling analysis to show compliance with the 1-hr SO_2 NAAQS (instead of taking a limit of less than 2,000 tons per year, as the state previously indicated to EPA).

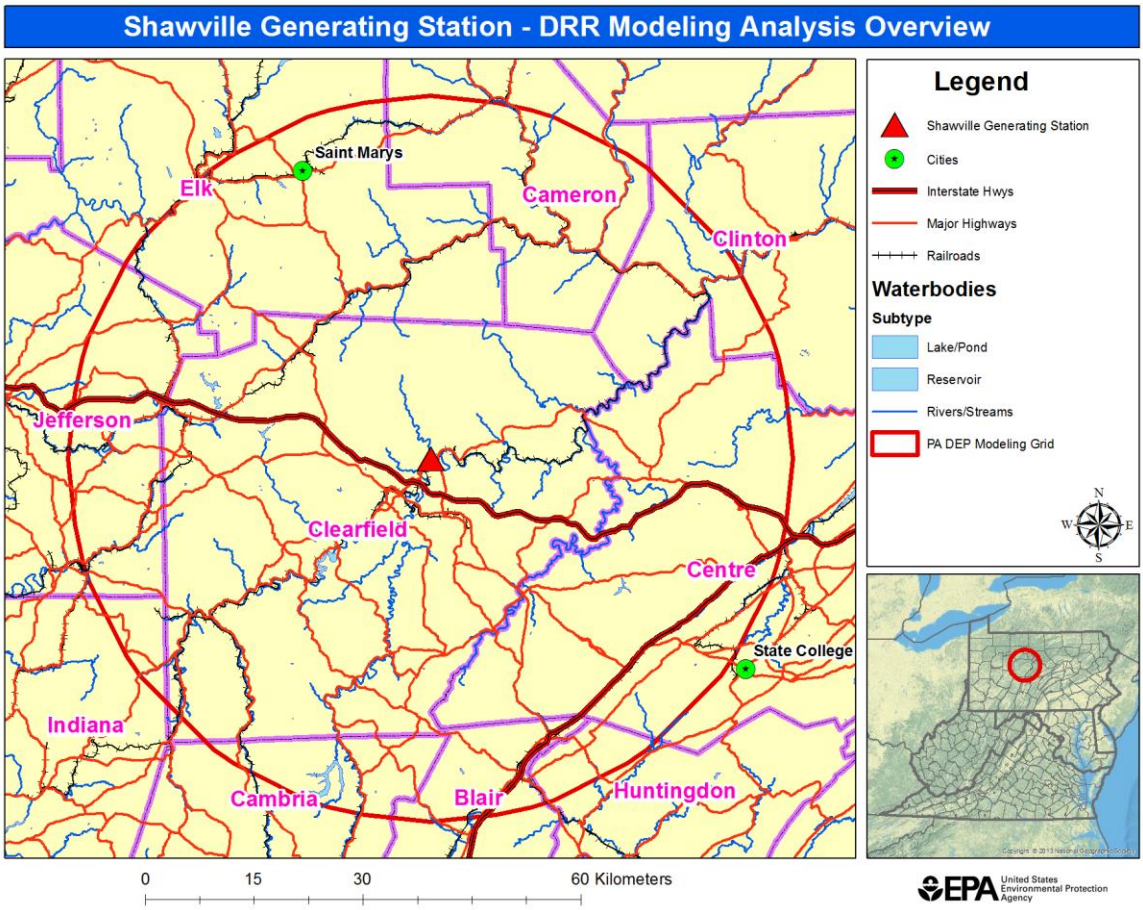
In Pennsylvania's original recommendation on June 23, 2011, Pennsylvania recommended that the area surrounding the Shawville Generation Station, specifically the entirety of Clearfield County, be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the Shawville Generation Station but did not update their recommendation. This modeling assessment and characterization of air quality was performed using air dispersion modeling software, i.e., AERMOD, to establish emission rates that are protective of the 1-hr SO_2 NAAQS. After careful review of the Pennsylvania's assessment, supporting documentation, and all available data, the EPA agrees with the Commonwealth'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 Pennsylvania has assessed via air quality modeling is located in north-central Pennsylvania in Clearfield County.

As seen in Figure 8.1below, the Shawville Generating Station facility is located on a 1,147-acre site along the west branch of the Susquehanna River, 10 miles northeast of Clearfield, PA. A survey of the area indicated there were no other sources above 100 tpy of SO_2 within the county thus only the Shawville Generating Station was included in the modeling analysis. The modeling domain analyzed by PA DEP extends radially almost 50 km from the Shawville Generating Station and includes portions of Blair, Cambria, Cameron, Centre, Clearfield, Clinton, Elk, Huntington, Indiana, and Jefferson counties in Pennsylvania. See EPA's analysis of the modeling receptor grid in section 8.3.1.3 below.

The EPA's intended unclassifiable designation boundary for the Clearfield County area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

Figure 8.1. Map of the Clearfield County, Pennsylvania Area Addressing Shawville Generating 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, which was provided by Pennsylvania.

8.3.1. Modeling Analysis Provided by the State

On May 26, 2017 Pennsylvania submitted its current DRR modeling analysis to EPA for the Shawville Generation Station source.

8.3.1.1. 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

As stated, PA DEP delivered its modeling analysis to EPA on May 26, 2017. On January 17, 2017, EPA published its revision to Appendix W – Guideline to Air Quality Models.[32] Since the publication of Appendix W the current version of AERMOD is version 16216r. The initial modeling analysis completed by Pennsylvania for the Shawville Generation Station was rerun by PA DEP and submitted using AERMOD version 16216r with the Adjust U* option, which included a bug fix noted in AERMOD version 15181. On March 14, 2017, the effective date for implementation of Appendix W was extended until May 22, 2017. This date has since passed means the revised Appendix W is in effect. A discussion of the Commonwealth's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

8.3.1.2. 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.

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

The Auer method was utilized by examining the 3-km area surrounding the Shawville Generating Station. A rural classification was determined using this method. In addition to using aerial imagery for the Auer analysis, further support is shown for the rural classification by examining the 2011 NLCD data within a 3-km radius of the facility. The 2011 data show well below 50% of the area can be classified as urban land use, which supports the rural designation. Therefore, rural dispersion characterization was used for this modeling effort. EPA reviewed these results and agrees with using a rural classification for the modeling analysis.

8.3.1.3. 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 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 are described in the introduction to this section. For the Clearfield County area, the state has included no other emitters of SO_2 within 50 km of Shawville Generation Station 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 violations in the area of analysis. No other sources beyond 50 km were determined by the state to have the potential to cause concentration gradient impacts within the area of analysis.

Pennsylvania's grid extends radially 50 km away from the facility. The grid receptor spacing for the area of analysis remodeled by Pennsylvania is as follows:

- a 50-m regularly spaced grid extending radially to a distance of 2 km
- a 100-m regularly spaced grid extending radially between 2 and 5 km
- a 500-m regularly spaced grid extending radially between 5 km and 30 km
- a 1,000-m regularly spaced grid extending radially between 30 km and 50 km

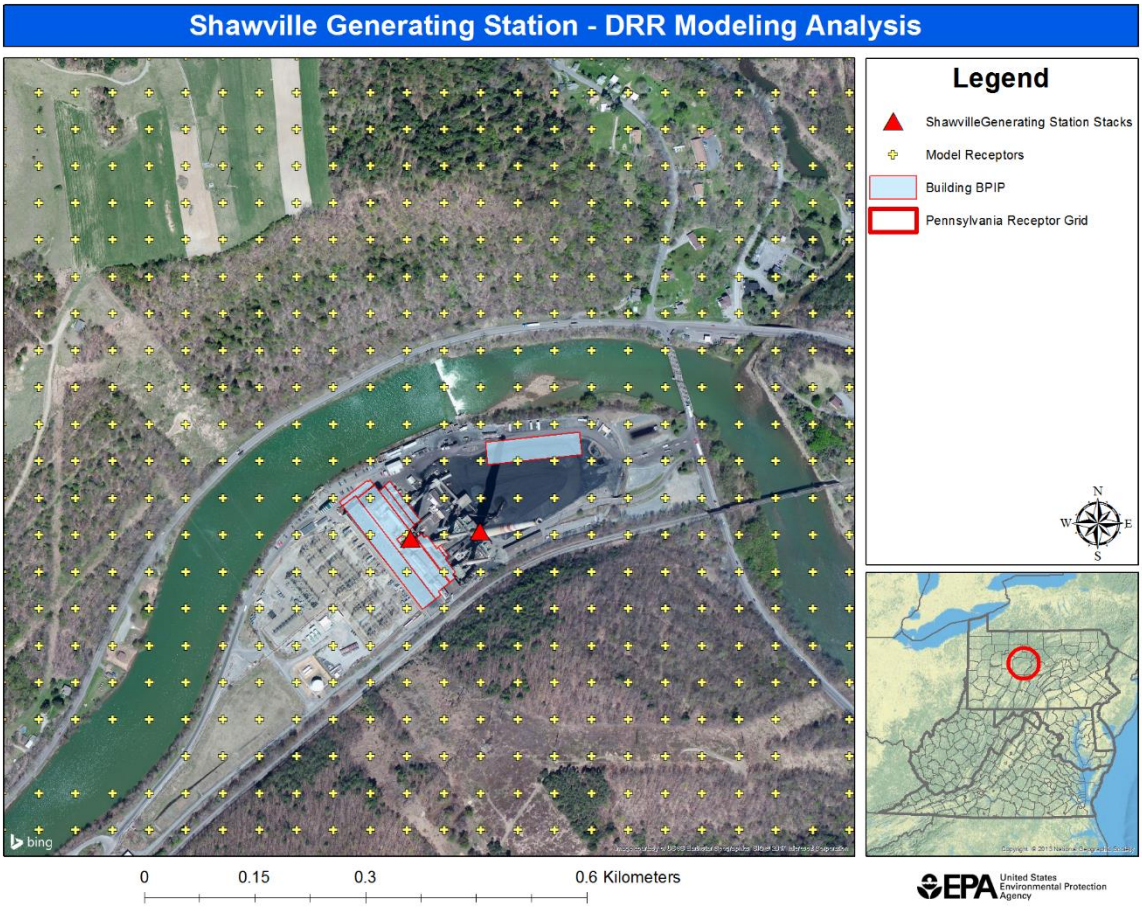
Pennsylvania's modeling analysis also included several areas with refined 25-m spaced Cartesian grids. The locations of these grids were chosen to better resolve peak concentrations that were noted on the main grid and determine the maximum modeled concentration. Properly resolving the areas of maximum model concentrations was important since the modeling analysis was being used to develop the critical emission value and set an emission limit that is protective of the health-based 1-hour SO_2 NAAQS.

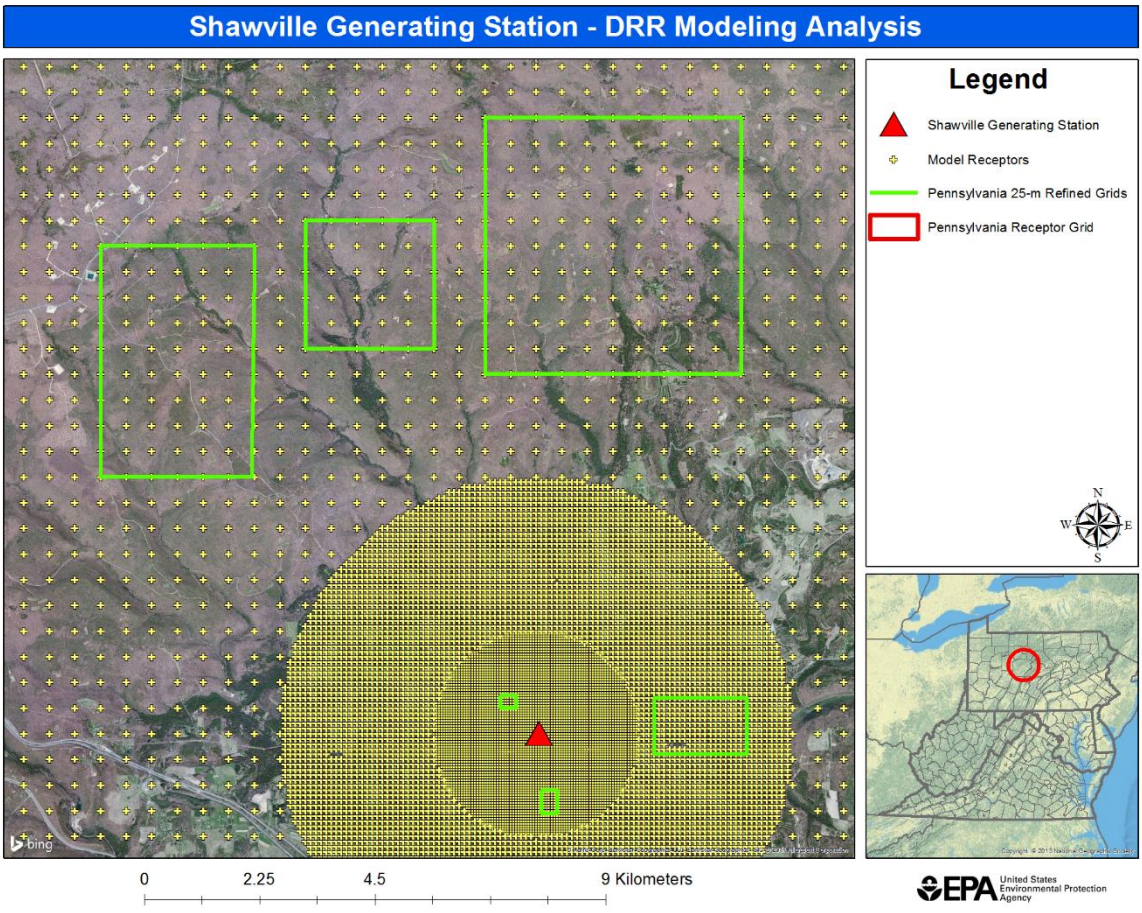
Combining Pennsylvania's remodeled receptor grids, the receptor network contained 103,690 receptors, and covered portions of Blair, Cambria, Cameron, Centre, Clearfield, Clinton, Elk, Huntington, Indiana, and Jefferson counties in north-central Pennsylvania.

Figures 8.2 and 8.3, included in the Commonwealth's recommendation, show the state's chosen area of analysis surrounding the Shawville Generating Station, as well as the receptor grid for the area of analysis.

Pennsylvania's grid did not delineate any ambient air boundary for Shawville Generating Station. Given the stack heights for the Unit 1 & 2 and Unit 3 & 4 stacks exceed 175 m, building downwash is not expected to be impacting final model concentration in the immediate vicinity of the facility. Indeed, maximum impacts from Pennsylvania's analysis are many kilometers removed from the stack release points and therefore well away from any potential facility ambient air boundary.

Figure Series 8.2: Area of Analysis for the Clearfield County Area




Shawville Generating Station - DRR Modeling Analysis
Legend
Shawville Generating Station
Model Receptors
Pennsylvania 25-m Refined Grids
Pennsylvania Receptor Grid
N
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bing
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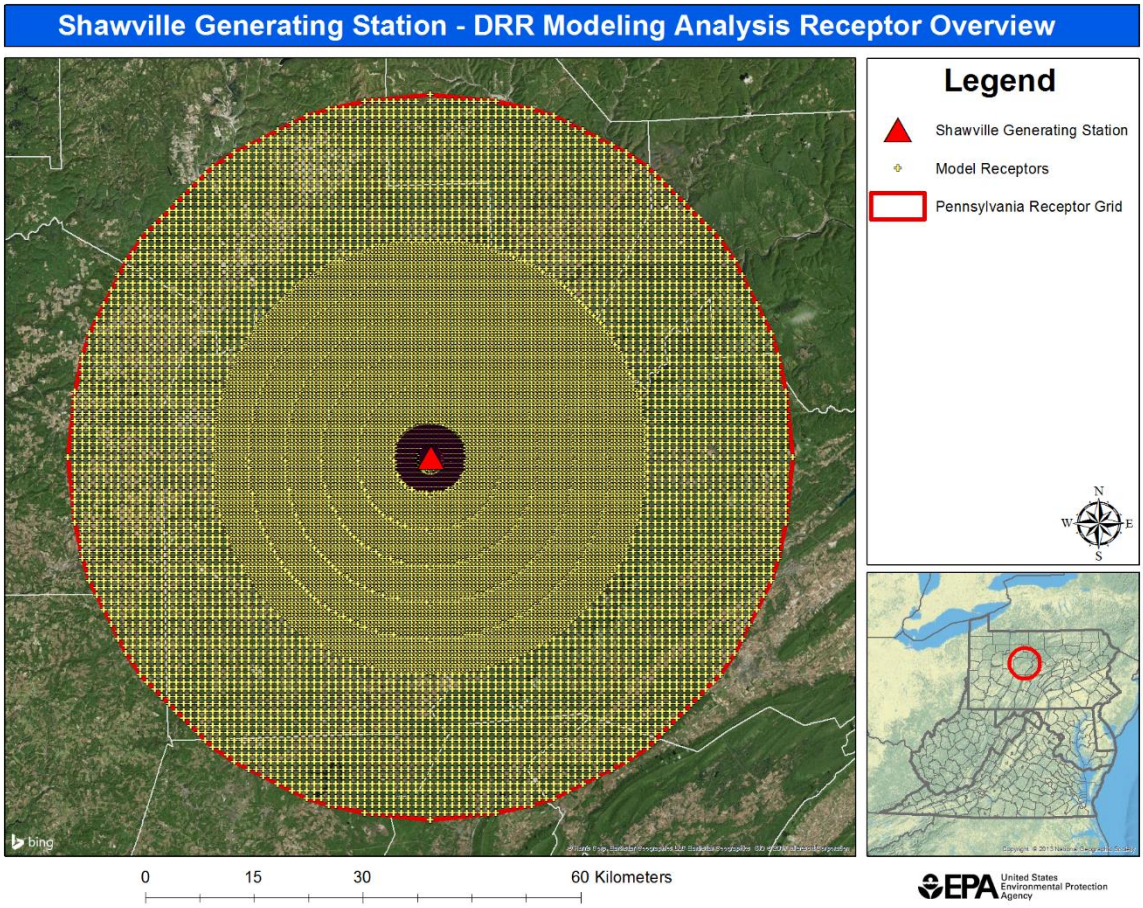
4.5
9 Kilometers
EPA
United States
Environmental Protection
Agency

Figure 8.3: Receptor Grid for the Clearfield County Area



EPA evaluated Pennsylvania's revised model receptor grid, including the refined 25-m grids, and determined that it is of adequate resolution to capture the maximum modeled 1-hour SO_2 concentration.

8.3.1.4. 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 or following GEP policy with allowable emissions.

The Shawville Generating Station has four (4) main boiler units capable of burning natural gas, back up fuel oil or coal. In addition to these main units, there are three (3) start up diesel generators, two (2) emergency generators, and two (2) fire pump diesel engines. Only the main boilers were used in the modeling analysis. The other sources historical emissions and operations were reviewed and it was determined that their operations were too infrequent and their emissions were too small to be expected to contribute significantly to the annual distribution of

daily maximum 1-hour concentrations in accordance with EPA's March 1, 2011 Clearinghouse Memorandum.

The four (4) units at the Shawville Generating Station exhaust through two (2) separate stacks. Units 1 & 2 exhaust through a 182.9 m stack and units 3 & 4 exhaust through a 259 m stack. Building parameters were entered into BPIP to calculate downwash parameters for the modeling analysis. BPIP noted that both stacks exceeded the GEP formula calculations. A wind-tunnel study conducted in 1989 for the Units 3 & 4 stack demonstrated that the actual 259-meter stack is GEP and, thus, fully creditable for modeling purposes. A report detailing this analysis was included in the final report submitted by Pennsylvania and supports the use of both stack heights for modeling purposes. The modeled exhaust gas temperatures and velocities were based on a review of actual data collected during the period from 2010 through 2015 (coal-firing operations). It is projected that the boiler heat inputs and exhaust gas stream parameters (stack temperatures and exit velocities) will be similar for natural gas-firing operations. Stack velocities for the unit 1 & 2 stack appeared to be unusually high, over 125 ft./s. Stack velocities for the unit 3 & 4 stack were not as high but were still over 75 ft./s.

Modeling for the full load case for boilers 1 through 4 was conducted to determine the critical emission values that result in compliance with the 2010 1-hour SO_2 NAAQS. The resulting SO_2 critical emission values for boilers 1 & 2 and for boilers 3 & 4 are 2,690.0 lb/hr and 3,580.0 lb/hr, respectively. These limits are in the form of 1-hour limits not to be exceeded.

EPA has reviewed the modeling analysis and determined, for the most part, that the Shawville Generating Station's source characteristics appear valid, though stack velocities for the unit 1 & 2 stack (38.6 m/s) appear unusually high for a large boiler.

A gas conversion project was scheduled to be completed in 2016, allowing the facility to operate on cleaner burning natural gas and significantly reduce emissions.[33] Coal-firing capabilities were retained to allow fuel flexibility. Modeling was proposed to establish limits that would be protective of the health-based 1-hr SO_2 NAAQS. These limits were incorporated into a federally enforceable permit on June 8, 2017.

8.3.1.5. 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.

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

[33] http://maps.nrg.com/media/attachments/PLA.2016_Shawville_v2.pdf

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, Pennsylvania included the Shawville Generating Station and no other emitters of SO_2 within 50 km in the area of analysis. The Commonwealth has chosen to model this facility to develop a critical emission value that will be a federally enforceable PTE limit for SO_2 emissions. The facility in the Commonwealth's modeling analysis, its actual emissions from 2013-15 and its modeled critical emission value emission rate are summarized below.

For the Shawville Generating Station, the state provided the modeled critical emission value to show compliance with the 1-hour SO_2 NAAQS. This information along with past actual emission values are summarized in Table 8.1. A description of how Pennsylvania obtained hourly emission rates is given below this table.

Table 8.1. SO_2 Emissions based on PTE from Facilities in the Clearfield County Area

Modeled Emissions	
Facility Name	**SO_2 Emissions (tons per year, based on PTE)**
Shawville Generating Station Units 1&2 (338.94 g/s, 2,690 lbs/hr)	11,782.4
Shawville Generating Station Units 3&4 (451.08 g/s, 3,580 lbs/hr)	15,680.7
Total Emissions from All Facilities in the Area of Analysis	**27,463.1**

EPA Clean Air Markets Division Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Shawville Unit 1	4,815.0	6,963.0	3,596.8
Shawville Unit 2	5,430.7	9,369.9	3,049.1
Shawville Unit 3	9,258.7	9,793.8	3,625.9
Shawville Unit 4	6,163.7	10,809.2	4,024.5
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**25,668.2**	**36,936.0**	**14,296.4**

eFACTS[34] Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Shawville Generating Station	25,668.5	36,936.2	14,374.5
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**25,668.5**	**36,936.2**	**14,374.5**

2014 NEI Emissions	
Facility	**2014 NEI SO_2 Emissions (tpy)**
Shawville Generating Station	36,936.2
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**36,936.2**

[34] http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facilityemissions.aspx

The critical emission values for units 1 & 2 and units 3 & 4 in pounds per hour/grams per second for the Shawville Generating Station was determined by the state based on its modeling analysis. These critical emission values are separate maximum hourly emission limits. No effort was made to establish a combined emission limit for all units. Longer averaging times were also not pursued so the limits on each set of units are not to be exceeded at any time.

Actual emission rates for the Shawville Generating Station are summarized for comparison to the modeled critical emission values. EPA notes that past actual emission rates at the Shawville Generating Station have exceeded the critical emission values.

