Appendix Q
Dispersion Modeling Analysis for Conesville Power Plant
2010 SO_2 NAAQS Recommended Designation

Introduction

The United States Environmental Protection Agency (U.S. EPA) established a new National Ambient Air Quality Standard (NAAQS) for SO_2 on June 22, 2010, of 75 ppb, as the 99^{th} percentile of maximum daily values, averaged over three years. In addition, U.S. EPA revoked the primary annual and 24-hour standards.

Pursuant to the third round of designations and in accordance with the August 21, *2015 Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide (SO_2) Primary National Ambient Air Quality Standard (NAAQS); Final Rule*, Ohio EPA is submitting a designation recommendation for the American Electric Power (AEP) Conesville Power Plant source area. This document supports Ohio's recommended designation of the Conesville source area based on refined dispersion modeling.

Per U.S. EPA's guidance (February 2016 *Draft SO_2 NAAQS Designations Modeling Technical Assistance Document* (herein referred to as "Modeling TAD"), "The primary objective of the modeling would be to determine whether an area currently meets the SO_2 NAAQS, and thereby indicate the designation process for the area". Ohio EPA is including this refined dispersion modeling analysis as a portion of the five-factor approach recommended by U.S. EPA in defining designation areas.

The dispersion modeling analysis was conducted for the 2013-2015 period, using actual hourly variable emissions from the Conesville facility. This was done per the Modeling TAD, in which U.S. EPA recommends modeling the most recent 3 years of available actual emissions.

Temporally varying emissions were modeled to determine the contribution of emissions from each source in the modeling domain. Ohio EPA used variable emissions at the finest temporal scale available for each unit included in the modeling domain. Hourly variable emissions data for the 2013-2015 period were submitted to Ohio EPA by AEP for all SO_2 sources at the Conesville facility. As described in Ohio's designation modeling protocol (Appendix B of the State of Ohio 2010 Revised Sulfur Dioxide National Ambient Air Quality Standard, Recommended Area Designations, Round 3 submittal), Part 75 emissions reporting data was used for the majority of hourly emissions, with data substitutions for some hours, as described in the modeling protocol.

Modeling Approach

Per U.S. EPA's Modeling TAD,

> "Since the purpose here pertains to designations, this guidance supports analyses of existing air quality rather than analyses of emissions limits necessary to provide

for attainment. Consequently, the guidance in this TAD differs in selected respects from the guidance published in Appendix W. These differences include:

- Placement of receptors only in areas where it is feasible to place a monitor vs. all ambient air locations (NSR, PSD, and SIP)
- Use of the most recent 3 years of actual emissions (designations) vs. maximum allowable emissions (NSR, PSD, and SIP)
- Use of 3 years of meteorological data (designations) vs. one to five years (NSR, PSD, and SIP)
- Use of actual stack height for designations using actual emissions vs. Good Engineering Practice (GEP) stack height for other regulatory applications (NSR, PSD, and SIP)"

Ohio EPA incorporated the differences listed above and followed Appendix W guidance where applicable to modeling for designation purposes. The averaging period for the 2010 SO_2 NAAQS is the 99th percentile of maximum monitored daily values, averaged over three years. Per the Modeling TAD, three years of National Weather Service data is sufficient to allow the modeling to simulate a monitor. Thus, the modeled form of the standard is expressed as the 99th percentile of maximum daily values averaged over three years (herein referred to as "design value") for the purposes of designation.

The recommended dispersion model for modeling for SO_2 designations is the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) modeling system. There are two input data processors that are regulatory components of the AERMOD modeling system: AERMET, a meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, and AERMAP, a terrain data preprocessor that incorporates complex terrain using United States Geological Survey (USGS) Digital Elevation Data. Additionally, Ohio EPA utilized the AERMINUTE module to incorporate 1-minute ASOS meteorological data into the hourly surface input file. Ohio EPA utilized the most up-to-date versions of AERMOD and the associated preprocessors available at the time of the attainment modeling analyses. These are as follows: AERMOD version 15181, AERMET version 15181, AERMINUTE version 14337, and AERMAP version 11103. All dispersion modeling for this submittal was conducted following Ohio EPA's designations modeling protocol, submitted on July 1, 2016. AERMOD and all associated preprocessors were run in the default regulatory mode.