8.3.1.6. Modeling Parameter: Meteorology and Surface Characteristics

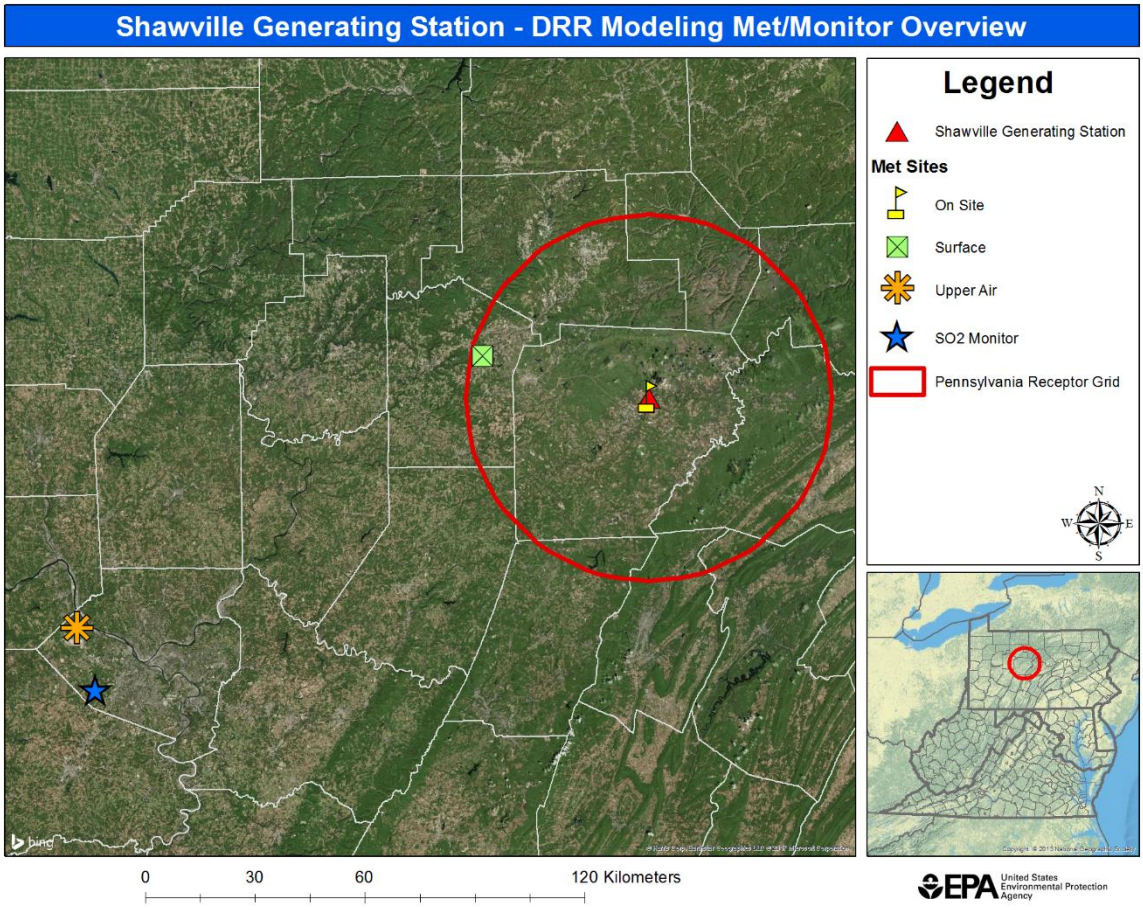
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of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

For the Clearfield County area of analysis, the modeling analysis used on-site meteorological data collected from a nearby meteorological tower and SODAR instrument. Only one year, November 22, 1993, through November 21, 1994, was used in the modeling analysis to determine the critical emission value that is protective of the 1-hour SO2 NAAQS. Processing of meteorological data was represented as the full calendar year of 1994 where November 22 – December 31, 1993, data was re-designated as 1994 data. In accordance with a prior PA DEP request, AERMET was run so that missing on-site wind and temperature data were not substituted by the surface station. The representative cloud cover data from Dubois was used in AERMET for the computation of planetary boundary layer parameters to be used as input to AERMOD. Upper air data (RAWINSONDE data) from Pittsburgh, PA. The surface met tower and SODAR were located less than 1 km from the Shawville Generating Station. The surface ASOS site used for cloud cover information is located approximately 47 km and the upper air site is located approximately 168 km from the Shawville Generating Station. This combination of meteorological sites was selected as best representative of meteorological conditions within the area of analysis.

Pennsylvania used AERSURFACE version 13016 using data from on-site met tower and SODAR sit to estimate the surface characteristics of the area of analysis. The Commonwealth estimated values for three (3) spatial sectors based upon visual observation of the land use about the site out to 1.0 km at a seasonal temporal resolution for dry, wet, average conditions. Slight changes in the default seasonal categories were imposed on the AERSURFACE analysis based on snow cover during the on-site collection period that extended from December through March. Pennsylvania also estimated values for albedo (the fraction of solar energy reflected from the earth back into space), the Bowen ratio (the method generally used to calculate heat lost or heat gained in a substance), and the surface roughness (sometimes referred to as "Zo").

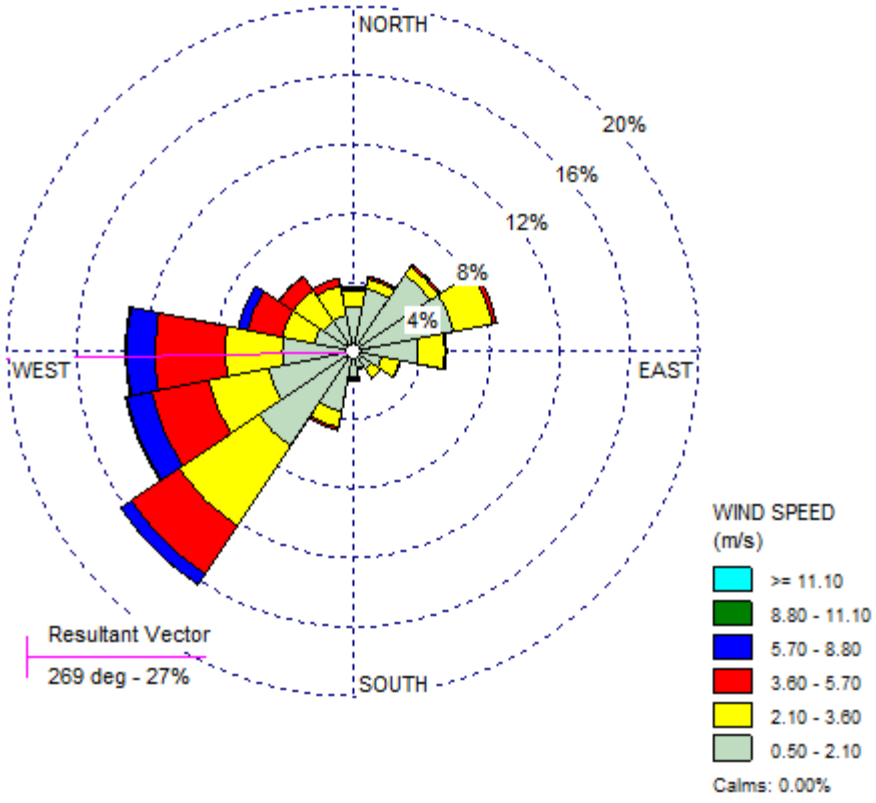
In Figure 8.4 below, generated by the EPA, the location of the Shawville (On-site) Met Tower, NWS stations and the SO_2 monitoring site are shown relative to the area of analysis.

Figure 8.4]. Area of Analysis, the Shawville Met Tower and the NWS stations used in the Clearfield County Area



As part of its recommendation, the Commonwealth provided one year of multilevel on-site met tower (and SODAR) data collected near the Shawville Generating Station. In Figure 8.5, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose was produced using the final processed AERMET sfc file in Lakes Envirionmental's WRPLOT program. The met tower winds were primarily from the west-southwest with another peak wind frequency from the northeast. This wind distribution probably reflects the orientation of the local topography along the West Branch of the Susquehanna River. A resultant wind vector of all hours was from a westerly direction. The bulk of the wind measurements included in the final processed met file are from the 10-m level on the met tower. AERMET did replace some of the missing 10-m wind measurements with other wind measurements at the next highest tower collection level (52 meters or 100 meters) when those values were available. The wind rose thus does not represent measurements collected at one exclusive level like ASOS derived met data.

Figure 8.5: Clearfield County, Pennsylvania Area Cumulative Annual Wind Rose for the Shawville Generating Station Met Tower. Data represents one year of tower measurements collected between November 22, 1993 through November 21, 1994



Meteorological data from the above on-site met tower, 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. The state followed the methodology and settings presented in EPA's Modeling TAD, including Sections 7.3.2 and Section 7.4, 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 not was provided since the modeling analysis used one year of on-site data to determine a critical emission value. The use of the AERMINUTE preprocessor was not necessary for this modeling analysis since on-site tower data was used. 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.

Pennsylvania ran AERMOD using AERMET version 16216. However, an issue with the meteorological data that was noted in the modeling protocol is still an issue with the analysis Pennsylvania submitted. EPA commented that there were differences in the wind collection methods between the tower and SODAR data. Tower wind measurements as well as most ASOS wind measurements are collected in scalar format while SODAR collects wind measurements in vector format. The proper way to integrate these wind measurement is to ensure that both data are in vector format and then use the VECTORWS option within AERMOD. This was not done and therefore there was improper mixing of wind data in scalar and vector formats. This is a significant deficiency in the modeling analysis.

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

The terrain in the area of analysis is best described as hilly. The Shawville Generating Station is located inside the Allegheny Plateau physiographic province of the Appalachian Mountains; portions of the eastern modeling domain reside in the Ridge and Valley province. The facility sits along the West Branch of the Susquehanna River. The river itself flows from southwest to northeast through a broad valley with similar orientation that stretches across 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 source of the elevation data incorporated into the model is from terrain elevations from 1-arc second, or 30-meter, National Elevation Data (NED) from USGS were used to develop the receptor terrain elevations required by AERMOD. EPA concurs that the terrain was properly accounted for in the modeling analysis.

8.3.1.8. 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, Pennsylvania used a (Tier 2) seasonal, hourly varying background concentration from the South Fayette (42-003-0067) monitor located in Allegheny County, PA. The background concentrations for this area of analysis were determined by the state to vary from 7.86 micrograms per cubic meter ($\mu g/m^3$), equivalent 3.0 ppb when expressed in two significant figures,[35] to 28.82 $\mu g/m^3$ (11.0 ppb), with an average value of 16.35 $\mu g/m^3$ (6.2 ppb). The South Fayette monitor is located approximately 170 km from the Shawville Generating Station and probably provides an adequate regionally representative background site.

8.3.1.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Clearfield County area of analysis are summarized below in Table 8.2

[35] 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 8.2: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Clearfield County Area

Input Parameter	Value
AERMOD Version	16216r with Adjust U*
Dispersion Characteristics	Rural
Modeled Sources	1
Modeled Stacks	2
Modeled Structures	2
Modeled Fencelines	None
Total receptors	103,690
Emissions Type	PTE as Determined by Modeling Critical Emission Value (CEV)
Emissions Years	Modeling determines critical emission value to show compliance
Meteorology Years	1993, 1994
NWS Station for Surface Meteorology	Shawville Met Tower/DuBois-Jefferson County Airport, PA
NWS Station Upper Air Meteorology	Pittsburgh International Airport, PA
NWS Station for Calculating Surface Characteristics	Shawville Met Tower
Methodology for Calculating Background SO_2 Concentration	Seasonal Temporal Varying
Calculated Background SO_2 Concentration	7.86 to 28.86 $\mu g/m^3$

The results presented below in Table 8.3 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

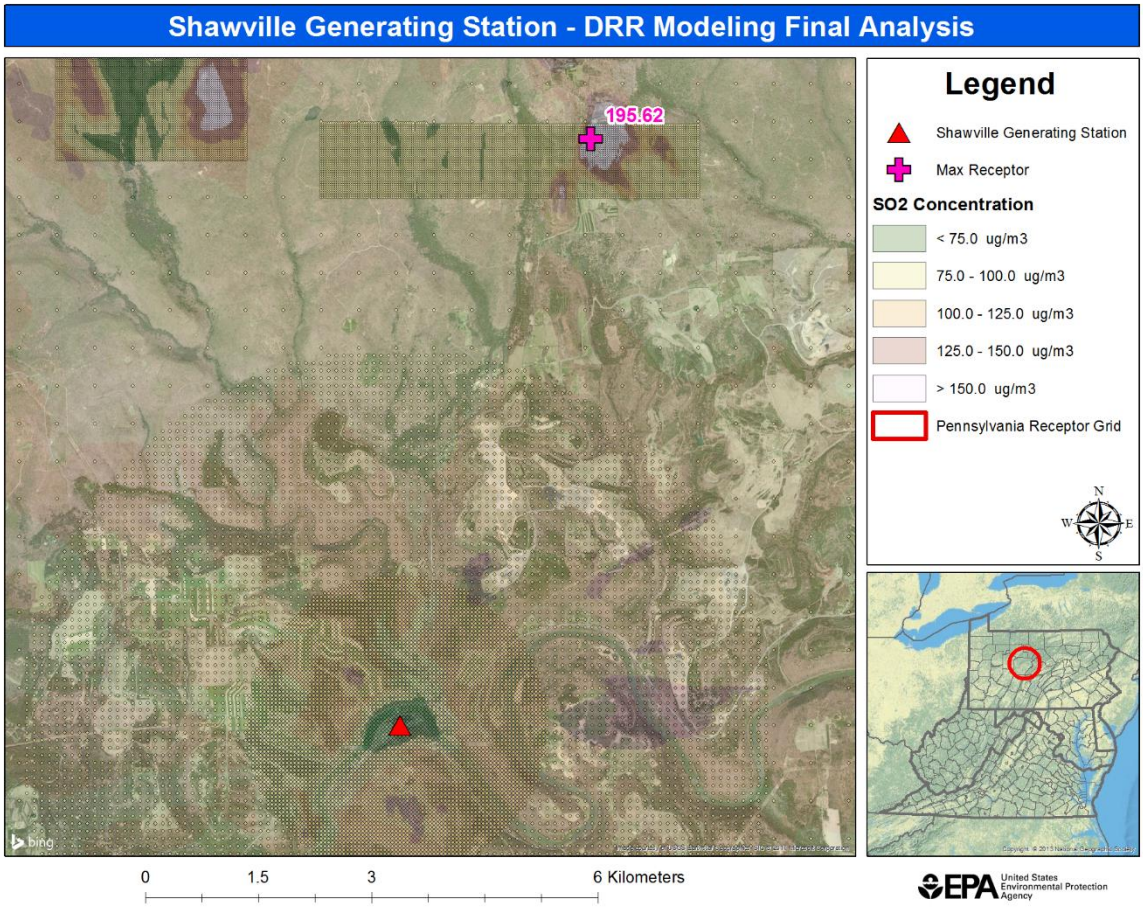
Table 8.3. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Clearfield County Area

		Receptor Location [UTM zone 17]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
Averaging Period	**Data Period**	**UTM/Latitude**	**UTM/Longitude**	**Modeled concentration (including background)**	**NAAQS Level**
99th Percentile 1-Hour Average	1-Yr On-site Met Data	723957	4557335	195.62	196.4*

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

The Commonwealth's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 195.62 µg/m^3, equivalent to 74.7 ppb. This modeled concentration included the background concentration of SO_2, and is based the modeled critical emission value calculated for the facility. Figure 8.6 below was produced from Pennsylvania's modeling submittal, and indicates that the maximum predicted modeled value occurred approximately 8 km to the north-northeast of the Shawville Generating Station. The peak model concentration is located in elevated terrain on the north side of the valley that contains the West Branch of the Susquehanna River. A portion of Pennsylvania's receptor grid is also shown in the figure.

Figure 8.6 Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Clearfield County Area



The modeling submitted by the state does not show that the 1-hour SO_2 NAAQS would be violated at the receptor with the highest modeled concentration using a critical emission value for the Shawville Generating Station. Pennsylvania's modeling analysis determined a critical emission value based on a 1-hour emission rate for Boilers 1 & 2 and for Boilers 3 & 4 of 2,690.0 lb/hr and 3,580.0 lb/hr, respectively. These limits will be applied to each unit; the limits will not be combined to create a facility wide emission limit.

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

EPA finds that most of the elements presented in the Pennsylvania modeling are compliant with the Modeling TAD with the exception of the mixing of scalar and vector wind measurements in the AERMET processing steps. On-site met data from the Shawville Met Tower collected in the early 1990s included SODAR wind measurements, which are typically vector measurements, while wind measurements from the multilevel instrumented met tower represent scalar values. The generally followed practice in this situation is to use the vector wind measurements from met tower and combine them with the vector SODAR measurements and then use the VECTORWS in the AERMOD command line to properly account for not using scalar values. As a result, due to these meteorological data concerns, this modeling analysis cannot be used to determine if the area is attaining or not attaining the NAAQS.

8.3. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Clearfield County, Pennsylvania 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.

8.4. Jurisdictional Boundaries in the Clearfield County, Pennsylvania Area

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

In Pennsylvania's original recommendation on June 23, 2011, Pennsylvania recommended that the area surrounding the Shawville Generation Station, specifically the entirety of Clearfield County, be designated as unclassifiable.

8.5. Other Information Relevant to the Designations for the Clearfield County, Pennsylvania Area

Indiana County is part of a designated nonattainment area and neighbors Clearfield County to the southwest.

8.6. The EPA's Assessment of the Available Information for the Clearfield County, Pennsylvania Area

The EPA reviewed the modeling information submitted for this area. While the modeling analysis indicates the area would attain the NAAQS, the EPA found that the modeled analysis contains significant errors in the meteorological data which was used. Therefore, the modeling cannot be used as a basis for the designations nor can it be used to determine if the source contributes to the nearby nonattainment area. As a result, the EPA agrees with the state's recommendation and intends to designate the area as unclassifiable.

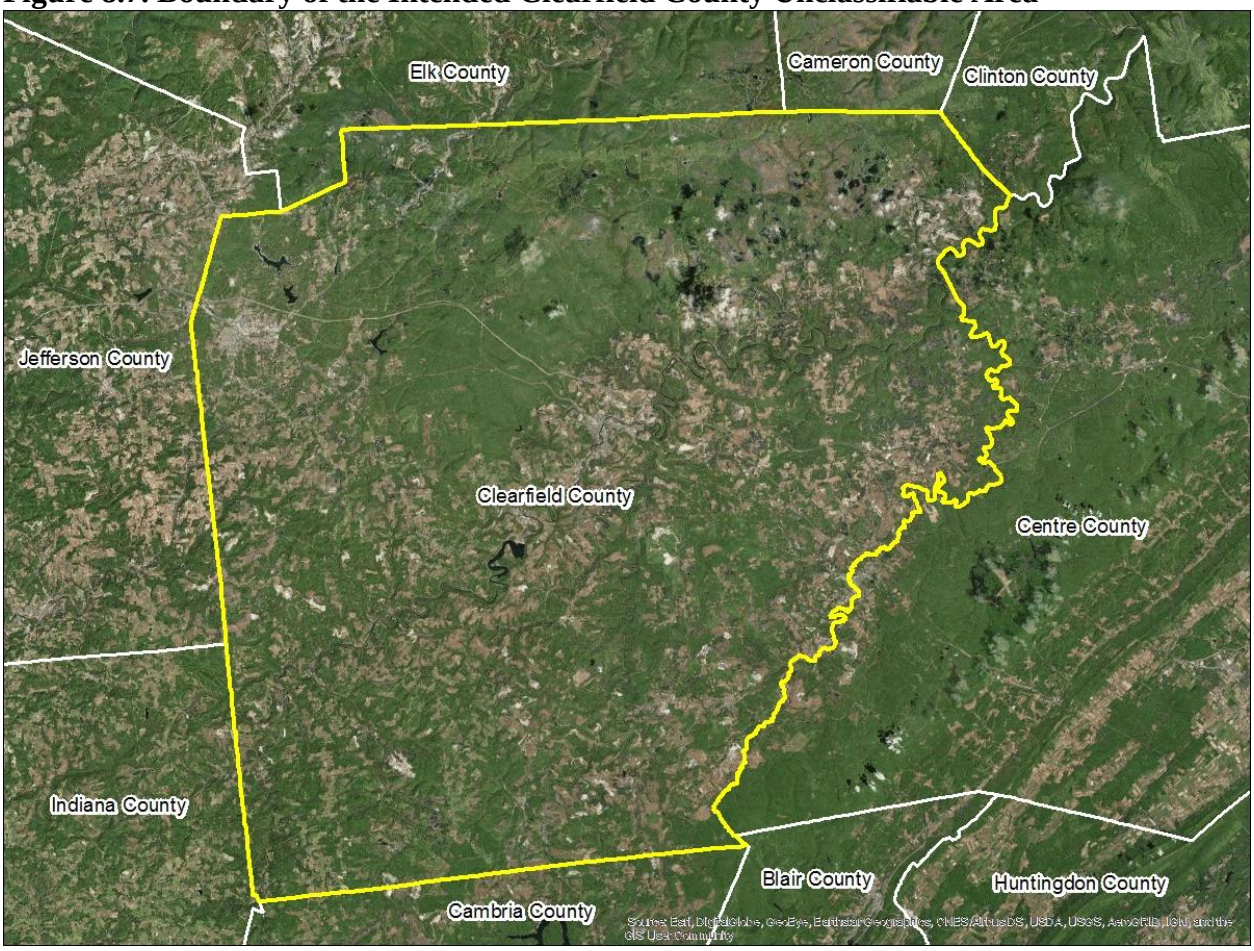
The EPA concludes that our intended unclassifiable area, bounded by the Clearfield County, Pennsylvania boundary will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable area.

8.7. Summary of Our Intended Designation for the Clearfield County, Pennsylvania Area

After careful evaluation of the Commonwealth's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate Clearfield County area as unclassifiable for the 2010 SO_2 NAAQS. The Clearfield County unclassifiable 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 boundaries are comprised of the county boundary of Clearfield County, PA.

Figure 8.7 shows the boundary of this intended designated area.

Figure 8.7. Boundary of the Intended Clearfield County Unclassifiable Area



At this time, our intended designations for the state only apply to this and the other areas presented in this technical support document.

9. Technical Analysis for the Carbon County and Schuylkill County Area

9.1. Introduction

The EPA must designate the Carbon County and Schuylkill County area by December 31, 2017 because the area has not been previously designated and Pennsylvania 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 Carbon or Schuylkill counties. Pursuant to the DRR (*see* 40 CFR part 51, subpart BB), states had the option to characterize large sources of SO_2 by either monitoring, modeling or capping emissions below 2,000 tons of SO_2 per year. Pennsylvania elected to conduct modeling for the cluster of sources in Carbon and Schuylkill Counties that are subject to the DRR.

9.2. Air Quality Monitoring Data for the Carbon County and Schuylkill County Area

There are no air quality monitors in the Carbon County and Schuylkill County area of analysis.

9.3. Air Quality Modeling Analysis for the Carbon County and Schuylkill County Area Addressing a Cluster of Sources

9.3.1. Introduction

The PA DEP identified a cluster of emissions sources in Schuylkill and Carbon counties that were subject to the DRR for the 2010 1-hour SO_2 primary NAAQS. This was outlined in a January 15, 2016 letter submitted to the EPA. The Commonwealth of Pennsylvania was required to submit a plan to the EPA with regards to the path forward for addressing the DRR. The five (5) sources identified in Schuylkill and Carbon counties were analyzed using a dispersion model to satisfy SO_2 DRR requirements. The modeling analysis approach was outlined in a modeling protocol submitted to the EPA in October of 2016.

This Section 9.3 presents all the available air quality modeling information for a portion of Carbon County and Schuylkill County that includes Gilberton Power, Northeastern Power, St Nicholas CoGen, and Wheelabrator Frackville in Schuylkill County and Panther Creek in Carbon County. (This portion of Carbon-Schuylkill County will often be referred to as "the Carbon-Schuylkill County area" within this section 11.3.). This area contains the following SO_2 sources around which Pennsylvania 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 Gilberton Power facility in Schuylkill County does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 1,401 tons of SO_2 according the 2014 NEI.

- The Northeast Power facility in Schuylkill County does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 228 tons of SO_2 according the 2014 NEI.
- The St Nicholas CoGen facility in Schuylkill County does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 1,924 tons of SO_2 according the 2014 NEI.
- The Wheelabrator Frackville facility in Schuylkill County does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 516 tons of SO_2 according the 2014 NEI.
- The Panther Creek facility in Carbon County does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source was not included in the modeling analysis submitted to EPA but it was noted that this facility was performing modeling independent of the other sources included on Pennsylvania's DRR sources in Schuylkill County. This source emitted approximately 520 tons of SO_2 according the 2014 NEI.
- The Westwood Generation facility is not on the SO_2 DRR Source list and is located in the western portion of Schuylkill County. It was not included in the modeling analysis submitted by Pennsylvania to the EPA. This source emitted approximately 305 tons of SO_2 according the 2014 NEI.

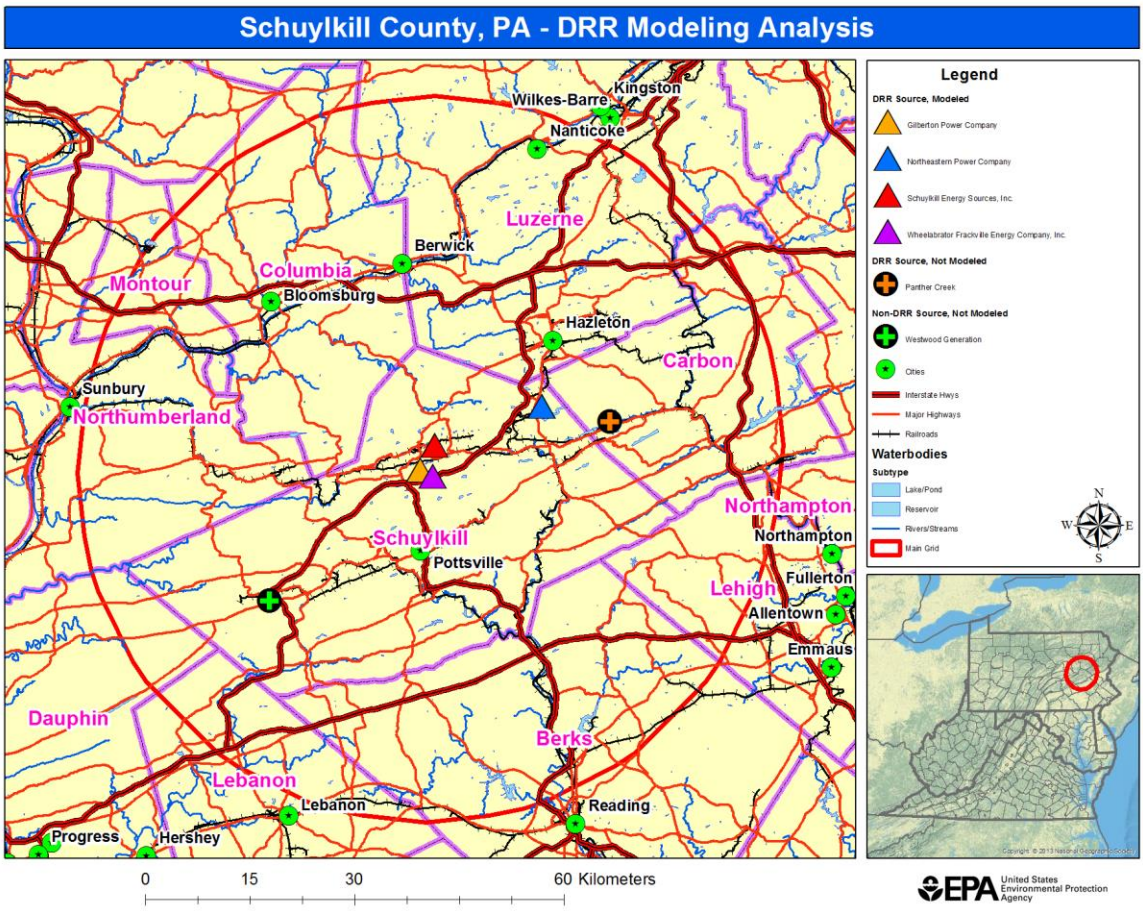
Because we have available results of air quality modeling in which these sources are modeled together, the area around this group of sources is being addressed in this section with consideration given to the impacts of all these sources.

In Pennsylvania's original recommendation on June 23, 2011, Pennsylvania recommended that the area surrounding the DRR listed facilities, specifically the entirety of Carbon and Schuylkill Counties, be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the DRR listed facilities but did not update their recommendation. 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. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

As seen in Figure 9.1 below, the five (5) DRR listed sources are located in the eastern portion of Pennsylvania; this area includes the extreme southwest portions of the Anthracite Coal Region of the state. The modeling submitted by Pennsylvania only included the four (4) DRR sources located in Schuylkill County. The modeling domain itself covers all of Schuylkill County and portions of ten (10) other counties in Pennsylvania including Berks, Carbon, Columbia, Dauphin, Lebanon, Lehigh, Luzern, Northampton, Northumberland, and Montour.

The EPA's intended unclassifiable designation boundary for the Carbon County and Schuylkill County area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

Figure 9.1. Map of the Carbon County and Schuylkill County, Pennsylvania Area Addressing a Cluster of Sources



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 one modeling assessment, which was submitted by Pennsylvania.

9.3.2. Modeling Analysis Provided by the State

On May 26, 2017, Pennsylvania submitted its current DRR modeling analysis to EPA for a cluster of sources in Carbon and Schuylkill counties.

9.3.2.1. 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

Pennsylvania delivered its modeling analysis to EPA on May 26, 2017. On January 17, 2017 EPA published its revision to Appendix W – Guideline to Air Quality Models. 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. This date has since passed and the revised Appendix W is in effect.

The modeling analysis completed by Pennsylvania for the cluster of DRR sources in Schuylkill County was submitted using AERMOD version 15181 with the Adjust U* option. EPA released a memo dated March 8, 2017 entitled *Clarification on the AERMOD Modeling System Version for Use in SO_2 Implementation Efforts and Other Regulatory Actions*[36] which states:

> "*[B]ecause the use of AERMET version 15181 with the ADJ_U* beta option contains a known and corrected formulation bug that leads to concentration under predictions, the associated AERMOD modeling results would be unreliable as a basis for determinations of SO_2 air quality in the modeled area*."

Given this point, the modeling submitted for the Schuylkill County DRR sources using actual emissions cannot be deemed sufficient to determine if the area is attaining or not attaining the 2010 1-hour SO_2 NAAQS. In addition to the use of Adjust U* in AERMOD version 15181, the modeling analysis is also not definitive since one DRR source, Panther Creek in Carbon County, and one other SO_2 source in Schuylkill County, Westwood Generation, was not included in the modeling analysis.

9.3.2.2. 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.

[36] https://www3.epa.gov/ttn/scram/guidance/clarification/SO2_DRR_Designation_Modeling_Clarificaiton_Memo-03082017.pdf

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 mode. This was based on examining 1992 land used classifications within 3 km for each of the modeled sources. Land use classifications were overwhelmingly rural. Aerial imagery for each source was also examined to ensure there were no large centers of population that would warrant an urban classification. None were observed supporting the use of the rural classification for the modeling analysis. EPA concludes the rural classification for the modeled sources is correct.

9.3.2.3. 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 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 Carbon-Schuylkill area, the state has included four (4) emitters of SO_2 within an area roughly 50 km in diameter surrounding the Schuylkill County DRR sources. 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 violations in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. Modeled Schuylkill County DRR sources included in the area of analysis are Gilberton Power, Northeast Power, St Nicholas CoGen, and Wheelabrator Frackville. No other sources beyond 50 km were determined by the state 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:

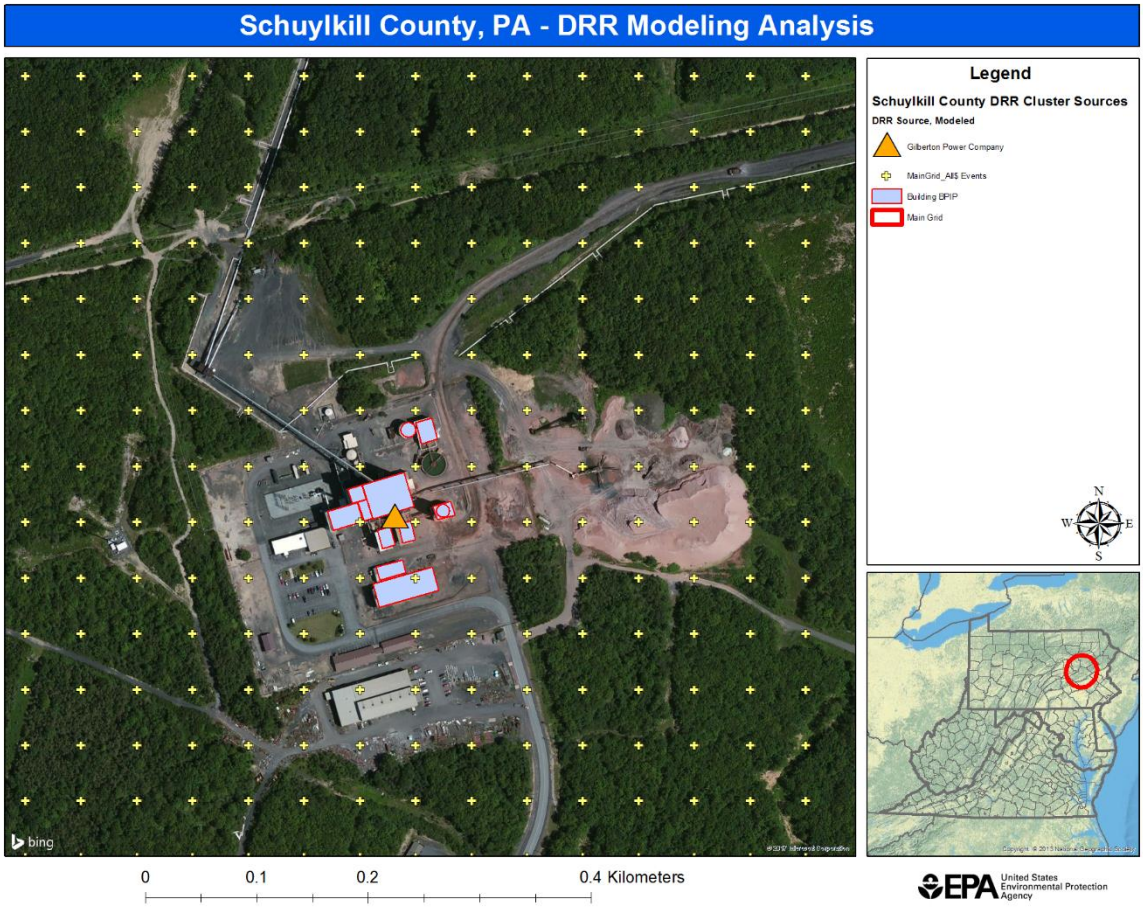
- No ambient air boundaries were delineated for any of the Schuylkill County DRR sources included in the modeling analysis
- A 50-m evenly spaced grid extending radially from each of the Schuylkill County DRR sources out to 2 km
- A 100-m evenly spaced grid extending radially from 2 to 5 km from each of the Schuylkill County DRR sources
- A 500-m evenly spaced grid extending radially from 5 to 30 km from each of the Schuylkill County DRR sources
- A 1,000-m evenly spaced grid extending radially from 30 to 50 km from each of the Schuylkill County DRR sources
- A 10-m 76 by 76 Cartesian grid centered over the area on the main grid (described above) to better resolve the peak modeled concentration

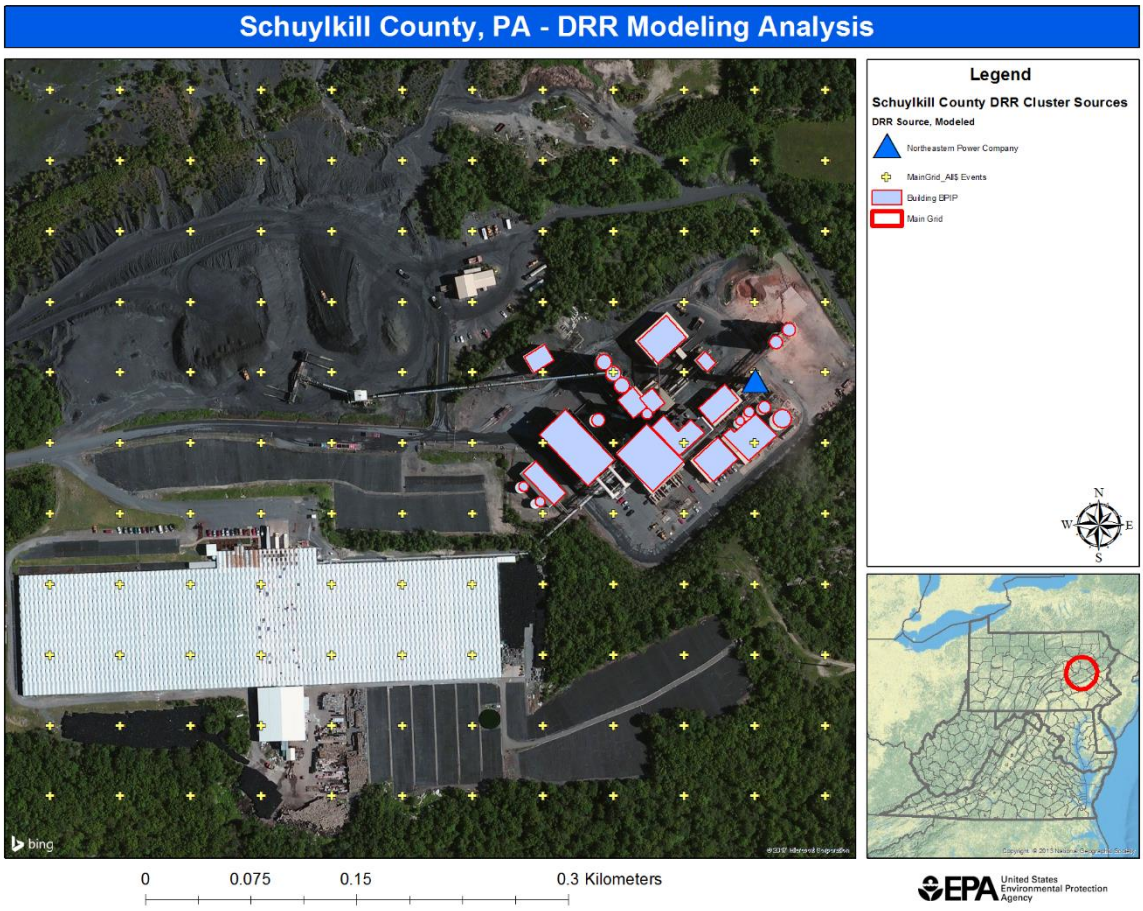
The combined receptor network contained 103,247 receptors, and the network covered Schuylkill as well portions of ten (10) other counties including Berks, Carbon, Columbia, Dauphin, Lebanon, Lehigh, Luzern, Northampton, Northumberland, and Montour.

Figures 9.2 and 9.3, included in the Commonwealth's submittal, show the state's chosen area of analysis surrounding the four (4) Schuylkill County DRR sources 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 all facilities' property. No areas, including areas inside each facility's potential ambient air boundary were excluded from the modeling analysis.

Figure Series 9.2: Area of Analysis for the Carbon County and Schuylkill County Area




Schuylkill County, PA - DRR Modeling Analysis
Legend
Schuylkill County DRR Cluster Sources
DRR Source, Modeled
Northeastern Power Company
MainGrid_All$ Events
Building EPIP
Main Grid
N
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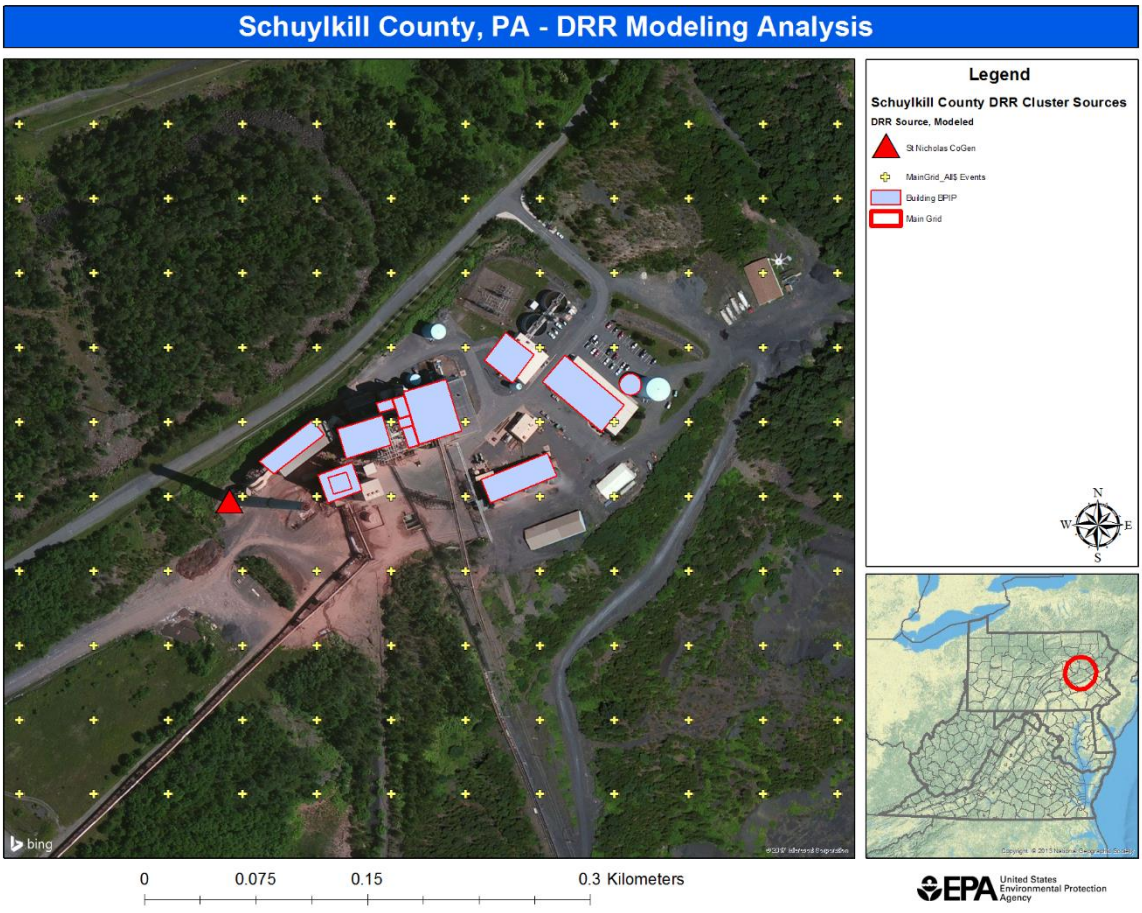
0.3 Kilometers
EPA United States Environmental Protection Agency


Schuylkill County, PA - DRR Modeling Analysis
Legend
Schuylkill County DRR Cluster Sources
DRR Source, Modeled
St Nicholas CoGen
MainGrid_All$ Events
Building EPIP
Main Grid
N
W
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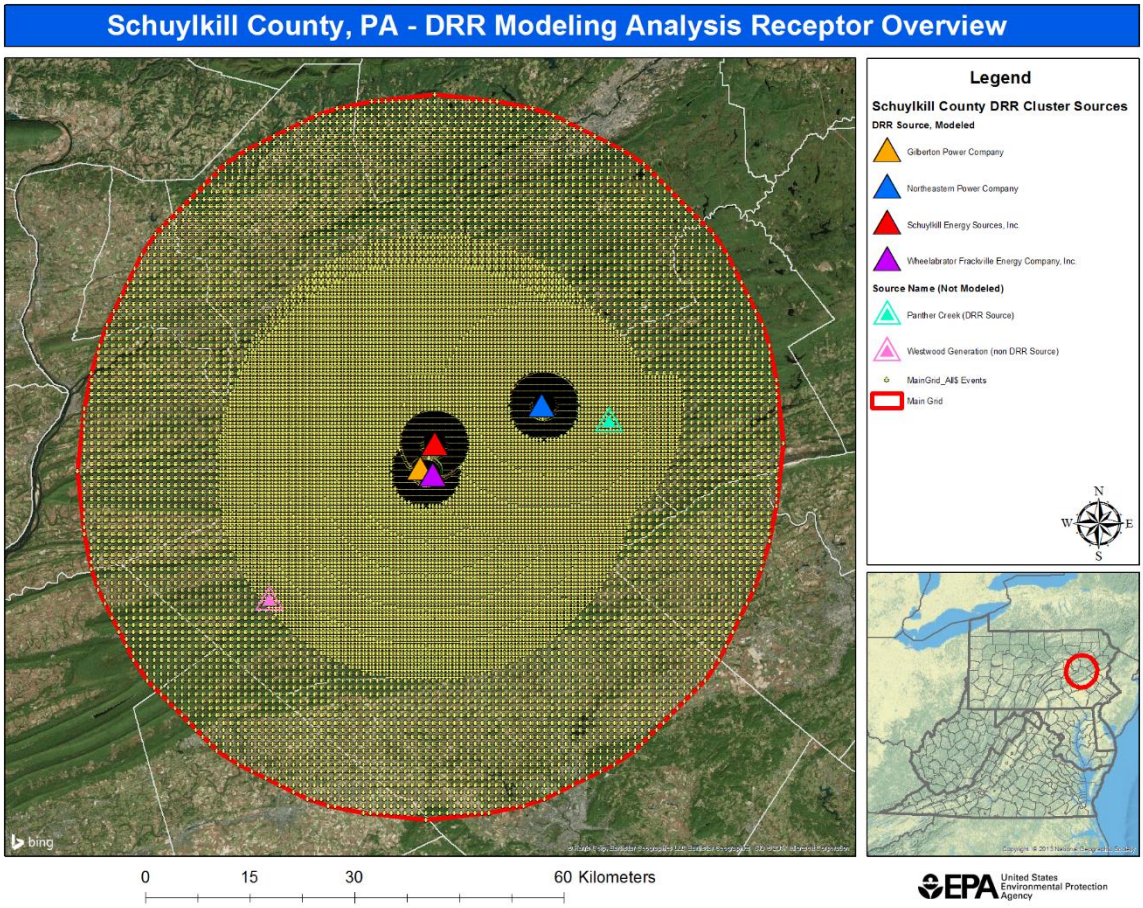
S
bing
0
0.075
0.15
0.3 Kilometers
EPA
United States
Environmental Protection
Agency

Figure 9.3: Receptor Grid for the Carbon County and Schuylkill County Area



Pennsylvania's modeling analysis did not exclude receptors within any of the four (4) DRR source's potential ambient air boundaries. Model results include building downwash and show the peak model concentration occurs well away from the ambient boundaries of the four (4) Schuylkill County DRR sources meaning proper boundary delineation is not a critical component of the modeling analysis. EPA agrees the model receptor grid is adequate to capture the maximum modeled concentrations.

9.3.2.4. 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.

This section will briefly summarize the modeled emission sources at the four (4) Schuylkill County DRR facilities (Panther Creek in Carbon County not included in modeling analysis) that

were identified as a cluster of possible contributing sources and included in the final modeling analysis:

Gilberton Power: Gilberton Power is a cogeneration facility that utilizes processed fuel to generate electricity. The facility has two Circulating Fluidized Bed (CFB) boilers that vent to one common stack at the facility. These CFB boilers burn the processed fuel in a low temperature staged combustor utilizing limestone injection to capture sulfur and assure efficient combustion at the lowest possible emission levels. No other stationary sources of SO_2 emissions were identified for the modeling analysis at this site.

A summary of the building parameters was provided in the modeling analysis. These were based on site provided data and aerial imagery. This information was processed in BPIP and used for Gilberton Power's building downwash calculations for the modeling analysis.