Meteorological Data

In order to generate meteorological input data for use with AERMOD, AERMET, along with AERMINUTE and AERSURFACE preprocessing for the modeling domain was conducted to generate the surface (.sfc) and profile (.pfl). Ohio EPA used the AERMINUTE pre-processing module. This module accepts as input 1-minute ASOS meteorological surface observations, calculates an hourly average for each hour in the modeled time period, and substitutes any missing values from the co-located ISHD surface data. Use of AERMINUTE reduces the number of calm hours present in the input files, and these enhanced hourly files are therefore considered more representative of local meteorological conditions.

Meteorological data from 2013-2015 from surface station #14821 located at the John Glenn Columbus International Airport and the Pittsburgh, Pennsylvania upper air station (station #94823) located at the Greater Pittsburgh International Airport were used in these analyses. These sites were determined to be representative of Coshocton County, OH and the Conesville facility. AERSURFACE was run using twelve sectors and monthly surface characteristics, centered on the location of the surface meteorological station. Monthly precipitation values, years 2013-2015 from the John Glenn Columbus International Airport were compared to the 30 year climatological averages to inform monthly surface characteristics.

A composite wind-rose of annual trends and distribution of wind directions, years 2013-2015 for surface station #14821 is shown in Figure 1. This figure demonstrates that the predominant wind directions are from the south and southwest, with significant contributions from winds originating in the south, and some contribution from all directions.