The preferred modeling approach recommended in the modeling TAD is the use of Continuous Emissions Monitoring System (CEMS) data. A CEMS-derived, hour-by-hour modeled emission rate dataset provides the most accurate representation of the actual emissions history of the source for the 2012-2014 time period considered in the modeling analysis. Gilberton Power maintains and operates a SO_2 CEMS that also records exhaust flowrate and temperature on an hourly basis for the common stack. As such, an hourly emissions file for 2012 through 2014 was used in this analysis that is based on hourly values of SO_2 emissions, exit temperature, and exhaust flowrate as measured by the CEMS. The data used is consistent with that reported to PA DEP and U.S. EPA and already reflects the missing data procedures in accordance with 40 CFR Part 75 requirements.

Northeastern Power: Northeastern Power is a 58 MW cogeneration facility that became operational in 1989 and utilizes culm, coal, and #2 fuel oil to generate electricity. The only sources of SO_2 emissions at the site are a boiler and an auxiliary boiler. Nearly all of the facility's emissions are from the main boiler.

A summary of the building parameters was provided in the modeling analysis. These were based on site provided data and aerial imagery. This information was processed in BPIP and used for Northeaster Power's building downwash calculations for the modeling analysis.

Northeastern Power maintains and operates a SO_2 CEMS that also records exhaust flowrate and temperature on an hourly basis for the main boiler. As such, an hourly emissions file for 2012 through 2014 was used in this analysis that is based on hourly values of SO_2 emissions, exit temperature, and exhaust flowrate as measured by the CEMS. The data used is consistent with that reported to PA DEP and U.S. EPA and already reflects the missing data procedures in accordance with 40 CFR Part 75 requirements. CEMS data is not available for the auxiliary boiler. Instead, the auxiliary boiler emissions were calculated based on a ratio of monthly fuel input to annual fuel throughput and the total SO_2 emissions per year from annual emissions reports for 2012

through 2014. Additionally, temperature and velocity data from the emission statements was used. There are no missing data considerations based on the methodology to allot emissions for the auxiliary boiler.

St. Nicholas CoGen: A 100-megawatt anthracite culm-fired cogeneration facility that was constructed in 1989 to convert the culm bank from the long abandoned St. Nick Breaker. Sources of SO_2 include a boiler and a flash dryer. No other stationary sources of SO_2 emissions were included in the modeling analysis.

A summary of the building parameters was provided in the modeling analysis. These were based on site provided data and aerial imagery. This information was processed in BPIP and used for St. Nicholas CoGen's building downwash calculations for the modeling analysis. Material is transported via conveyor from the culm pile to the cogen plant accounting for the significant distances between building complexes in the BPIP analysis.

CEMS-derived, hour-by-hour modeled emission rate dataset provides the most accurate representation of the actual emissions history for the 2012-2014 time period considered in the modeling. St. Nicholas CoGen maintains and operates a SO_2 CEMS that also records exhaust flowrate and temperature on an hourly basis for the main boiler used in the modeling analysis. The data used is consistent with that reported to PA DEP and U.S. EPA and already reflects the missing data procedures in accordance with 40 CFR Part 75 requirements. CEMS data is not available for the flash dryer. Emissions for the flash dryer were calculated based on a ratio of monthly fuel input to annual fuel throughput and the total SO_2 emissions per year from annual emissions reports. This procedure was performed for 2012 through 2014. Flash Dryer temperature and velocity data was taken from emission statements and no missing data considerations were used for this source.

Wheelabrator Frackville: Wheelabrator Frackville is a cogeneration facility that utilizes coal mining waste (culm) to generate 48 megawatts (MW) of electricity using a CFB built in 1988. The site also supplies steam to the Pennsylvania State Correctional Institution at Frackville. The only source of SO_2 emissions included in the modeling analysis was the fluidized bed boiler.

A summary of the building parameters was provided in the modeling analysis. These were based on site provided data and aerial imagery. This information was processed in BPIP and used for Wheelabrator Frackville's building downwash calculations for the modeling analysis. BPIP output indicated the stack exceeded the GEP stack height. In accordance with the Modeling TAD, the actual stack height was used in the modeling analysis since actual emissions were modeled.

CEMS-derived, hour-by-hour modeled emission rate dataset provides the most accurate representation of the actual emissions history of the source for the 2012-2014 time period considered in the modeling. Wheelabrator Frackville maintains and operates a SO_2 CEMS that also records exhaust flowrate on an hourly basis. As such, an hourly

emissions file for 2012 through 2014 was used in this analysis that is based on hourly values of SO_2 emissions and exhaust flowrate as measured by the CEMS. The data used is consistent with that reported to PA DEP and U.S. EPA and already reflects the missing data procedures in accordance with 40 CFR Part 75 requirements.

Pennsylvania characterized these sources 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 actual emissions. The Commonwealth also adequately characterized the source's building layouts and locations, 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 concludes the state's source characterization is generally accurate.

9.3.2.5. 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 concludes 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 that 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, Pennsylvania included a cluster of four (4) DRR sources in Schuylkill County (another named DRR source, Panther Creek, in Carbon County was omitted) in their modeling analysis. The Commonwealth has chosen to model these facilities using actual emissions. The facilities in the Commonwealth's modeling analysis and their associated annual actual SO_2 emissions between 2012 and 2014 are summarized below.

For Gilberton Power, Northeast Power, St Nicholas CoGen, and Wheelabrator Frackville the Commonwealth provided annual actual SO_2 emissions between 2012 and 2014. This information is summarized in Table 9.1. A description of how Pennsylvania obtained hourly emission rates is given below this table.

Table 9.1. Actual SO_2 Emissions Between 2012 – 2014 from Facilities in the Carbon County and Schuylkill County Area.

Modeled Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2012**	**2013**	**2014**
Gilberton Power	929.5	1,527.8	1,402.0
Northeast Power Main	662.0	730.2	224.3
Northeast Power Aux	0.5	0.1	3.1
St Nicholas CoGen Main	1,940.0	1,822.1	1,922.7
St Nicholas CoGen Dryer	1.6	2.3	2.3
Wheelabrator Frackville	463.2	491.7	497.3
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**3,996.8**	**4,574.3**	**4,051.7**
EPA Clean Air Markets Division Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2012**	**2013**	**2014**
Gilberton Power	929.5	1,527.8	1,402.0
Northeast Power Main	662.0	730.2	224.3
Northeast Power Aux	0.5	0.1	3.1
St Nicholas CoGen Main	1,940.0	1,822.1	1,922.7
St Nicholas CoGen Dryer	1.6	2.3	2.3
Wheelabrator Frackville	463.2	491.7	497.3
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**3,996.8**	**4,574.3**	**4,051.7**
eFACTS[37] Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2012**	**2013**	**2014**

[37] http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facilityemissions.aspx

Gilberton Power	930.0	1,544.9	1,401.4
Northeast Power	665.0	732.3	227.6
St Nicholas CoGen	1,940.2	1,825.0	1,923.5
Wheelabrator Frackville	471.5	524.8	516.3
Panther Creek (Carbon County)	556.2	506.7	520.3
Westwood Generation (Schuylkill County)	271.6	312.4	305.0
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**4,006.7**	**4,627.0**	**4,068.8**

2014 NEI Emissions	
Facility	**2014 NEI SO_2 Emissions (tpy)**
Gilberton Power	1,401.4
Northeast Power	227.6
St Nicholas CoGen	1,923.5
Wheelabrator Frackville	516.2
Panther Creek (Carbon County)	520.3
Westwood Generation (Schuylkill County)	305.0
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**4,589.1**

Several sources of emissions information for the four (4) Schuylkill County DRR sources were examined and compared to the modeled emissions. These included EPA's CAMD website,[38] PA DEP's eFACTS system,[39] and the 2014 NEI. In general, the total modeled yearly emissions from the four (4) Schuylkill County DRR sources were within several hundred tons of the annual emissions reported to EPA's CAMD and Pennsylvania's eFACTS systems. This emissions difference may be due to how missing emissions are reported in CAMD.

Two (2) sources were listed in the tables that were not included in the modeling analysis; Panther Creek, a DRR source in neighboring Carbon County and Westwood Generation, a non-DRR source located in western Schuylkill County. Together these sources total approximately 800 tpy of unmodeled SO_2 emissions, which is a significant amount compared to the total modeled emissions (a little over 4,000 tpy). Impacts from these sources, however, may be muted since both of these sources are generally far removed from the DRR cluster sources included in the modeling analysis. A screening analysis could be performed to determine whether either or both of these sources result in concentration gradients.

A closer look at the hourly emissions showed the four (4) DRR sources modeled hourly emissions were nearly all within +/- 250 lbs per hour of what was reported in CAMD (see Table 9.2below). Hourly modeled stack temperatures and stack velocities were generally within expected values for the types of sources included in the modeling analysis. Stack velocities for Gilberton Power's and St Nicholas CoGen's main boilers were both near 50 m/s, which seems

[38] https://ampd.epa.gov/ampd/
[39] http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facilityemissions.aspx

unusually high for these types of units. Minimum modeled stack temperatures for Gilberton Power, Northeast Power and St Nicholas CoGen main boiler units fell below 273 K, which is much too low for coal-fired boiler units. Stack temperatures below 273 K, however, appeared to occur during hours when the units were not emitting. Stack parameters for Northeast Power's auxiliary boiler, St Nicholas CoGen's dryer and Wheelabrator Frackville were kept constant throughout the model simulation.

Table 9.2. Table summarizing the difference between modeled and CAMD hourly emission rates (pounds per hour) for Gilberton Power, Northeast Power, St Nicholas CoGen and Wheelabrator Frackville.

Gilberton Power		**Northeast Power**		**St Nicholas CoGen**		**Wheelabrator Frackville**	
Bin	*Frequency*	*Bin*	*Frequency*	*Bin*	*Frequency*	*Bin*	*Frequency*
-750	0	-750	0	-750	0	-750	0
-500	0	-500	0	-500	0	-500	0
-250	0	-250	35	-250	0	-250	0
0	26,118	0	26,251	0	25,810	0	25,749
250	185	250	18	250	491	250	555
500	1	500	0	500	3	500	0

EPA concludes Pennsylvania properly characterized emissions from the four (4) Schuylkill County DRR sources included in the modeling analysis. Two (2) SO_2 sources were not included in the modeling analysis; one DRR source in neighboring Carbon County (Panther Creek) and one source in western Schuylkill County (Westwood Generation). Impacts from these two (2) unmodeled sources may be limited due to their distance from the four (4) modeled Schuylkill County DRR sources.

9.3.2.6. Modeling Parameter: Meteorology and Surface Characteristics

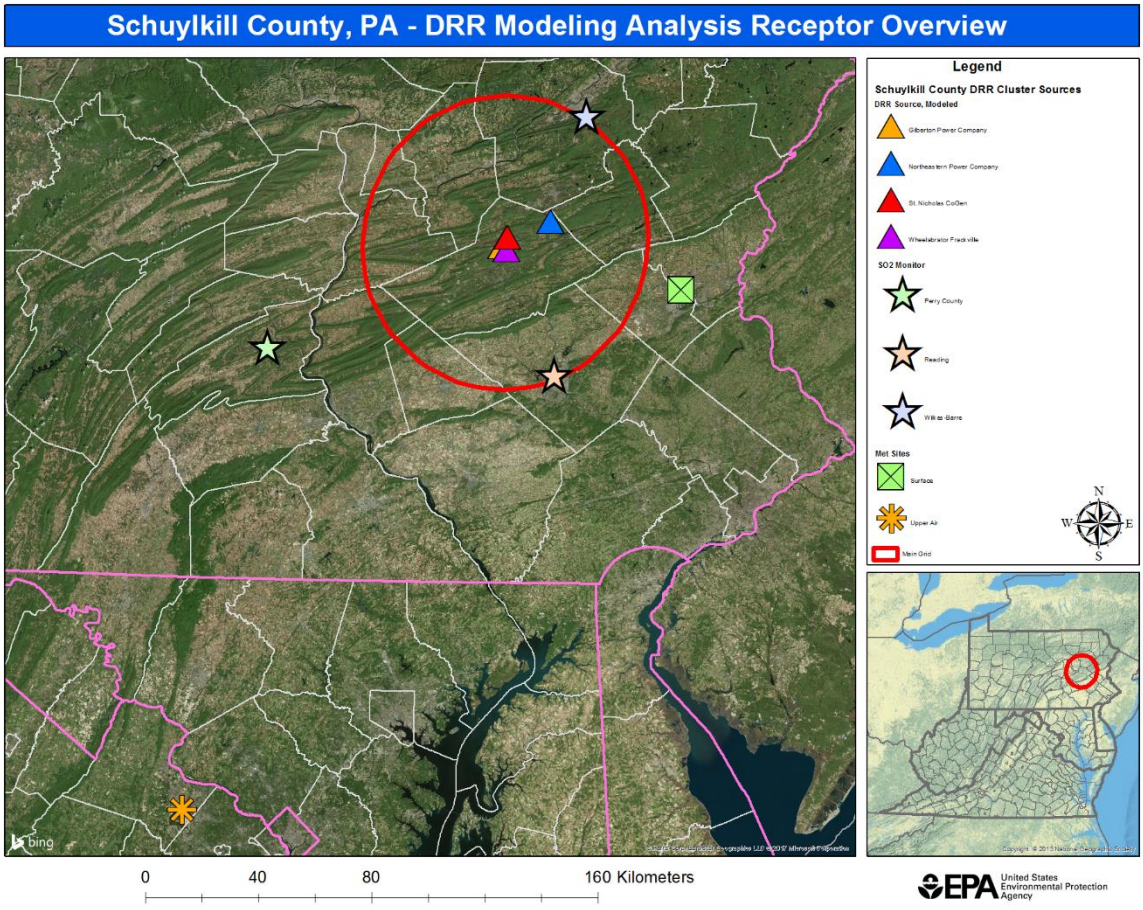
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of 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 Carbon County and Schuylkill area, Pennsylvania selected the surface meteorology from the Allentown-Bethlehem-Easton Airport and coincident upper air observations from Sterling, VA, as best representative of meteorological conditions within the area of analysis. The Allentown-Bethlehem-Easton Airport is located approximately 65 km east of St Nicholas CoGen, the largest emitter in the DRR source cluster, and approximately 233 km north of Sterling, VA.

Pennsylvania used AERSURFACE version 13016 using data from Allentown-Bethlehem-Easton Airport to estimate the surface characteristics of the area of analysis. The Commonwealth estimated values for twelve (12) spatial sectors out to 1.0 km at a seasonal temporal resolution for dry, wet and average conditions. 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"). PA DEP provided the final processed meteorological data used in the modeling analysis but no documentation was formally provided regarding the AERSURFACE processing steps.

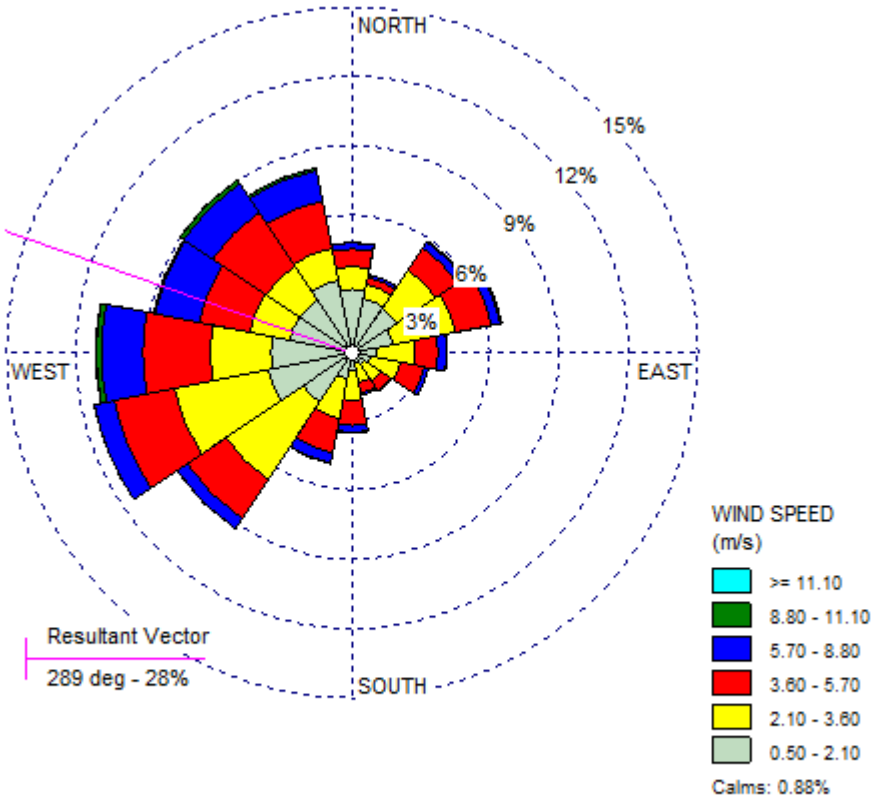
In the figure below, generated by the EPA, the locations of this NWS stations used in Pennsylvania's modeling analysis along with the SO_2 monitoring sites are shown relative to the area of analysis.

Figure 9.4. Area of Analysis and the NWS station in the Carbon County and Schuylkill County Area



As part of its recommendation, the Commonwealth provided the 3-year surface wind rose for the Allentown-Bethlehem-Easton Airport site for 2012-14. In Figure 9.5, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose was produced using the final processed AERMET sfc file in Lakes Environmental's WRPLOT program. Winds were somewhat distributed in the northeast to southwest quadrants. The resultant wind vector for all hours was from a northwesterly direction. The anemometer height used to generate the AERMET-ready files matched the height listed for the Allentown-Bethlehem-Easton Airport (26 ft, 7.92 m).

Figure 9.5: Carbon County and Schuylkill County, Pennsylvania 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. Pennsylvania followed the methodology and settings presented in Modeling TAD and associated guidance in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics. As noted earlier, the PA DEP processed and provided the AERMET-ready file used in the modeling analysis.

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 for the Allentown-Bethlehem-Easton 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.

Details of the AERMET processing stages were missing from the analysis since PA DEP provided the AERMET-ready files used in the modeling analysis. EPA concludes the files were processed correctly and reflect surface condition such as soil moisture and seasonal snow cover for the area of analysis.

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

The terrain elevation for each model receptor, building, and emission source was determined using USGS 1/3 arc second National Elevation Data (NED). The NED, obtained from the USGS, has terrain elevations at 30-meter intervals. Using the AERMOD terrain processor, AERMAP (version 11103), the terrain height for each receptor, was determined by assigning the interpolated height from the digital terrain elevations surrounding each source. These were used directly in the AERMOD model.

In addition, AERMAP was used to compute the hill height scales associated with each elevated receptor. This computation enables the model to determine the effect that terrain has on plumes from the sources. AERMAP searches all nearby elevation points for the terrain height and location that has the greatest influence on each receptor to determine the hill height scale for that receptor. AERMOD then used the hill height scale in order to select the point where a plume may divide between going around a terrain feature and lofting over the feature. The area surrounding the Cluster contains significant terrain features and thus, the inclusion of terrain elevations in the modeling was necessary. The bulk of the modeling domain lies within the Ridge and Valley province of the Appalachian Mountains. Blue Mountain, which lies along the border of Schuylkill and Berks counties, marks the boundary between Ridge and Valley terrain from the Piedmont terrain to the south and east.

EPA concludes the receptor grid information was properly processed.

9.3.2.8. 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 a tier 2 background concentration approach using three (3) monitoring sites in Berks, Luzerne and Perry counties. Background concentration values were determined by hour of day and wind direction (flow vector) for that hour of the model simulation using the AERMOD BGSECTOR keyword. Wind sector (hourly) background concentrations were assigned as follows:

15 to 115° - Perry County SO_2 Monitor (Perry County)
271 to 14° - Reading SO_2 Monitor (Berks County)
116 - 270° - Wilkes-Barre SO_2 Monitor (Luzern County)

The background concentrations for this area of analysis are summarized in the Table 9.3. Background concentrations are generally similar between the three (3) monitoring sites with the Reading monitor in neighboring Berks County being somewhat higher than the other monitoring sites. The Perry County monitor is the furthest away (roughly 100 km) from the Schuylkill County DRR sources with Reading and Wilkes-Barre roughly the same distances and slightly closer (a little over 50 km on average). These sited are regionally representative background sites.

Table 9.3. Table summarizing background concentration ranges (in ppb) from the three (3) background monitors for the Carbon County and Schuylkill County, Pennsylvania Area

Background Monitor	Max	Min	Average
Perry County	7.33	0.33	2.58
Reading	12.00	1.67	4.26
Wilkes-Barre	7.00	0.33	2.91

9.3.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Carbon County and Schuylkill County area of analysis are summarized below in Table 9.4

Table 9.4: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Carbon County and Schuylkill County Area

Input Parameter	Value
AERMOD Version	15181 Adjust U*
Dispersion Characteristics	Rural
Modeled Sources	4
Modeled Stacks	6
Modeled Structures	64
Modeled Fencelines	None
Total receptors	103,247
Emissions Type	Actual
Emissions Years	2012-14
Meteorology Years	2012-12
NWS Station for Surface Meteorology	Allentown-Bethlehem-Easton Airport, PA
NWS Station Upper Air Meteorology	Sterling, VA
NWS Station for Calculating Surface Characteristics	Allentown-Bethlehem-Easton Airport, PA
Methodology for Calculating Background SO_2 Concentration	Season, Temporal Varying, Wind Vector Varying
Calculated Background SO_2 Concentration	0.33 to 12 ppb

The results presented below in Table 9.5 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

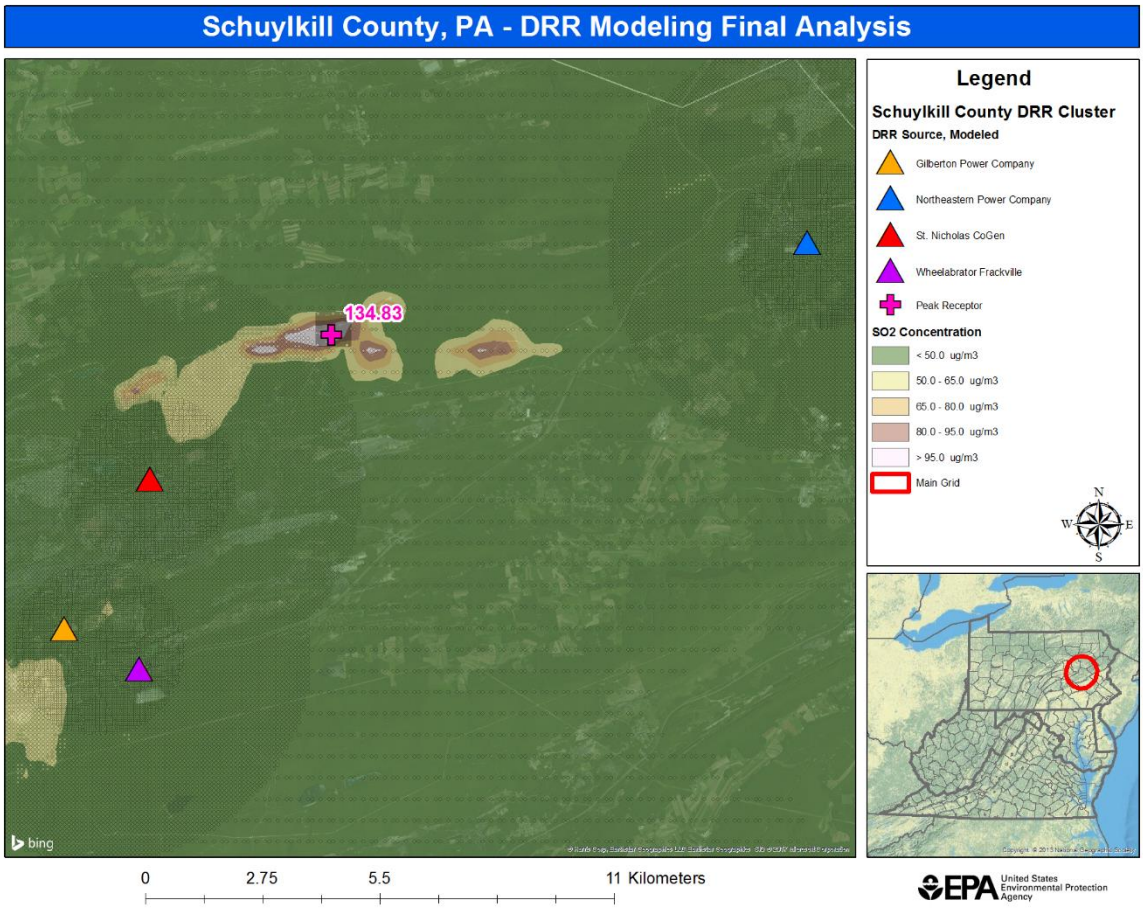
Table 9.5. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Carbon County and Schuylkill County Area

		Receptor Location [UTM zone 18]		99th percentile daily maximum 1-hour SO_2 Concentration (µg/m^3)	
Averaging Period	**Data Period**	**UTM Easting**	**UTM Northing**	**Modeled concentration (including background)**	**NAAQS Level**
99th Percentile 1-Hour Average	2012-14	405185	4523055	134.83	196.4*

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

Pennsylvania's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 134.83 µg/m^3, equivalent to 51.5 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the four (4) Schuylkill County DRR sources. The final modeling analysis does not include SO_2 emissions from the Panther Creek facility in Carbon County, which was included in the DRR cluster or the Westwood Generation facility located in western Schuylkill County (not included in the DRR cluster). Figure 9.6 below was generated by EPA from Pennsylvania's model analysis output files, and indicates that the predicted value occurred approximately 5.5 km northeast of the St. Nicholas CoGen facility, the largest emitter in the Schuylkill County DRR cluster. A portion of Pennsylvania's receptor grid is also shown in the figure.