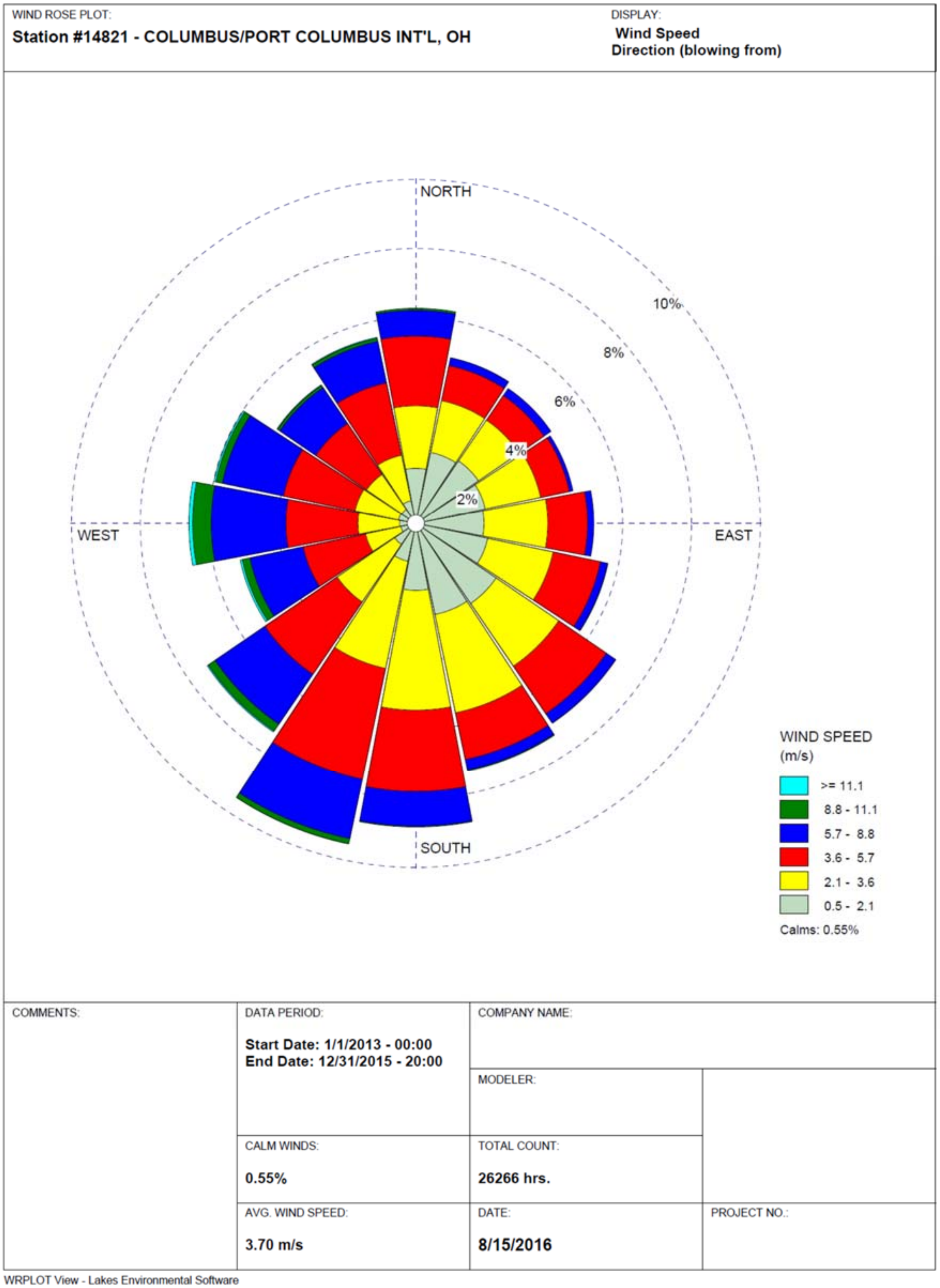

Figure 1: Wind roses, years 2012-2014, Columbus met station.

The predominant wind directions were used, in part, to inform which facilities within 50 kilometers may potentially impact ambient SO_2 concentrations in the Conesville source area not accounted for by background and therefore necessitate inclusion in the dispersion modeling analysis. As shown in Figure 1, the predominant winds in the source area originate from the south and southwest, though significant wind contributions come from all directions. Figure 2 shows the location of all facilities located within 50 kilometers of the Conesville facility, as well as a composite wind rose, years 2013-2015, from the surface meteorological station.