Figure 9.6: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Carbon County and Schuylkill County Area



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

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

Pennsylvania's DRR modeling analysis is generally incomplete given the omission of Panther Creek, a named DRR source, and Westwood Generation, a 300+ tpy source located in western Schuylkill County. Failure to fully account for impacts from these sources in the modeling analysis means that EPA cannot fully determine if the area is in compliance with the 1-hour SO_2 NAAQS.

The modeling analysis also utilizes the Adjust U* option in AERMOD version 15181. As noted previously, this version contains a known formulation bug in the Adjust U* that can lead to an under prediction bias. Peak model concentrations occur in elevated terrain during overnight hours when the Adjust U* option is probably affecting the model. Rerunning using the most current version of AERMOD would eliminate the possibility of an under prediction bias from older version of AERMOD with the Adjust U* option.

9.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Carbon County and Schuylkill County, Pennsylvania 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.

9.5. Jurisdictional Boundaries in the Carbon County and Schuylkill County, Pennsylvania Area

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

In Pennsylvania's original recommendation on June 23, 2011, Pennsylvania recommended that the entirety of Carbon County and Schuylkill County, be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the DRR listed facilities in Carbon and Schuylkill counties but did not update their recommendation.

9.6. Other Information Relevant to the Designations for the Carbon County and Schuylkill County, Pennsylvania 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 Carbon County and Schuylkill County area of analysis.

9.7. The EPA's Assessment of the Available Information for the Carbon County and Schuylkill County, Pennsylvania Area

The EPA reviewed Pennsylvania's DRR modeling analysis for this area. While the modeling analysis indicates the area would attain the NAAQS, the EPA found significant issues with the analyses. First, the modeling analysis utilizes the Adjust U* option in AERMOD version 15181. As noted previously, this version contains a known formulation bug in the Adjust U* option that can lead to an under-prediction bias. Additionally, two sources, Panther Creek, a named DRR source, and Westwood Generation, a source located in western Schuylkill County were not included in the modeling analysis. Therefore, Pennsylvania's modeling analysis cannot be used to determine if the area is in attainment of the 1-hour SO_2 NAAQS or if it is contributing or is not contributing to any nearby areas that do not meet the NAAQS. As a result, the EPA intends to designate the area as unclassifiable.

In Pennsylvania's original recommendation on June 23, 2011, Pennsylvania recommended that the entirety of Carbon County and Schuylkill County, be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the DRR listed facilities in Carbon and Schuylkill counties but did not update their recommendation.

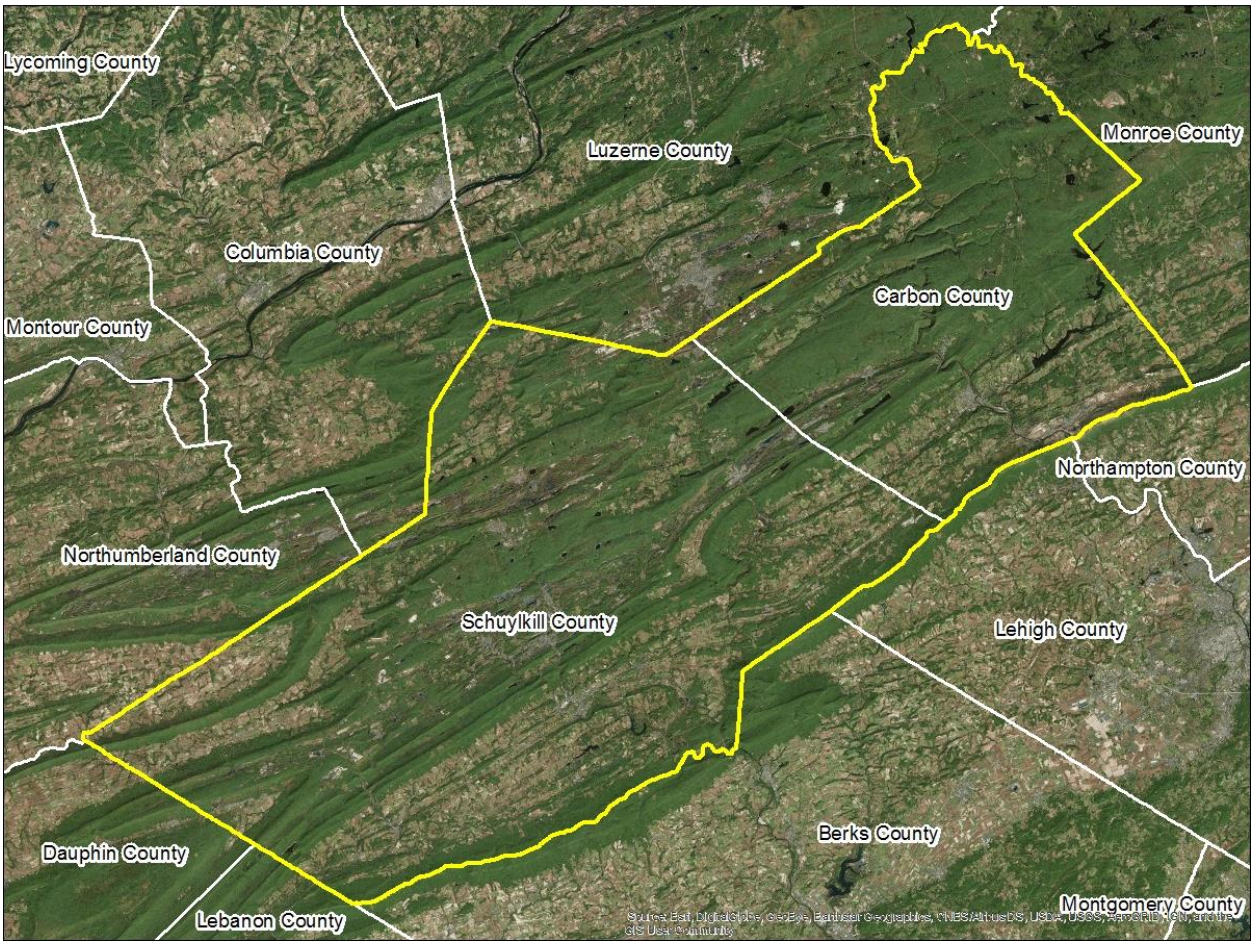
The EPA concludes that our intended unclassifiable area, bounded by the county jurisdictional boundaries, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable area.

9.8. Summary of Our Intended Designation for the Carbon County and Schuylkill County, Pennsylvania Area

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, the EPA agrees with the state's recommendation and intends to designate the Carbon County and Schuylkill County area as unclassifiable for the 2010 SO_2 NAAQS. The Carbon County and Schuylkill County unclassifiable 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 SO2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS. Specifically, the boundaries are comprised of the jurisdictional boundaries of Carbon County and Schuylkill County.

Figure 9.7 shows the boundary of this intended designated area.

Figure 9.7 Boundary of the Intended Carbon County and Schuylkill County, Pennsylvania Unclassifiable Area



At this time, our intended designations for the state only apply to this area and the other areas presented in this technical support document.

10. Technical Analysis for the Lehigh-Northampton County Area

10.1. Introduction

The EPA must designate Lehigh County and Northampton County, Pennsylvania area by December 31, 2017, because the area has not been previously designated and Pennsylvania has not installed and begun timely operation of a new, approved SO_2 monitoring network to characterize air quality in the vicinity of a source in Lehigh and Northampton Counties. Pursuant to the DRR (*see* 40 CFR part 51, subpart BB), states had the option to characterize large sources of SO_2 by either monitoring, modeling or capping emissions below 2,000 tons of SO_2 per year. Although there is an existing SO_2 monitor in Northampton County, Pennsylvania elected to conduct modeling to characterize a cluster of sources subject to the DRR.

10.2. Air Quality Monitoring Data for the Lehigh-Northampton County Area

This factor considers the SO_2 air quality monitoring data in the area of Lehigh County and Northampton County. Although the state did not provide specific monitoring data, the EPA reviewed available monitoring data in Northampton and Lehigh counties.

Table 10.1 Air Quality Data for the Lehigh-Northampton County Area

County	AQS Monitor ID	Latitude	Longitude	2011-2013 Design Value	2012-2014 Design Value	2013-2015 Design Value	2014-2016 Design Value
Northampton	42-133-0008	39.965278	-76.699444	24	20	24	24

- Air Quality System monitor 42-095-8000. This monitor is located in Northampton county, and is 7 km southeast of both ESSROC-Nazareth Plant and Hercules Cement and 14 km east of Keystone Cement. All three facilities are listed on the DRR and will be further discussed in the modeling section below. 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 2014-2016 DV being 24 ppb. However, EPA does not have information indicating this data is in an area of maximum concentration, so this data cannot be used as the basis for designation.

10.3. Air Quality Modeling Analysis for the Lehigh County-Northampton County Area Addressing a Cluster of Sources

10.3.1. Introduction

The PA DEP identified a cluster of emissions sources in Lehigh and Northampton counties that were subject to the DRR for the 2010 1-hour SO_2 primary NAAQS. This was outlined in a January 15, 2016, letter submitted to the EPA. The State of Pennsylvania was required to submit a plan to the EPA with regards to the path forward for addressing the DRR. The five (5) sources identified in Lehigh and Northampton counties were analyzed using a dispersion model to satisfy

SO_2 DRR requirements. The modeling analysis approach was outlined in modeling protocols for each source submitted to the EPA in October of 2016.

This section 10.3 presents all the available air quality modeling information for a portion of the Lehigh County-Northampton County area that includes the ESSROC-Nazareth Plant, Hercules Cement, Keystone Cement, Lafarge, and Northampton Generating Company, SO_2 emitters above 500 tpy in Lehigh and Northampton counties in east central Pennsylvania. (This portion of Lehigh County and Northampton County will often be referred to as "the Lehigh County-Northampton County area" within this section 11.3.). This area contains the following SO_2 sources around which Pennsylvania 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 ESSROC-Nazareth Plant facility in Northampton County does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 544.5 tons of SO_2 according the 2014 NEI.
- The Hercules Cement facility in Northampton County does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 1,373.5 tons of SO_2 according the 2014 NEI.
- The Keystone Cement facility in Northampton County does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 1,354.2 tons of SO_2 according the 2014 NEI.
- The Lafarge facility in Lehigh County does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 323.2 tons of SO_2 according the 2014 NEI.
- The Northampton Generating Company facility in Northampton County does not emit 2,000 tons or more annually, but was added to the SO_2 DRR Source list by agreement between the EPA regional office and the state. This source emitted approximately 391.2 tons of SO_2 according 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 of these sources.

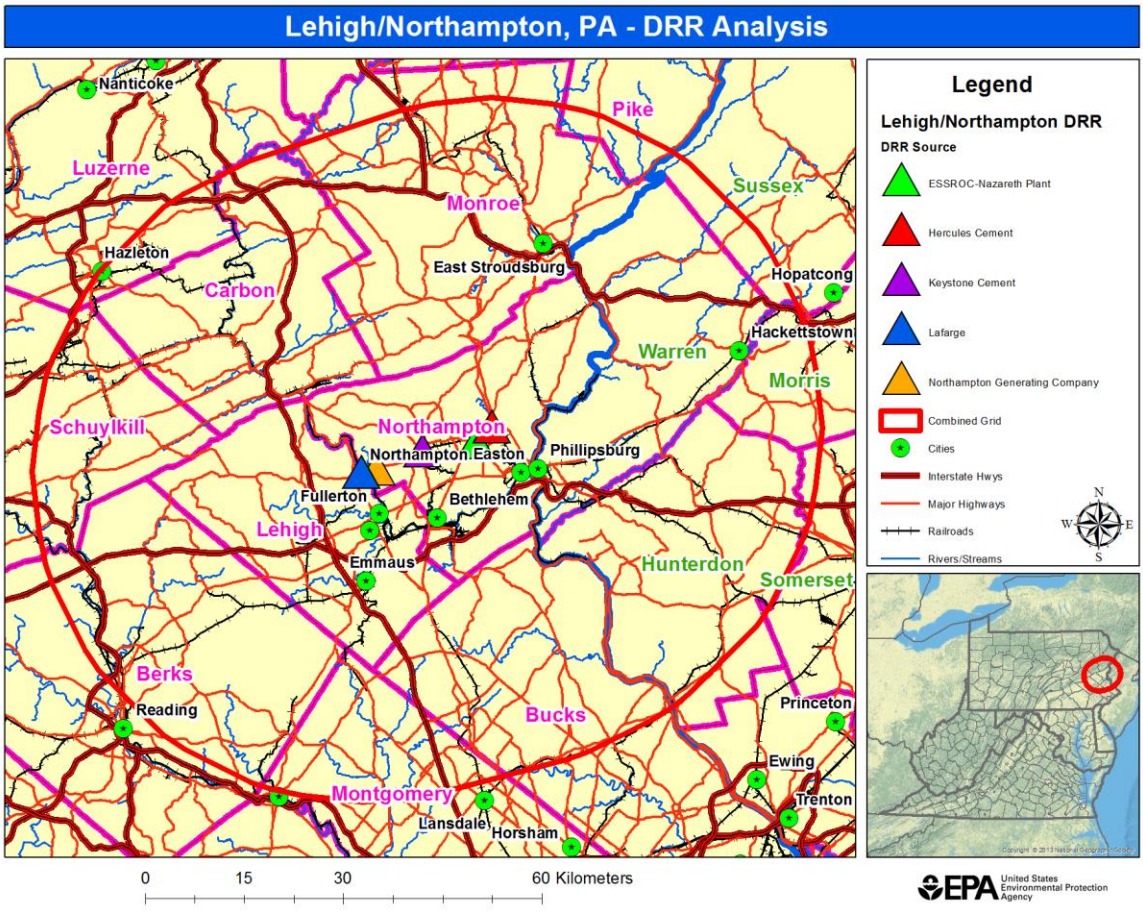
In its submission, Pennsylvania recommended that an area that includes the area surrounding the facilities, specifically the entirety of Lehigh County and Northampton County, be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the DRR listed facilities but did not update their recommendation. 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 be 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 the Commonwealth has assessed via air quality modeling is located in the Lehigh Valley region of eastern Pennsylvania and is the third largest metropolitan area in the state behind Philadelphia and Pittsburgh.

As seen in Figure 10.1 below, the cluster of SO_2 emitters is located in roughly a line stretching approximately 21 km from west to east starting near the border of Lehigh and Northampton counties east into central Northampton County. These are, from west to east, Lafarge, Northampton Generating Company, Keystone Cement, ESSROC-Nazareth, and Hercules Cement.

The EPA's intended unclassifiable designation boundary for the Lehigh County and Northampton County area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

Figure 10.1. Map of the Lehigh County and Northampton County, Pennsylvania Area Addressing a Cluster of Sources



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 one modeling assessment, which was submitted by Pennsylvania.

10.3.2. Modeling Analysis Provided by the State

On May 26, 2017, Pennsylvania submitted its current DRR modeling analysis to EPA for a cluster of sources in Lehigh and Northampton counties.

10.3.2.1. 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

Pennsylvania delivered its modeling analysis to the EPA on May 26, 2017. On January 17, 2017, EPA published its revision to Appendix W – Guideline to Air Quality Models. 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. This date has since passed and the revised Appendix W is now in effect.

The modeling analysis completed by Pennsylvania for the cluster of DRR sources in Lehigh and Northampton counties was submitted using AERMOD version 15181 with the Beta Adjust U* option. EPA released a memo dated March 8, 2017 entitled *Clarification on the AERMOD Modeling System Version for Use in SO_2 Implementation Efforts and Other Regulatory Actions*[40] which states:

> "*[B]ecause the use of AERMET version 15181 with the ADJ_U* beta option contains a known and corrected formulation bug that leads to concentration under predictions, the associated AERMOD modeling results would be unreliable as a basis for determinations of SO_2 air quality in the modeled area*."

[40] https://www3.epa.gov/ttn/scram/guidance/clarification/SO2_DRR_Designation_Modeling_Clarificaiton_Memo-03082017.pdf

Given this technical deficiency, the modeling submitted for the Lehigh and Northampton DRR sources using actual emissions cannot be used to determine if the area is attaining or not attaining the 2010 1-hour SO_2 NAAQS.

10.3.2.2. 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.

Land use classification was determined surrounding each source included in the Lehigh and Northampton DRR modeling analysis. A brief summary of the analysis technique for each source is included below:

> **ESSROC-Nazareth Plant:** Auer Method surveying 3 km of land use categories surrounding the facility. A rural determination was made using geographical information system (GIS) software examining various land use types contained in the NLCD 2011 electronic land use dataset.
>
> **Hercules Cement:** Land use data from the 1992 National Land Cover Data set, which provides 21 different land cover classes at 30 m resolution based on Landsat Thematic Mapper data, was examined within 3 km of Hercules Cement using AERSURFACE. Because this analysis was based on 1992 land use data, the applicant reviewed Google Earth imagery for 2016 to ensure that there were no sufficient changes to the land use within 3 km of Hercules Cement to change the determination of a rural land use classification from the original analysis.
>
> **Keystone Cement:** Land use data from the 1992 National Land Cover Data set, which provides 21 different land cover classes at 30 m resolution based on Landsat Thematic Mapper data, was examined within 3 km of Keystone Cement using AERSURFACE. Because this analysis was based on 1992 land use data, the applicant reviewed Google Earth imagery for 2016 to ensure that there were no sufficient changes to the land use within 3 km of Keystone Cement to change the determination of a rural land use classification from the original analysis.
>
> **Lafarge:** Auer Method surveying 3 km of land use categories surrounding the facility. A rural determination was made using geographical information system (GIS) software examining various land use types contained in the NLCD 2011 electronic land use dataset.
>
> **Northampton Generating Company:** Land use data from the 1992 National Land Cover Data set, which provides 21 different land cover classes at 30 m resolution based on Landsat Thematic Mapper data, was examined within 3 km of Northampton Generating Company using AERSURFACE. Because this analysis was based on 1992

land use data, the applicant reviewed Google Earth imagery for 2016 to ensure that there were no sufficient changes to the land use within 3 km of Northampton Generating Company to change the determination of a rural land use classification from the original analysis.

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. EPA agrees that the rural classification for the modeled sources is correct.

10.3.2.3. 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 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 Lehigh County-Northampton County area, the state has included five (5) sources in Lehigh and Northampton counties in east central Pennsylvania. Pennsylvania modeled an area roughly 50 km in diameter from the DRR source cluster. This area includes all of Lehigh and Northampton counties along with portions of Berks, Bucks, Carbon, Luzerne, Monroe, Montgomery, Pike, and Schuylkill counties in Pennsylvania and all of Warren County and portions of Hunterdon, Morris, Somerset, and Sussex counties in neighboring New Jersey. 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 violations in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. No other sources beyond the modeling domain were determined by Pennsylvania to have the potential to cause concentration gradient impacts within the area of analysis.

Pennsylvania submitted several sets of modeling for the Lehigh and Northampton DRR source cluster. Individual modeling analyses were then remodeled collectively. The collective analysis from Hercules Cement was the basis for the modeling analysis that EPA reviewed for this section of the TSD. The combined grid receptor description for the area of analysis chosen by the state and referred to as the collective analysis is as follows:

- The collective model analysis included only one source with a possible defined ambient boundary. That source was Lafarge located in Lehigh County. Ambient air receptors were place at 25-m intervals along an approximately 1.4 km border around Lafarge. Additional model receptors, however, appear to be placed inside the boundary receptors (possibly within Lafarge's potential ambient air boundary). No other sources in the collective model analysis appear to have a delineated ambient air boundary surrounding them.
- A 50-m regularly spaced grid extending radially out to 2 km from Lafarge, Keystone Cement, ESSROC-Nazareth, and Hercules Cement.
- A 100-m regularly spaced grid extending radially out from 2 to 5 km from Lafarge, Keystone Cement, ESSROC-Nazareth, and Hercules Cement.

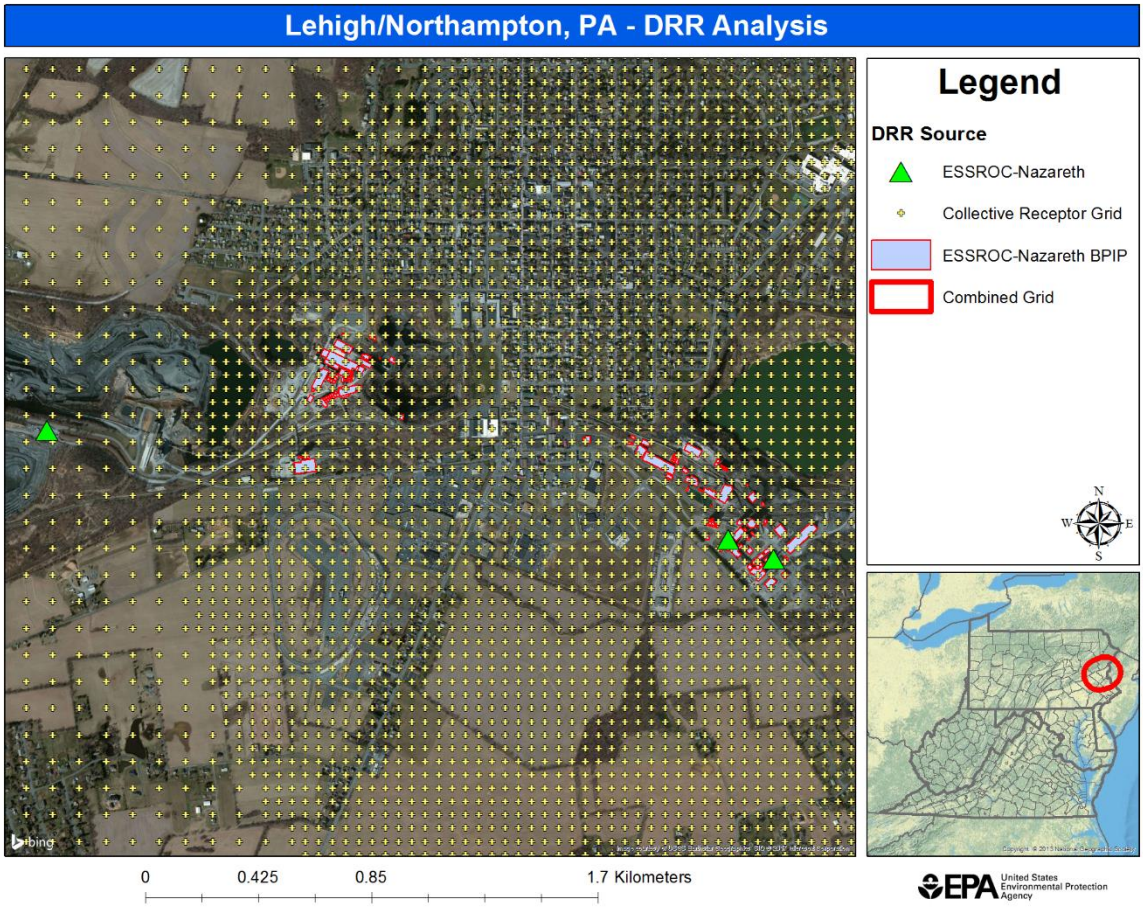
- A 500-m regularly spaced grid extending radially out from 5 to 50 km from Lafarge, Keystone Cement, ESSROC-Nazareth, and Hercules Cement.
- A 1,000-m regularly spaced grid extending into the remaining portions of the modeling domain over 50 km from any of the DRR sources.
- A refined 11 by 11 Cartesian Grid with receptor spacing of 10-m over the area of maximum model impact from the main grid to further refine the maximum modeled concentration. The refined grid is located approximately 5 km northwest of Keystone Cement.

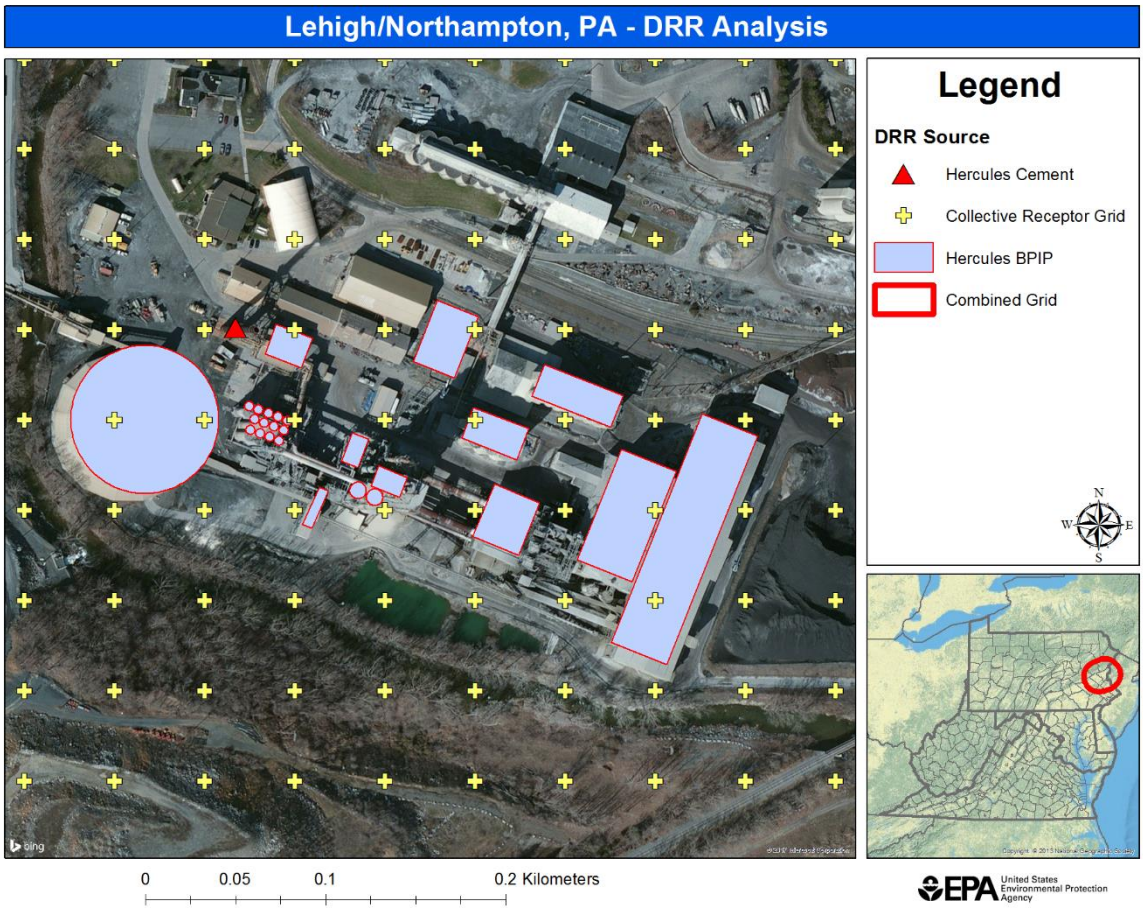
The receptor network for the collective model analysis contained 68,671 receptors with an additional 121 receptors in the refined grid. The network covered all or portions of ten (10) counties in east central Pennsylvania and extended eastward to include all or portions of five (5) counties in neighboring New Jersey.

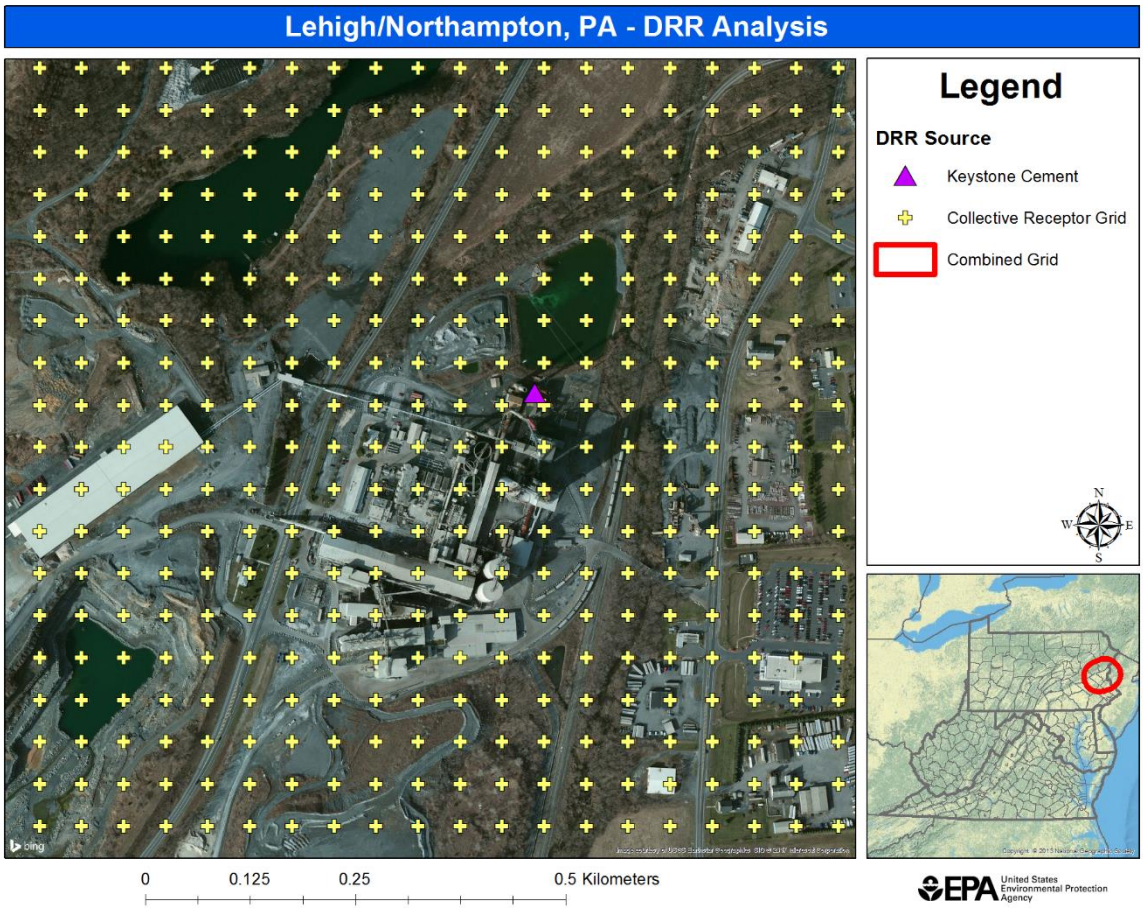
Figures 10.2 and 10.3, included in the state's recommendation, show the state's chosen area of analysis surrounding each of the DRR facilities, as well as the receptor grid for the area of analysis.

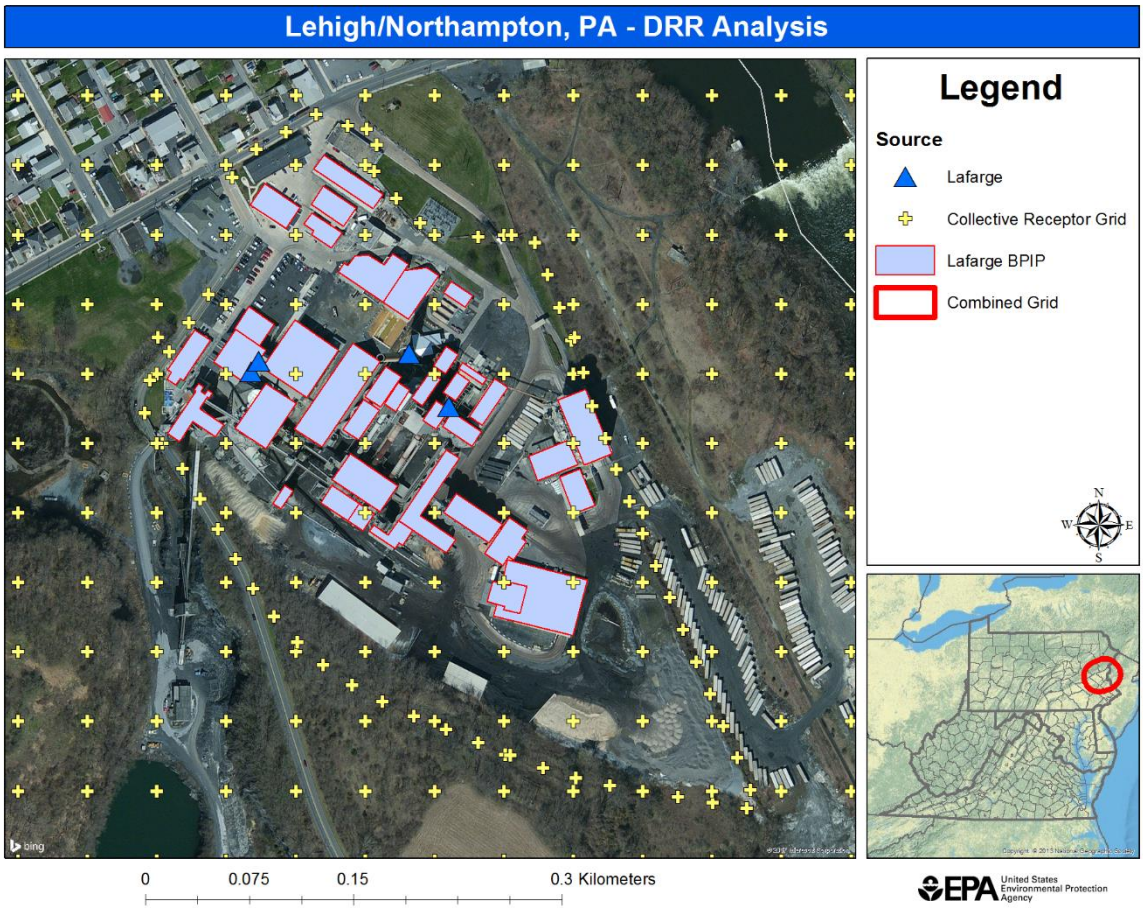
Consistent with the Modeling TAD, Pennsylvania placed receptors for the purposes of this designation effort in locations that would be considered ambient air as described in Section 4.2 of the Modeling TAD. As noted previously, the model receptor grid used in the collective model analysis only appeared to include one potential ambient air boundary for Lafarge, though receptors also appeared to have been included inside the boundary receptors. Boundary receptors were generally verified using GIS aerial imagery. No ambient air boundaries appear to have been delineated for any of the remaining DRR sources included in the Lehigh and Northampton cluster.

Figure Series 10.2: Area of Analysis for the Lehigh County-Northampton County Area




Lehigh/Northampton, PA - DRR Analysis
Legend
DRR Source
Hercules Cement
Collective Receptor Grid
Hercules BPIP
Combined Grid
N
W
E
S
0
0.05
0.1
0.2 Kilometers
EPA United States Environmental Protection Agency


Lehigh/Northampton, PA - DRR Analysis
Legend
DRR Source
Keystone Cement
Collective Receptor Grid
Combined Grid
N
W
E
S
0
0.125
0.25
0.5 Kilometers
EPA United States Environmental Protection Agency


Lehigh/Northampton, PA - DRR Analysis
Legend
Source
Lafarge
Collective Receptor Grid
Lafarge BPIP
Combined Grid
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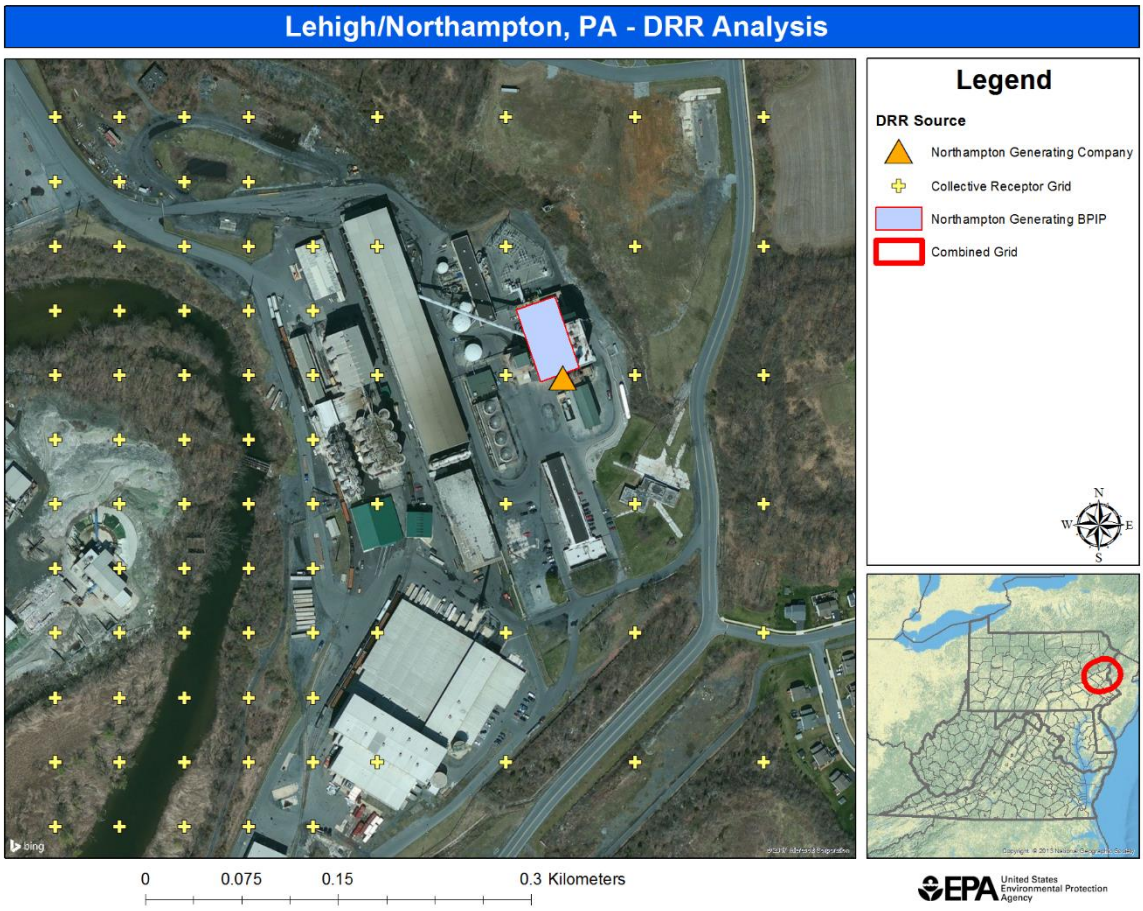
bing
0
0.075
0.15
0.3 Kilometers
EPA
United States
Environmental Protection
Agency


Lehigh/Northampton, PA - DRR Analysis
Legend
DRR Source
Northampton Generating Company
Collective Receptor Grid
Northampton Generating BPIP
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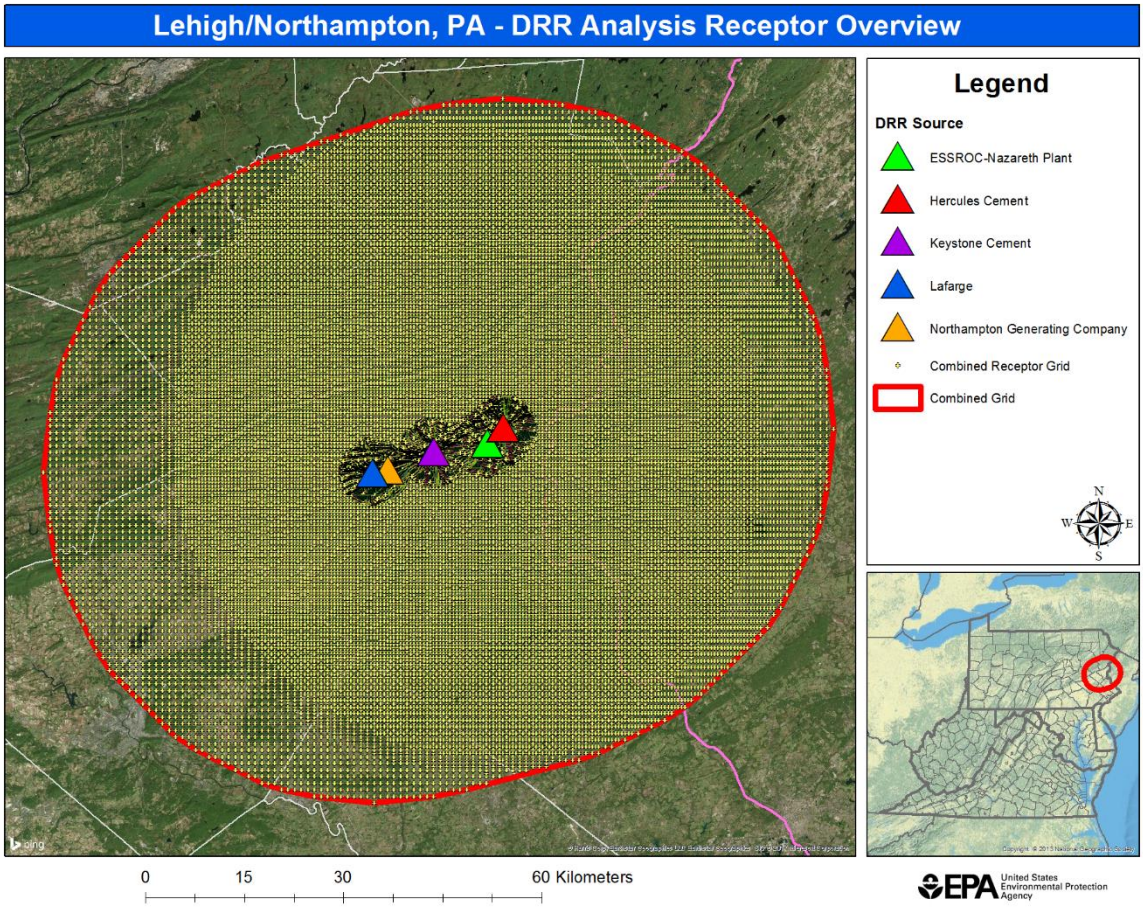
Agency

Figure 10.3: Receptor Grid for the Lehigh County-Northampton County Area



Pennsylvania's modeling analysis did not excluded receptors within at least four (4) out of the five (5) DRR source's ambient air boundaries. Model results include building downwash meaning proper boundary delineation may be an important part of the modeling analysis. EPA agrees the model receptor grid for the collective analysis is adequate to capture the maximum modeled concentration.

10.3.2.4. 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.

This section will briefly summarize the modeled emission sources at the five (5) Lehigh and Northampton county DRR facilities included in the collective analysis that were identified as a cluster of possible contributing sources:

> **ESSROC-Nazereth:** Produces Portland cement clinker in a dry preheater rotary cement kiln. The kiln utilizes any combination of permitted fuels (natural gas, bituminous coal,

and petroleum coke). A total of three (3) sources were included into the collective analysis. In addition to the ESSROC-Nazareth kiln, two (2) heaters, the Comfort Heater and the Coal Mill Heater, were included in the collective analysis. ESSROC-Nazareth did not include the emergency generator in the evaluation since it is assumed that it does not contribute to the distribution of daily maximum concentrations in accordance with EPA's March 1, 2011 Clarification Memo. The kiln and Coal Mill Heater were modeled as point sources while the Comfort Heater was modeled as a POINTCAP source in AERMOD.

A total of 161 structures were included in the BPIP preprocessor to determine building downwash parameters for AERMOD. The sources and building structures are scattered across approximately 3 km with the Comfort Heater located approximately 2.8 km west of the kiln. No ambient air boundary was included in the collective analysis. This makes this a less refined analysis since these areas probably lie within the source's ambient air boundary where model impacts would normally be removed.

Kiln emissions modeled hourly mass (lb/hr) emissions rates as calculated by the PA DEP Continuous Source Monitoring Manual Revision 8 (CSMM8) certified continuous emissions monitoring systems (CEMS). Periods of kiln downtime were modeled with no SO_2 emissions for those hours. For periods of CEMS downtime, ESSROC relied on data substitution procedures approved by PA DEP. The kiln is equipped with a dry lime reagent scrubber system for control of SO_2 emissions. For the Comfort Heater and Coal Mill Heater, hourly emissions were estimated by extrapolating fuel records (No. 2 fuel oil delivery/usage and used oil maintenance records) for each source. ESSROC-Nazareth applied the appropriate AP-42 emissions factor for external combustion to the quantify fuel fired for that hour. In the case of No. 2 fuel oil, ESSROC-Nazareth applied the available sulfur content information to each hour by using the most recent preceding vendor specification information. Stack temperatures and velocities for all sources were kept constant throughout the model simulation. Kiln temperatures were among the lowest of the cement kiln DRR sources.

Hercules Cement: Produces one million tons of cement per year. The kiln heats raw materials to 1500˚C to convert limestone and clay into Portland Cement using coal and coke. Only the kiln was included in the collective analysis. The process is designed with an inline raw mill, meaning exhaust gases from each kiln line are directed through the raw mill to provide heat to the fresh feed being introduced to the system. A significant portion of the fresh feed is limestone. As a result, the raw mill allows for significant scrubbing of SO_2 emissions from the gas stream when it is running, which is 80% to 90% of the time the kilns operate. In addition, water sprays cooling the gas stream upstream of the baghouse also achieve additional scrubbing of the SO_2 from the gas stream. On top of the SO_2 reductions achieved by the process design, Hercules Cement also operates a tailpipe control in the form of sorbent injection (calcium hydroxide). The kiln is treated as an unobstructed vertical source in the collective analysis.

A total of 26 structures were included in the BPIP analysis to determine potential building downwash for the kiln stack. Output files note that the Hercules Cement kiln stack exceeds the calculated GEP height formula, which is acceptable since the collective

analysis uses actual emissions. Building corners from BPIP were input into GIS software and showed the projections appear to be slightly off. This may be due to differences in the projection (NAD83 versus NAD27) and should be checked for correctness. No ambient air boundary was included. This makes this a less refined analysis since these areas probably lie within the source's ambient air boundary where model impacts would normally be removed.

Hourly-varying actual emissions of SO_2 along with exit temperature and exit velocity were modeled based on CEMS data from the years 2012-14, inclusive. Missing data was filled based on interpolation or other established methods. Hourly stack temperatures and velocities did vary but minimum modeled temperatures were below 273 K, which is unlikely for a cement kiln. These temperatures, however, appear to be occurring when the kiln in not operating.