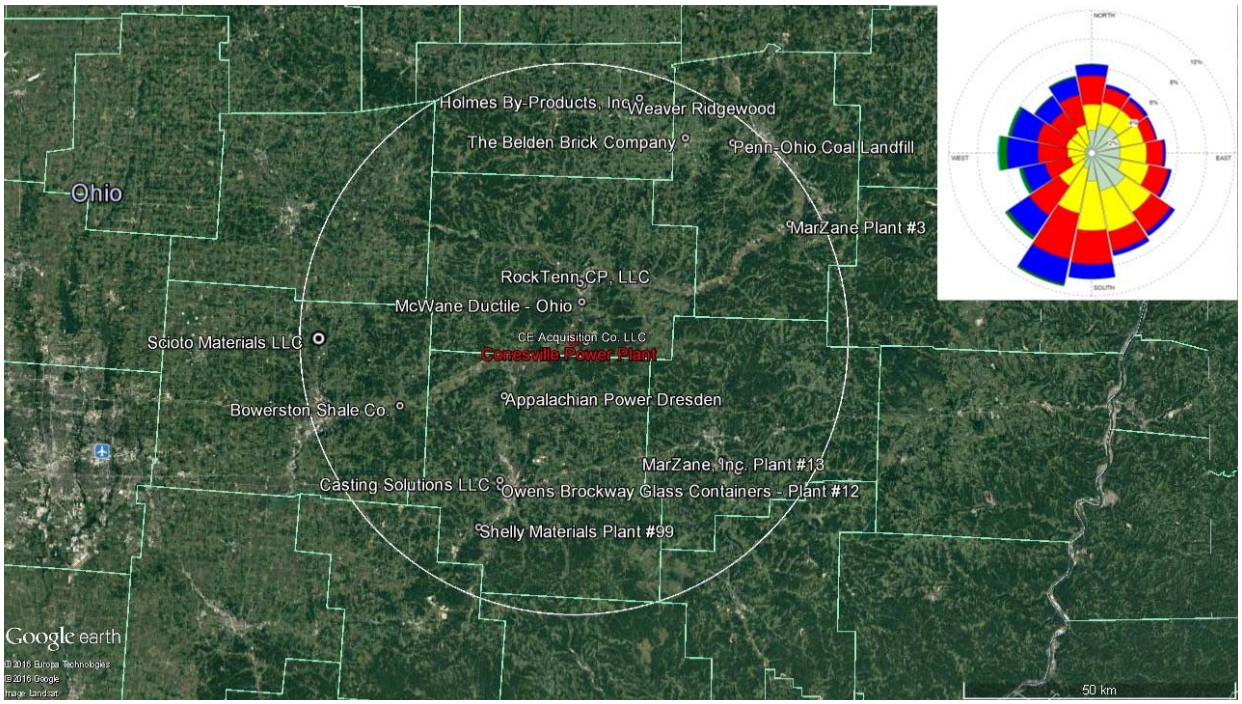

Figure 2: SO_2 sources in the Conesville source area, with 2013-2015 composite wind rose.

Considering the predominant wind directions, Ohio does not conclude that the emissions from those sources located within the Conesville source area will impact ambient SO_2 concentrations beyond what is accounted for in background due to the low emissions of those sources. As discussed in the emissions sources analysis below, all other SO_2 sources in the surrounding counties are of low enough emissions and/or far enough away from Conesville so as not to expect any significant concentration gradient beyond what is accounted for in the flat background value. However, as the two largest sources in the surrounding counties were to the Northeast in Tuscarawas county, as discussed in the emissions source analysis below, this meteorological analysis offers further evidence that emissions from those facilities will not contribute significantly to the area most impacted by Conesville.

Background

Ohio EPA applied background concentrations of SO_2 to all modeled results under all scenarios. As described in Appendix O of the State of Ohio 2010 Revised Sulfur Dioxide National Ambient Air Quality Standard, Recommended Area Designations, Round 3 submittal, Ohio EPA utilized a flat regional background value of 8 ppb (20.9 ug/m3) due to the absence of a nearby monitor and the lack of significant emission sources near Conesville Power Plant, as discussed below.

Emission Sources

The three SO_2 emission sources at the Conesville Power Plant were included in the designation modeling analysis as two egress points. The two units that share an egress point are identical 4,091 MMBtu/hour dry-bottom coal-fired boilers, and the remaining unit is a 7,960 MMBtu/hour dry-bottom coal-fired boiler. Variable emissions for the two sources that share a stack were combined to represent emissions from a single-stack egress point and variable emissions for the remaining source was represented with its own single-stack egress point. These two egress points were included in the model via AERMOD's HOUREMIS input pathway, years 2013-2015. Ohio EPA utilized the 1-hour SO_2 design value output option internal to the AERMOD code to simplify post-processing and eliminate the need to generate large hourly output files. Ohio EPA accounted for background as a flat rate, as discussed previously, added to the results of the modeling runs. The relevant release point parameters for the egress point included in this analysis are presented in Table 1, below. The stacks at the Conesville Power Plant facility were treated as point sources. Ohio EPA obtained the HOUREMIS input file from American Electric Power.

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elevation	Stack Height	Stack Diameter	Temperature	Exit Velocity	SO_2
		(m)	(m)	(m)	(m)	(m)	(K)	(m/s)	(g/s)
UNIT4	Coal-fired boiler B004	424970	4448730	226.5	243.23	9.95	Variable	Variable	Variable
CS056	Coal-fired boilers B007, B008	425207	4448783	225.9	243.84	7.93	Variable	Variable	Variable

Table 1: Modeled source parameters, Conesville Power Plant, 2013-2015.

Table 2 presents 2014 SO_2 emissions for all sources greater than 1 TPY of SO_2 within 50 kilometers of the Conesville facility. Coshocton County and the surrounding region are primarily un-industrialized, agricultural counties. Ohio EPA considered all sources with 2014 SO_2 emissions greater than 1 TPY for this analysis, with a particular focus on those sources with the potential to cause a significant concentration gradient in the source area beyond what is accounted for in background

Based on the data shown in Table 2, explicitly modeled emissions from the Conesville facility account for 80% of all SO_2 within the 50-kilometer source area. Of the remaining sources in the 50-kilometer area surrounding Conesville Power Plant, only two, The Belden Brick Company (902 TPY) and AMG Vanadium (631 TPY) exceed 500 TPY.