Keystone Cement: Uses a single dry preheater-precalciner kiln to produce cement. The facility incorporates an onsite limestone quarry, a dry kiln process, and uses coal and other waste derived fuels in its operation. Hazardous waste fuel blending was temporarily discontinued in May 2015. The kiln stack was the only source included in the collective analysis and was represented as a point source with a vertically, unobstructed discharging vent.

Only the BPIP program outputs were provided for the collective analysis and therefore structure inputs could not be verified using GIS software. BPIP input files should be provided for proper documentation. The kiln stack exceeds the GEP stack formula (noted in model output file), which is acceptable for this analysis since actual emissions were used. No ambient air boundary was included in the collective analysis. This makes this a less refined analysis since these areas probably lie within the source's ambient air boundary where model impacts would normally be removed.

Hourly-varying actual emissions of SO_2 along with exit temperature and exit velocity were modeled based on CEMS data from the years 2012-14, inclusive. Missing data was filled based on interpolation or other established methods. Hourly stack temperatures and velocities did vary but minimum modeled temperatures were below 273 K, which is unlikely for a cement kiln. These temperatures, however, appear to be occurring when the kiln in not operating.

Lafarge: Operates two (2) dry preheater rotary kilns along with (2) raw mill feed stock preheaters for a total of four (4) sources in the collective analysis. Primary kiln fuels consisting of coal, petroleum coke, and plastic derived fuel are combusted at the discharge end of the kiln. Tire derived fuel in the form of whole tires is introduced in the preheater. Both kilns were modeled as point sources in the collective analysis while the preheaters were modeled using AERMOD's POINTHOR (horizontal point) source option.

A total of 33 structures were included in the BPIP preprocessor to determine building downwash parameters for AERMOD. Building information was checked using GIS

software and appears largely correct. As noted previously, it appears model receptors were placed surrounding Lafarge delineating the facility's potential ambient air boundary. The model receptor grid, however, appears to continue inside these boundary receptors. Not defining a proper ambient air boundary would be more refined since building downwash was not be excluded from areas of the site where public access is actually restricted, if it in fact is restricted.

The two (2) kilns modeled hourly mass (lb/hr) emissions rates as calculated by the PA DEP CSMM8 certified continuous emissions monitoring systems CEMS. Periods of kiln downtime were modeled with no SO_2 emissions for those hours. For periods of CEMS downtime, Lafarge relied on preapproved data substitution procedures. Both kilns are equipped with a dry absorbent addition system for control of SO_2 emissions. Fixed exhaust flowrate and temperature for both kilns were consistent with steady-state operating conditions recorded during periods of normal operations for and are calculated averages of the 2012 through 2014 certified hourly CEMS flowrate and temperature measurements. Hourly emissions for the two (2) raw mills were calculated by utilizing monthly fuel usage records (natural gas or No. 5 fuel oil) for each raw mill. Lafarge applied the monthly fuel usage to the appropriate AP-42 emissions factor for external combustion to quantify emissions for each month. The calculated monthly emissions rate was divided by the corresponding hours for each month to develop an estimated hourly emission rate for each month. The raw mills had fixed exhaust flowrate and temperature based on historical site data. Emissions from on-site emergency generators were not included in the combined analysis since they do not contribute to the distribution of daily maximum concentrations in accordance with EPA's March 1, 2011 Clearinghouse Memo.

Northampton Generating Company: A 110 megawatt cogeneration facility that is fueled with anthracite waste coal and petroleum coke. The only source modeled in the collective analysis is the stack for the circulating fluidized-bed (CFB) boiler. SO_2 emissions are controlled by limestone injection into the CFB boiler. The CFB stack was represented as a point source and is modelled as a vertically, unobstructed discharging vent.

Only one (1) structure was included in the BPIP preprocessor to determine building downwash parameters for AERMOD. Building information was checked using GIS software. While the stack location appears correct there are several buildings west of the CFB stack that did not appear to be processed in BPIP. It's uncertain if these structures would have contributed to downwash given the CFB stack is 79 m tall. Building downwash could be important given no ambient air boundary was defined for this facility.

Hourly-varying actual emissions of SO_2, stack exit temperatures and stack exit velocities were modeled based on CEM data. Missing data were filled based on interpolation or other established methods. Hourly stack temperatures and velocities did vary but minimum modeled temperatures were below 273 K, which is unlikely for a coal-fired boiler. These temperatures, however, appear to be occurring when the kiln in not

operating. Maximum stack velocities were over 60 m/s for some hours (the overall average was 24 m/s), which seems unusually high for this type of unit.

Pennsylvania characterized these sources 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 actual emissions. The state for the most part adequately characterized the DRR source's building layouts and locations, as well as the stack parameters; including exit temperature, exit velocity, location, and diameter. Building locations at Hercules Cement appear to be slightly off when viewed in GIS software. No BPIP input file was provided for Keystone Cement and several structures were not included in the BPIP input file for Northampton Generating Company. Some source's stack parameters seemed unusual and should be verified. Where appropriate, the AERMOD component BPIPPRM was used to assist in addressing building downwash. EPA has reviewed Pennsylvania's source characterizations and has determined that the source characteristics are adequate.

10.3.2.5. 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 three (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 concludes that 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 three (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, Pennsylvania included a cluster of five (5) DRR sources in Lehigh and Northampton counties in their modeling analysis. The Commonwealth has chosen to model these

facilities using actual emissions. The facilities in Pennsylvania's modeling analysis and their associated annual actual SO_2 emissions between 2012 and 2014 are summarized below.

For ESSROC-Nazareth, Hercules Cement, Keystone Cement, Lafarge, and Northampton Generating Company Pennsylvania provided actual (hourly) SO_2 emissions between 2012 and 2014. This information is summarized (in annual form) in Table 10.2. A description of how Pennsylvania obtained hourly emission rates is given below this table.

Table 10.2. Actual SO_2 Emissions Between 2012 – 2014 from Facilities in the Lehigh County-Northampton County Area.

Modeled Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2012**	**2013**	**2014**
ESSROC-Nazareth	884.5	891.2	551.9
Hercules Cement	1,149.0	1,417.6	1,380.3
Keystone Cement	1,117.0	729.2	1,360.1
Lafarge	348.0	280.6	321.7
Northampton Generating Company	472.4	454.6	391.1
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**3,971.0**	**3,773.2**	**4,005.0**
EPA Clean Air Markets Division Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2012**	**2013**	**2014**
Northampton Generating Company	473.7	463.9	393.9
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**473.7**	**463.9**	**393.9**
eFACTS[41] Emissions			
	SO_2 Emissions (tpy)		
Facility Name	**2012**	**2013**	**2014**

[41] http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facilityemissions.aspx

ESSROC-Nazareth	865.6	877.7	544.5
Hercules Cement	1,146.2	1,417.8	1,373.5
Keystone Cement	1,123.2	743.0	1,354.2
Lafarge	336.4	273.3	323.2
Northampton Generating Company	514.3	454.8	391.2
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**3,985.6**	**3,766.6**	**3,986.6**

2014 NEI Emissions	
Facility	**2014 NEI SO_2 Emissions (tpy)**
ESSROC-Nazareth	544.5
Hercules Cement	1,373.5
Keystone Cement	1,354.2
Lafarge	323.2
Northampton Generating Company	391.2
Total Emissions from All Modeled Facilities in the Commonwealth's Area of Analysis	**3,986.6**

Several sources of emissions information for the five (5) Lehigh and Northampton county DRR sources were examined and compared to the modeled emissions. These included EPA's CAMD website,[42] PA DEP's eFACTS system,[43] and the 2014 NEI. Only the Northampton Generating Company had emissions in EPA's CAMD database. In general, the total modeled yearly emissions from the five (5) Lehigh and Northampton county DRR sources were within several hundred tons of the annual emissions reported to EPA's CAMD and Pennsylvania's eFACTS systems. This emissions difference may be due to how missing CEM emissions are reported and/or accounted for in the different inventories.

A closer look at the hourly CAMD emissions from the Northampton Generating Company showed modeled hourly emissions were all within +/- 250 lbs per hour of what was reported in CAMD (see Table 10.3x below).

[42] https://ampd.epa.gov/ampd/
[43] http://www.ahs.dep.pa.gov/eFACTSWeb/criteria_facilityemissions.aspx

Table 10.3. Table summarizing the difference between modeled and CAMD hourly emission rates (in pounds per hour) for Northampton Generating Company.

Northampton Generating Company	
Bin	*Frequency*
-500	0
-250	0
0	18,242
250	8,062
500	0
750	0
More	0

After comparing the modeled emission totals versus the CAMD, eFACTS, and 2014 NEI emission totals, EPA concludes Pennsylvania correctly captured the actual emissions in the collective analysis.

10.3.2.6. Modeling Parameter: Meteorology and Surface Characteristics

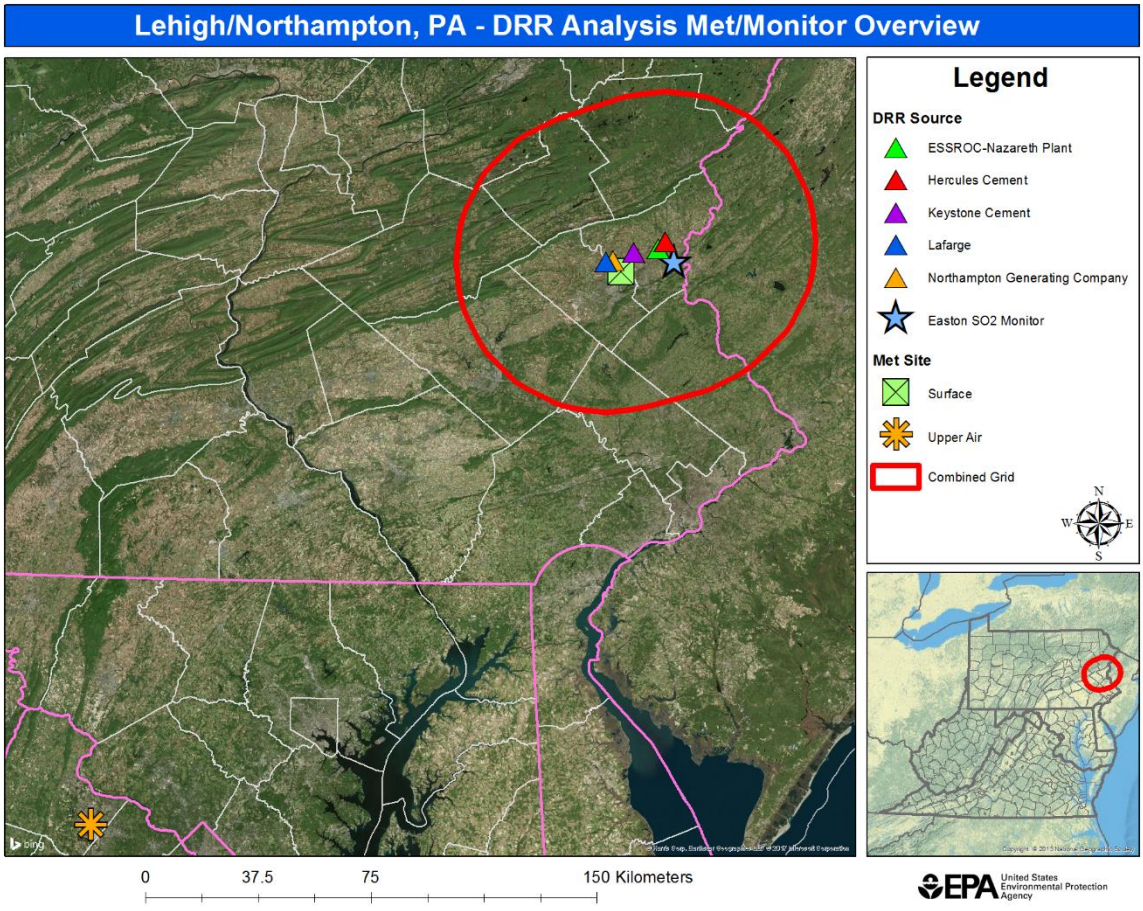
As noted in the Modeling TAD, the most recent three (3) years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness 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 Lehigh County and Northampton County area, the state selected the surface meteorology from the Allentown-Bethlehem-Easton Airport located in Lehigh County, PA, and coincident upper air observations from Sterling, VA, as best representative of meteorological conditions within the area of analysis. The Allentown-Bethlehem-Easton Airport is located approximately 17 km southwest of Hercules Cement, the largest emitter in the DRR source cluster, and approximately 272 km north of Sterling, VA. The surface met site and background monitoring site are located within the modeling domain and are both within 25 km of all of the Lehigh and Northampton county DRR sources.

Pennsylvania used AERSURFACE version 13016 using data from Allentown-Bethlehem-Easton Airport to estimate the surface characteristics of the area of analysis. The Commonwealth estimated values for twelve (12) spatial sectors out to 1.0 km at a seasonal temporal resolution for dry, wet and average conditions. 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"). PA DEP provided the final processed meteorological data used in the modeling analysis but no documentation was formally provided regarding the AERSURFACE processing steps.

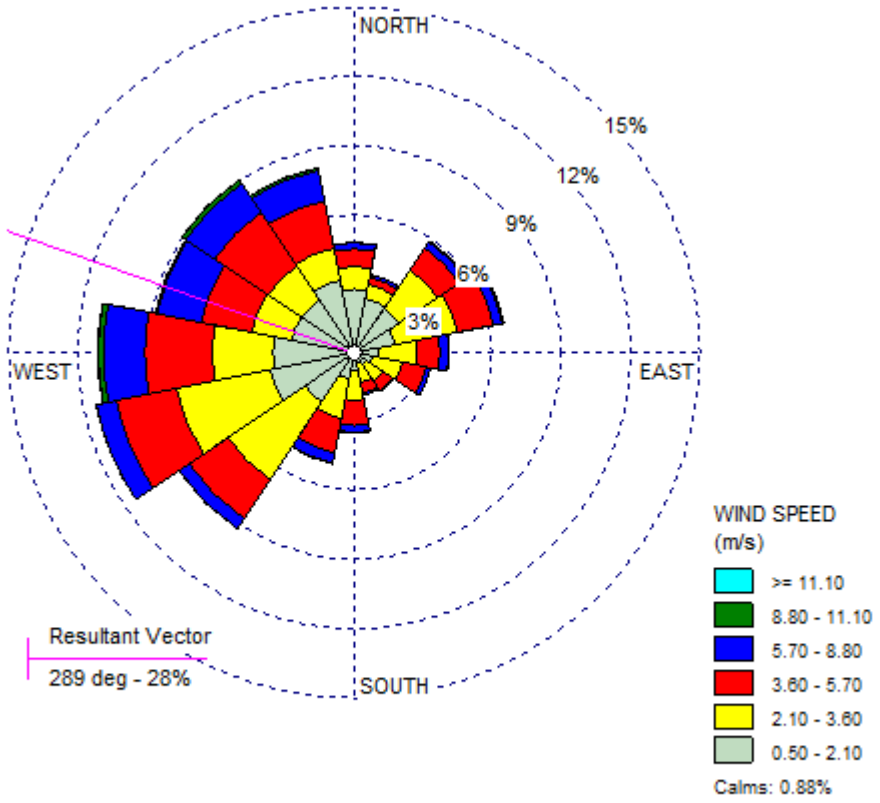
In the figure below, generated by the EPA, the locations of this NWS stations used in Pennsylvania's modeling analysis along with the SO_2 monitoring sites are shown relative to the area of analysis.

Figure 10.4. Area of Analysis and the NWS station[s] in the Lehigh County-Northampton County Area



As part of its submittal, Pennsylvania provided the 3-year surface wind rose for the Allentown-Bethlehem-Easton Airport site for 2012-14. In Figure 10.5 the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The wind rose was produced using the final processed AERMET sfc file in Lakes Environmental's WRPLOT program. Winds were somewhat distributed in the northeast to southwest quadrants. The resultant wind vector for all hours was from a northwesterly direction. The anemometer height used to generate the AERMET-ready files matched the height listed for the Allentown-Bethlehem-Easton Airport (26 ft, 7.92 m).

Figure 10.5 Lehigh County-Northampton County, Pennsylvania 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. Pennsylvania followed the methodology and settings presented in Modeling TAD and associated guidance in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics. As noted earlier, the PA DEP processed and provided the AERMET-ready file used in the collective analysis.

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 for the Allentown-Bethlehem-Easton 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 Commonwealth 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.

Details of the AERMET processing stages were missing from the analysis since PA DEP provided the AERMET-ready files used in the modeling analysis. EPA concludes the files were processed correctly and reflect surface condition such as soil moisture and seasonal snow cover for the area of analysis.

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

The five (5) Lehigh and Northampton county DRR sources lie within the Lehigh Valley, which is roughly oriented from west to east. This valley is part of the Piedmont province of the Appalachian Mountain system. More elevated terrain is located a little over 10 km north where Blue Mountain marks the boundary of the higher terrain features of the Ridge and Valley province.

No formal documentation regarding the collective model receptor grid construction was given in the final modeling reports or the initial modeling protocol; Pennsylvania provided the receptor grid used in the collective analysis. A more detailed description of the receptor grid processing via AERMAP should be provided by Pennsylvania to determine if the model receptor grid was correctly processed for the final collective analysis.

10.3.2.8. 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 collective analysis that included all five (5) DRR sources in Lehigh and Northampton counties used a Tier 2 approach with seasonal and hourly varying background concentrations. The background concentrations for this area of analysis were determined by the state to vary from 6.99 micrograms per cubic meter ($\mu g/m^3$), equivalent to 2.7 ppb when expressed in 2 significant figures[44], to 34.06 $\mu g/m^3$ (13 ppb), with an average value of 16.69 $\mu g/m^3$ (6.4 ppb).

Background concentrations for the collective analysis were provided by Pennsylvania. It was not clear what years the background concentrations represented and full documentation should be provided. The Easton monitor is located approximately 7 km south of Hercules Cement and within 23 km of the other DRR sources included in the collective analysis. Background concentrations are probably influenced by the five (5) DRR sources and may introduce the possibility of "double counting" where emissions are explicitly modeled and also included in the background concentrations. Final model concentrations, therefore, may be considered a conservative estimate of actual collective DRR source emission impacts. Using a regionally representative site may lower concentrations somewhat by removing double counting due to DRR emissions impacting the nearby Easton monitor.

10.3.2.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Lehigh County and Northampton County area of analysis are summarized below in Table 10.4

[44] 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 10.4: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Lehigh County-Northampton County Area

Input Parameter	Value
AERMOD Version	15181 Adjust U*
Dispersion Characteristics	Rural
Modeled Sources	5 (Collective Analysis)
Modeled Stacks	10 (Collective Analysis)
Modeled Structures	221 (excluding Keystone)
Modeled Fencelines	1 (Lafarge, with receptors within boundary)
Total receptors	68,792
Emissions Type	Actual
Emissions Years	2012-14
Meteorology Years	2012-14
NWS Station for Surface Meteorology	Allentown-Bethlehem-Easton Airport, PA
NWS Station Upper Air Meteorology	Sterling, VA
NWS Station for Calculating Surface Characteristics	Allentown-Bethlehem-Easton Airport, PA
Methodology for Calculating Background SO_2 Concentration	Tier 2, Seasonal, Hourly Varying
Calculated Background SO_2 Concentration	6.99 to 34.06$\mu g/m^3$

The results presented below in Table 10.5 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

Table 10.5. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Lehigh County-Northampton County Area

		Receptor Location [UTM zone 18]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
Averaging Period	**Data Period**	**UTM**	**UTM**	**Modeled concentration (including background)**	**NAAQS Level**
99th Percentile 1-Hour Average	2012-14	463230	4510910	169.95	196.4*

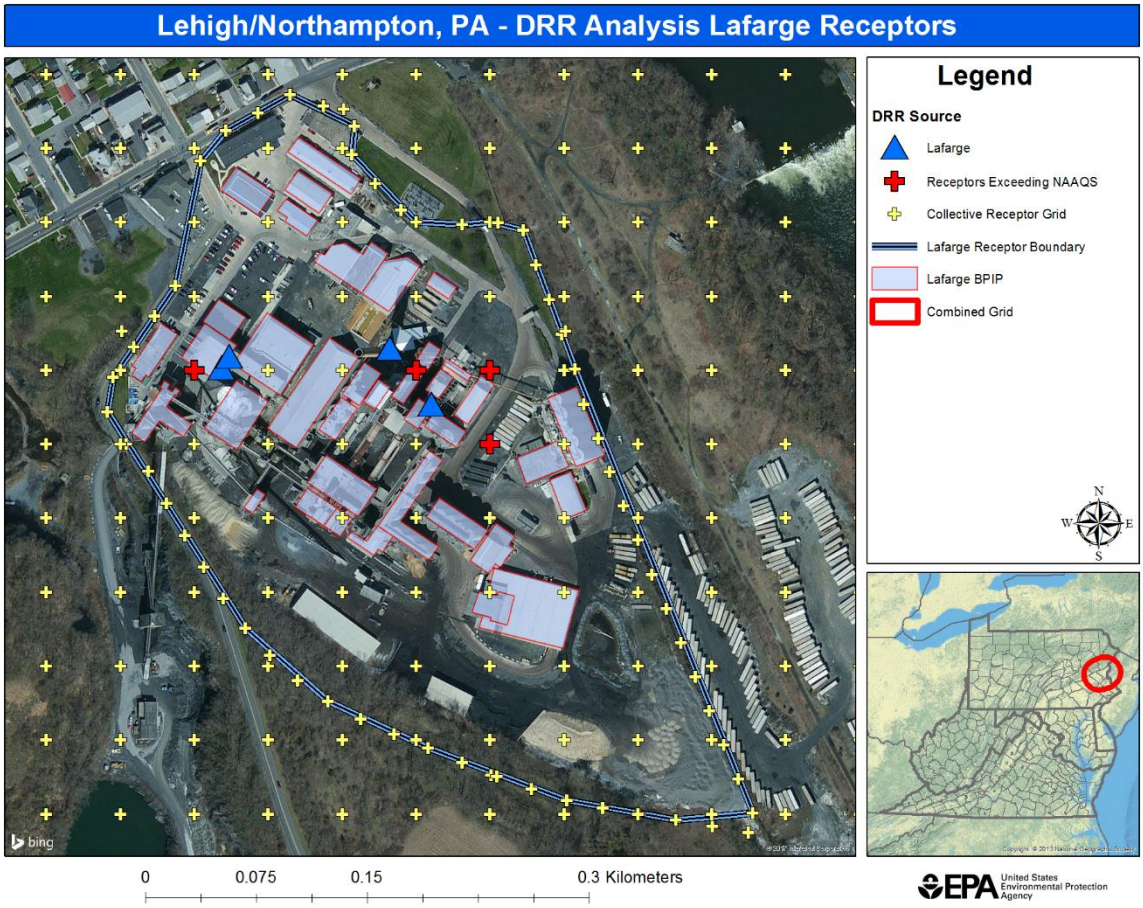
*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor

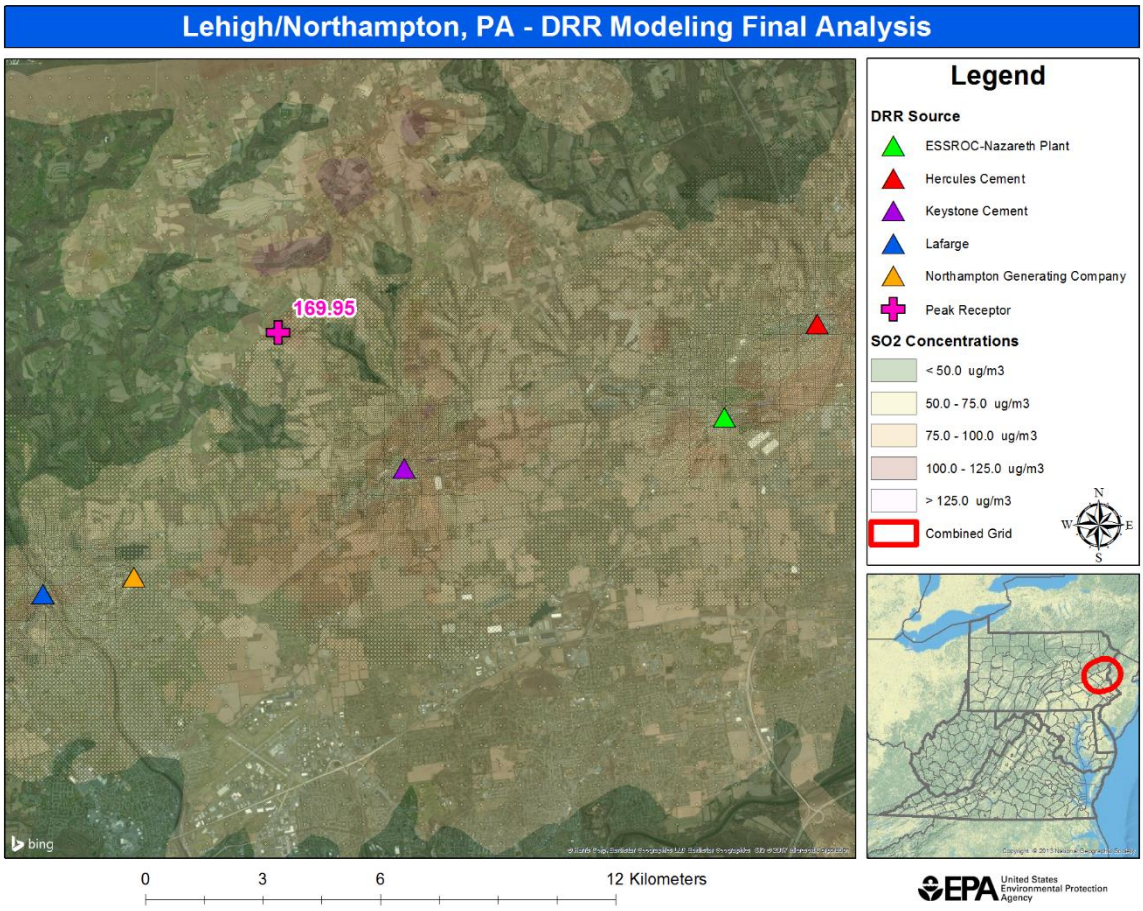
Pennsylvania's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 169.95 $\mu g/m^3$, equivalent to 64.9 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the five (5) DRR sources in Lehigh and Northampton counties that were included in the collective analysis.

Modeled concentrations from the collective analysis did exceed the 1-hr SO_2 NAAQS at four (4) model receptors. These receptors, however, appear to be located inside the delineated potential ambient air boundary for Lafarge. The receptors that violate the NAAQS may be impacted by building downwash. These receptors are potentially not in ambient air for Lafarge, but would be considered ambient air relative to the other modeled facilities. These receptors were not used in determining the final peak model concentration listed previously. Pennsylvania should properly document whether these violating receptors are within an ambient air boundary for Lafarge (i.e. document whether public access is precluded within the property boundary delineated) and remodel these receptors to include only modeling impacts from the remaining four (4) DRR sources inside Lafarge's potential ambient air boundary.

Figure 10.6below was produced using the collective model outputs. A figure showing the four (4) model receptors possibly inside Lafarge's ambient air boundary that violated the 1-hour SO_2 NAAQS is included along with a figure showing the area near the peak model receptor (outside of Lafarge). Peak model concentrations from the collective model analysis show that that the predicted maximum value occurred approximately 5 km northwest of Keystone Cement. A portion of the state's receptor grid near the five (5) DRR sources in Lehigh and Northampton counties is also shown in the figure.

Figure 10.6 Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Lehigh County-Northampton County Area





The modeling submitted by Pennsylvania does not indicate that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration. Peak receptor concentrations over the three-year collective simulation all occurred during the overnight hours indicating that the Adjust U* option was probably impacting final model concentrations. Rerunning using the most current version of AERMOD may increase the final peak concentration given the version used in Pennsylvania's collective run has a known formulation bug that leads to model under predictions.

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

As noted in several sections, the collective modeling analysis that Pennsylvania performed for the Lehigh and Northampton DRR source cluster is not sufficient to determine whether the area is attaining or not attaining the 2010 1-hour SO_2 NAAQS due to several deficiencies. The main deficiency is the use of the Beta Adjust U* option within AERMOD version 15181 in the collective analysis. This version of AERMOD contains a known formulation bug that leads to possible under predictions in model concentrations. Given the peak model receptor's concentrations occurred during the overnight hours of the simulation, there is a strong possibility that the Beta Adjust U* option was contributing to the final model concentrations. The collective analysis should be rerun using the most current version of AERMOD to assess the area's final designation status.

In addition to the use of Adjust U* option within AERMOD version 15181, there are several gaps in the documentation for the collective analysis submitted by Pennsylvania. These include the following:

- Lack of supporting documentation for the development of the collective model receptor grid including files used to run the AERMAP preprocessor.
- Documentation showing the four (4) model receptors that violated the 1-hour SO2 NAAQS reside inside Lafarge's potential ambient air boundary. Additionally, these receptors should be rerun to show whether the impacts from the other four (4) DRR sources are causing violations inside Lafarge's potential ambient air boundary.
- Complete documentation for the processed meteorological files used in AERMOD including the AERSURFACE processing steps used to generation the surface characteristics used in the AERMET preprocessor.
- Full documentation for the background monitor (Easton, PA) concentrations used in the collective analysis including the monitor collection times.
- Examination of the hourly stack temperatures that were below 273 K to assure equipment was not operational and no emissions occurred during those hours. Examine suspect stack velocities in excess of 40 m/s in the hourly source emission file.

Full documentation would be needed to make a final designation determination.

10.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Lehigh County-Northampton County, Pennsylvania 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.

10.5. Jurisdictional Boundaries in the Lehigh County-Northampton County Area

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

In Pennsylvania's original recommendation on June 23, 2011, Pennsylvania recommended that the area surrounding the cluster of sources in Lehigh County and Northampton County, specifically the entirety of Lehigh County and Northampton County, be designated as unclassifiable. On May 26, 2017, Pennsylvania submitted a modeling analysis for the Lehigh County and Northampton County area but did not update their recommendation.

10.6. Other Information Relevant to the Designations for the Lehigh County-Northampton County 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 Lehigh County and Northampton County area of analysis.

10.7. The EPA's Assessment of the Available Information for the Lehigh County-Northampton County Area

The EPA finds that available air quality monitoring data alone are unreliable to be representative of the area's air quality because, although the design value from the air quality monitor located within this area of analysis is well below the standard of 75 ppb (24 ppb), it is unclear if this monitor is located in areas of maximum concentration, and therefore, it is unclear if the monitoring data is representative of actual air quality in the area.

The EPA finds that the collective modeling analysis that Pennsylvania performed for the Lehigh and Northampton DRR source cluster is not sufficient to determine whether the area is attaining or not attaining the 2010 1-hour SO_2 NAAQS or whether the area is contributing or not contributing to any nearby nonattainment areas due to several deficiencies. The main deficiency is the use of the Beta Adjust U* option within AERMOD version 15181 in the collective analysis. The second deficiency is the lack of documentation in several areas of the modeling analysis including the development of the proper model receptor grid, meteorological files, background monitor data, and accurate hourly stack temperatures and velocities.

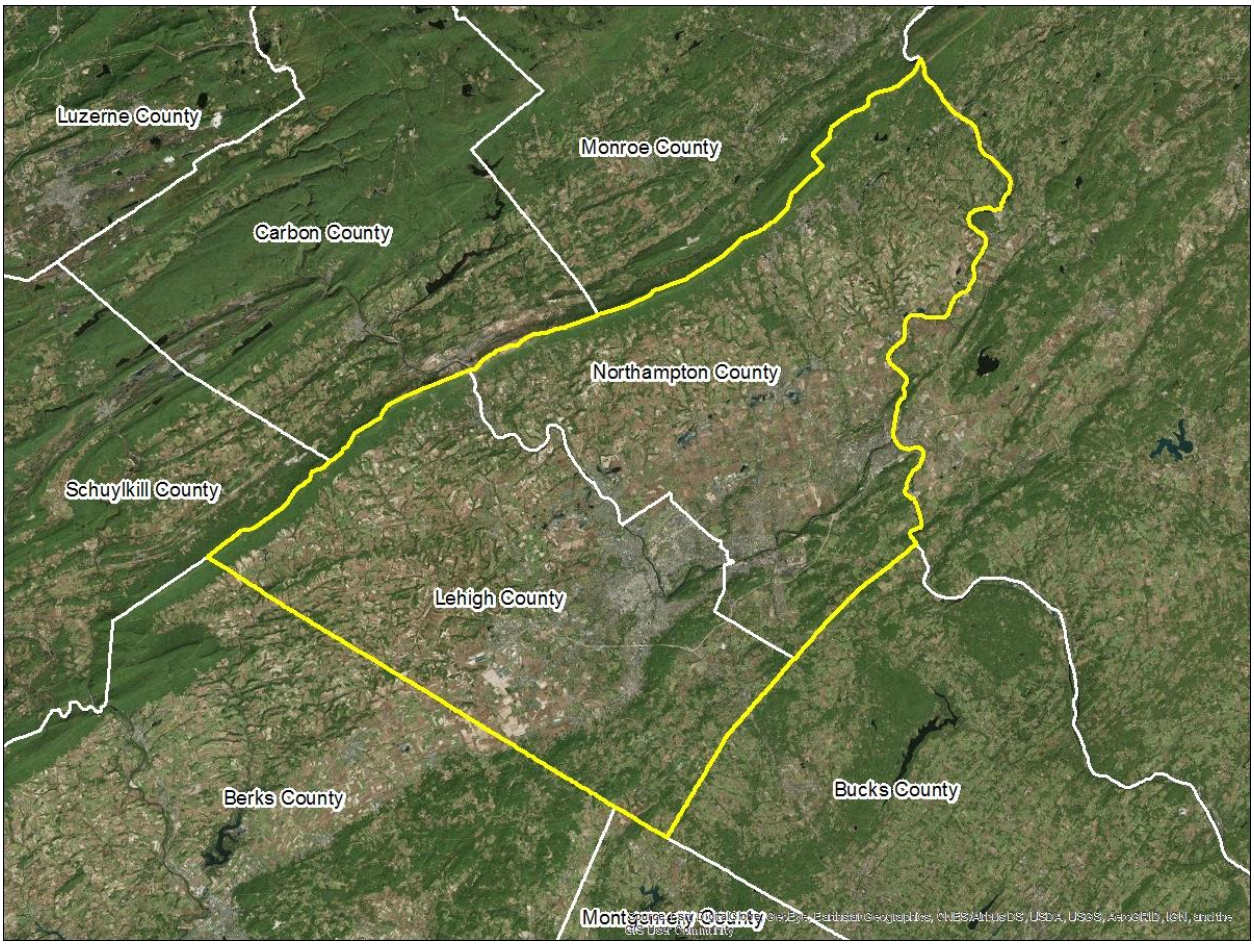
The EPA concludes that our intended unclassifiable area, bounded by the county jurisdictional boundaries, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable area.

10.8. Summary of Our Intended Designation for the Lehigh County-Northampton County, Pennsylvania Area

After careful evaluation of Pennsylvania's recommendation and supporting information, as well as all available relevant information, the EPA agrees with the Commonwealth's recommendation and intends to designate Lehigh County-Northampton County area as unclassifiable for the 2010 SO_2 NAAQS. The Lehigh County-Northampton County unclassifiable 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 boundaries are comprised of jurisdictional boundaries for Lehigh County and Northampton County, Pennsylvania

Figure 10.7 shows the boundary of this intended designated area.

Figure 10.7. Boundary of the Intended the Lehigh County-Northampton County Unclassifiable Area



At this time, our intended designations for the state only apply to this area and the other areas presented in this technical support document.

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11. Technical Analysis for All Other Counties and Portions Thereof

11.1. Introduction

The EPA is designating the counties and portions of counties in Table 11.1 in the Commonwealth 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. In accordance with the DRR, these counties are not required to monitor or model because they do not contain any sources larger than 2,000 tons of SO_2 per year. Pennsylvania has not installed and begun timely operation of a new, approved SO_2 monitoring network meeting EPA specifications referenced in the EPA's DRR for any sources of SO_2 emissions in the counties identified in Table 11.1. 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 and portions of counties. In addition, there is no air quality monitoring data that indicate any violation of the 1-hour SO_2 NAAQS.

Table 11.1. Counties and Portions Thereof that the EPA Intends to Designate Unclassifiable/Attainment

County or Partial County	Pennsylvania's Recommended Area Definition	Pennsylvania's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Adams County	Adams County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Armstrong County (p)	Armstrong County	Unclassifiable	Remainder of County (excluding Plumcreek and South Bend Townships and Elderton Borough)	Unclassifiable/ attainment
Beaver County (p)	Beaver County	Nonattainment	Remainder of County (excluding Industry, Shippingport, and Midland Boroughs, and Brighton, Potter and Vanport Townships)	Unclassifiable/ attainment

County or Partial County	Pennsylvania's Recommended Area Definition	Pennsylvania's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Bedford County	Bedford County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Berks County	Berks County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Blair County	Blair County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Bradford County	Bradford County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Bucks County	Bucks County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Butler County	Butler County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Cameron County	Cameron County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Centre County	Centre County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Chester County	Chester County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Clarion County	Clarion County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Clinton County	Clinton County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Columbia County	Columbia County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment

County or Partial County	Pennsylvania's Recommended Area Definition	Pennsylvania's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Crawford County	Crawford County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Cumberland County	Cumberland County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Dauphin County	Dauphin County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Elk County	Elk County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Erie County	Erie County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Fayette County	Fayette County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Forest County	Forest County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Franklin County	Franklin County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Fulton County	Fulton County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Greene County	Greene County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment

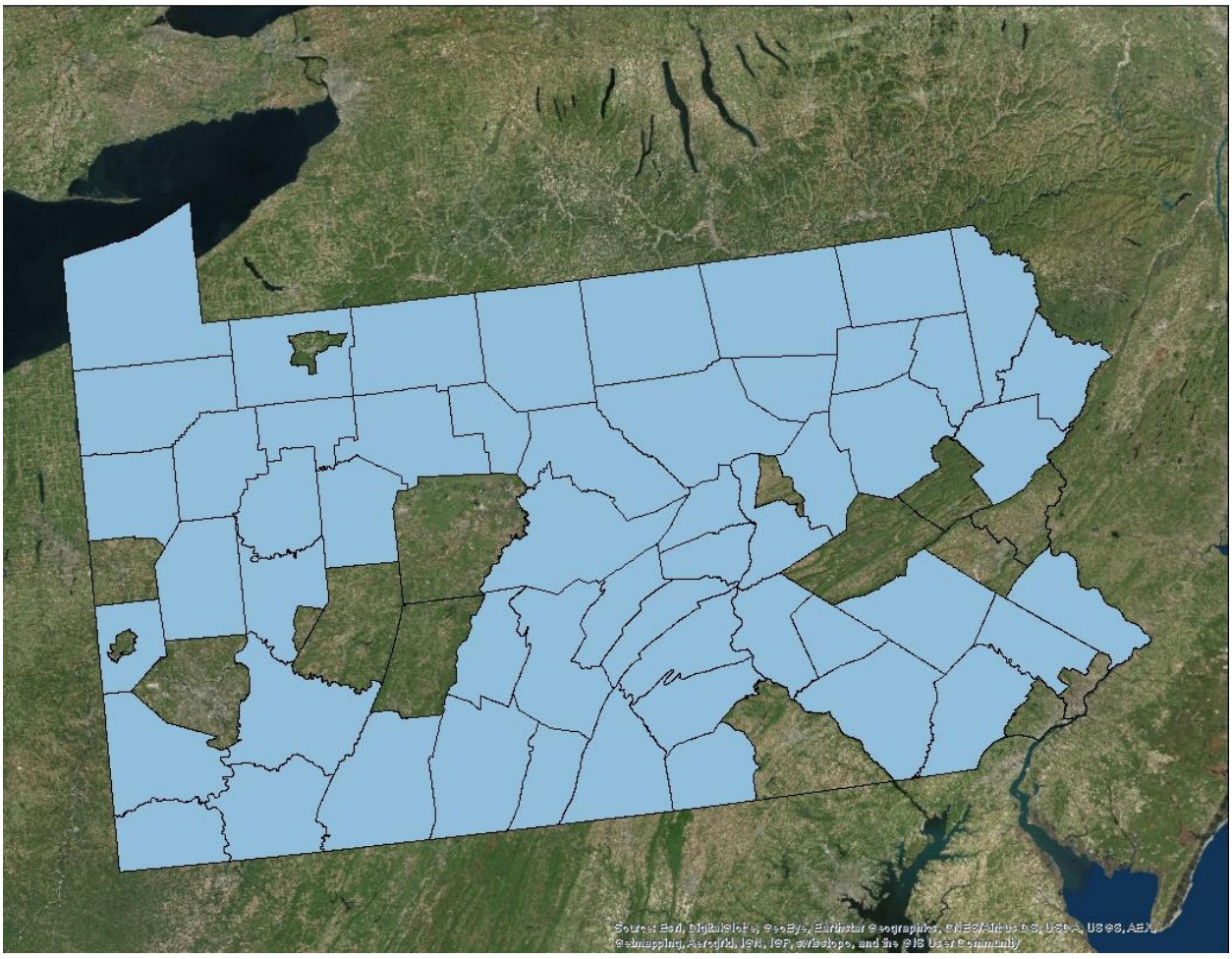
County or Partial County	Pennsylvania's Recommended Area Definition	Pennsylvania's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Huntingdon County	Huntingdon County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Jefferson County	Jefferson County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Juniata County	Juniata County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Lackawanna County	Lackawanna County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Lancaster County	Lancaster County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Lebanon County	Lebanon County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Luzerne County	Luzerne County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Lycoming County	Lycoming County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
McKean County	McKean County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Mercer County	Mercer County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment

County or Partial County	Pennsylvania's Recommended Area Definition	Pennsylvania's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Mifflin County	Mifflin County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Monroe County	Monroe County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Montgomery County	Montgomery County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Northumberland County	Northumberland County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Perry County	Perry County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Pike County	Pike County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Potter County	Potter County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Snyder County	Snyder County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Somerset County	Somerset County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Sullivan County	Sullivan County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment

County or Partial County	Pennsylvania's Recommended Area Definition	Pennsylvania's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Susquehanna County	Susquehanna County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Tioga County	Tioga County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Union County	Union County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Venango County	Venango County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Warren County (p)	Warren County	Nonattainment	Remainder of County (except Conewango, Glade, and Pleasant Townships, and the City of Warren)	Unclassifiable/ attainment
Washington County	Washington County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Wayne County	Wayne County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment
Westmoreland County	Westmoreland County	Unclassifiable	Different than Commonwealth's Recommendation	Unclassifiable/ attainment
Wyoming County	Wyoming County	Unclassifiable	Same as Commonwealth's Recommendation	Unclassifiable/ attainment

Table 11.1 also summarizes Pennsylvania's recommendations for these areas. Specifically, Pennsylvania recommended that the entirety of the counties be designated as unclassifiable based on the lack of air quality monitoring and modeling data with the exception of portions of Armstrong, Beaver, and Warren counties which were designated as nonattainment during Round 1 of SO_2 designations (see 78 Federal Register 4719). After careful review of Pennsylvania's assessment, supporting documentation, and all available data, the EPA intends to modify Pennsylvania's recommendation for these counties and remaining portions of three counties, and designate the areas as unclassifiable/attainment. Figure 11.1 shows the locations of these areas within Pennsylvania.

Figure 11.1 The EPA's Intended Unclassifiable/Attainment Designation(s) for Counties in Pennsylvania



As referenced in the Introduction (see Table 2), the county associated with sources for which Pennsylvania 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.

11.2. Air Quality Monitoring Data for All Other Counties

Table 11.2 lists AQS monitors located in Pennsylvania which have sufficient valid data for 2013-2016 and these data indicate that there was no violation of the 2010 SO_2 NAAQS at the monitoring site in that period. However, these data alone are not sufficient to support a conclusion that there is no NAAQS violation in any other portion of the area without sufficient information indicating that the monitor(s) are located in the maximum concentration for the area.

Table 11.2. Air Quality Monitoring for Other Counties or Portions Thereof

County	AQS Monitor ID	2010-2012 Design Value	2011-2013 Design Value	2012-2014 Design Value	2013-2015 Design Value	2014-2016 Design Value
Adams	42-001-0001	-	-	12*	12*	10*
Berks	42-011-0011	23*	17*	12*	13	8*
Blair	42-013-0801	32	31	35	36	29*
Bucks	42-017-0012	20	18	15	12	10*
Centre	42-027-0100	21*	19*	18*	18*	15*
Erie	42-049-0003	22	17	14	14	12*
Greene	42-059-0002	20*	17*	17*	18	18*
Luzerne	42-079-1101	13	9	8	9	8*
Montgomery	42-091-0013	12	9	7	6	6*
Washington	42-125-0005	21	20	26	33	36
Washington	42-125-5001	33	24	17	17	17

*Incomplete/invalid design value

11.3. Jurisdictional Boundaries for All Other Counties

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

Pennsylvania's original recommendation, dated June 2011, recommended that each county listed in Table 11.1in Pennsylvania be designated as unclassifiable. With the exception of the partial counties designated as nonattainment in Round 1 of designations[45] (Allegheny, Armstrong, Beaver, Warren) as well as those for which we received modeling analyses for Round 3 (Allegheny (partial), Cambria, Carbon, Clearfield, Delaware, Lawrence, Lehigh, Montour, Northampton, Philadelphia, Schuylkill,), and those deferred to Round 4 designations (York , the remaining counties and portions of counties listed in Table 11.1 remain recommended as unclassifiable by Pennsylvania. Pennsylvania's recommended boundaries defaulted to the jurisdictional boundary for each county.

11.4. The EPA's Assessment of the Available Information for All Other Counties

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 Table 11.1[insert] as unclassifiable/attainment for the 2010 SO_2 NAAQS.

Our intended unclassifiable/attainment area, bounded by the county 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/attainment area.

As shown in Table 2, York County will be designated in by December 31, 2020 because a new monitoring network has been installed and began timely operation in that area.

In addition, portions of three counties (Armstrong, Beaver and Warren) were designated as nonattainment during Round 1 of SO_2 designations (see 78 Federal Register 4719). Pennsylvania's original recommendation dated June 23, 2011[46] recommended nonattainment for all of Beaver and Warren counties and unclassifiable for Armstrong county. During Round 1 of SO_2 designations in a letter to the EPA dated April 8, 2013,[47] Pennsylvania recommended only a portion of Beaver and Warren counties be designated as nonattainment. Pennsylvania did not update their initial recommendation for the remainder of these counties or Armstrong county.

[45] See PA TSD from Round 1 SO_2 designations - https://www.epa.gov/sites/production/files/2016-03/documents/pa-tsd.pdf
[46] https://www.epa.gov/sites/production/files/2016-03/documents/pa-rec.pdf
[47] https://www.epa.gov/sites/production/files/2016-03/documents/pa-remarks.pdf

The remainder of Armstrong, Beaver, and Warren counties are now being designated as unclassifiable/attainment for the reasons stated previously above.

11.5. Summary of Our Intended Designation for All Other Counties

After careful evaluation of the Commonwealth's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the areas listed in Table 11.1 as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of the jurisdictional boundary for each county except for the partial counties of Armstrong, Beaver, and Warren.

Figure 11.1 above shows the location of these areas within Pennsylvania. Except for the partial counties listed in Table11.1 the boundary of the unclassifiable/attainment area is the county boundary.

At this time, our intended designations for Pennsylvania only apply to these areas and the other areas presented in this technical support document. The EPA intends to evaluate and designate York County in Pennsylvania by December 31, 2020.