However, the distance between these facilities and the Conesville facility, 42 and 35 kilometers, respectively, is significant. Based on the limited extent of impacts from the Conesville facility described in the Results portion of this document, it is highly unlikely that emissions from these sources will interact in a significant manner.

Ohio EPA's experience in modeling for both the 1-hour SO_2 and NO_2 standards indicates that sources located beyond 25 kilometers are unlikely to interact or contribute significantly to a concentration gradient. Those facilities within 25 kilometers may interact in a significant manner, and warrant further discussion. Figure 3 shows those sources with 2014 emissions greater than 1 TPY located within 25 kilometers of the Conesville facility.

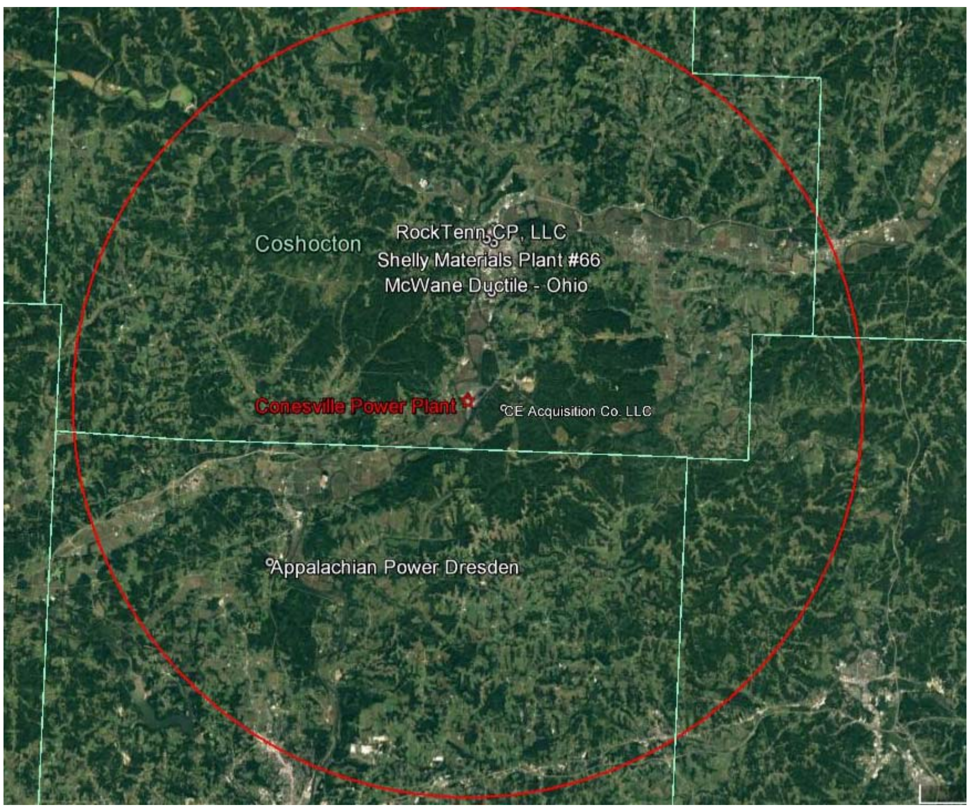

Figure 3: Sources within 25 km of the Conesville Power Plant.

There are five sources of SO_2 located within 25 kilometers of Conesville Power Plant; RockTenn CP, CE Acquisition, Appalachian Power Dresden, Shelly Materials Plant #66, and McWane Ductile. In 2014, these facilities had a combined SO_2 emission rate of 33.8 TPY. Taking into account the predominant wind direction, low emissions, and distance between these sources and Conesville facility, it is highly unlikely that these sources would together or individually contribute to a concentration gradient beyond what is accounted for in the conservative background applied in the modeling analysis. Further, the explicit modeling of the Conesville facility accounts for 99.5% of all SO_2 emissions within a 25-kilometer radius of the Conesville facility.

Considering the predominant wind directions, Ohio does not conclude that the emissions from those sources located within the Conesville source area will impact ambient SO_2 concentrations beyond what is accounted for in background due to the low emissions of those sources. All other SO_2 sources in the surrounding counties are of low enough emissions and/or far enough away from Conesville so as not to expect any significant concentration gradient beyond what is accounted for in the flat background value. The two largest sources in the surrounding counties were to the Northeast in Tuscarawas county, as discussed in the emissions source analysis, and meteorological analysis offers further evidence that emissions from those facilities will not contribute significantly to the area. Lastly, based on modeling results, emissions from Conesville do not impact concentrations beyond approximately 3 kilometers from the facility.

Based on an extensive analysis of emissions sources within 50 kilometers of the Conesville facility source area, it was determined that the only source necessitating inclusion in the modeling analysis was the Conesville facility and the remaining sources are represented via the background concentrations.

State	County	Facility ID	Facility Name	2014 SO_2 Emissions (TPY)	Distance from Conesville (km)
OH	Coshocton	616000000	Conesville Power Plant	7,370	--
OH	Coshocton	616010001	RockTenn CP,LLC	13.4	10
OH	Coshocton	616010006	McWane Ductile - Ohio	1.2	7.1
OH	Coshocton	616010087	CE Acquisition Company LLC	9.7	3.6
OH	Coshocton	664000078	Shelly Materials Plant #66	1.8	14
			Coshocton Total	***7,396***	
OH	Guernsey	630010005	AMG Vanadium, Inc.	630.6	35
OH	Guernsey	660000081	Mar-Zane, Inc. Plant #13	1.4	38
			Guernsey Total	***632***	
OH	Holmes	238000004	HOLMES BY-PRODUCTS INC.	2.5	46
OH	Holmes	238000137	Weaver Ridgewood	2.3	44
			Holmes Total	***4.8***	
OH	Knox	142010065	OWENS CORNING	6.4	55
			Knox Total	***6.4***	
OH	Licking	145000010	Bowerston Shale Company	39.8	34
OH	Licking	145000400	Scioto Materials LLC St. Louisville	15.1	46
OH	Licking	145020185	Owens Corning Insulating Systems, LLC	21.1	46
			Licking Total	***76.00***	
OH	Muskingum	660000247	Appalachian Power Co, Dresden Plant	7.7	16
OH	Muskingum	660010007	Owens Brockway Glass Containers - Plant #12	177.3	30

OH	Muskingum	660010101	Casting Solutions, LLC	1.4	28
OH	Muskingum	664980012	Shelly Materials Inc. Plt. #99	1.6	43
			Muskingum Total	***188.0***	
OH	Tuscarawas	660010023	Mar Zane Plant No 3	1.75	43
OH	Tuscarawas	679000118	The Belden Brick Company	902.34	41
OH	Tuscarawas	679010213	Penn-Ohio Coal Co., d.b.a Kimble Sanitary Landfill	2	47
OH	Tuscarawas	679030152	Aleris Rolled Products, Inc.	5.38	50
			Tuscarawas Total	***911.47***	
			Grand Total within 50 km of Conesville Power Plant	***9,214.67***	

Table 2: SO_2 sources and 2014 emissions, Conesville source area.

Analysis

The designation modeling analysis consisted of a single modeling run, years 2013-2015. The results of this analysis are to be used to inform the designation process for the area surrounding the Conesville facility.

Receptors

A total of 32,548 receptors were included in the modeling domain for the purposes of designations modeling. 50 meters spacing was used along the fenceline of the Conesville Power Plant facility, and a 50 meters spacing to 3 kilometers from the fenceline was used. The dense grid around the facility was informed by screen modeling to ensure that the point of maximum impact would be located within this densely-spaced grid. 100 meters spacing was used within 5 kilometers of the fenceline, 250 meters spacing was used to 6 kilometers from the fenceline, and a 500 meters spacing was used to 9 kilometers from the fenceline, 1000 meters spacing was used to 13 kilometers from the fenceline. Beyond 13 kilometers, a 5,000 meters spacing was used to 25 kilometers distant. Figure 3 shows the location of the facility as well as the receptor grid used. For clarity, receptors beyond 13 kilometers are not shown.

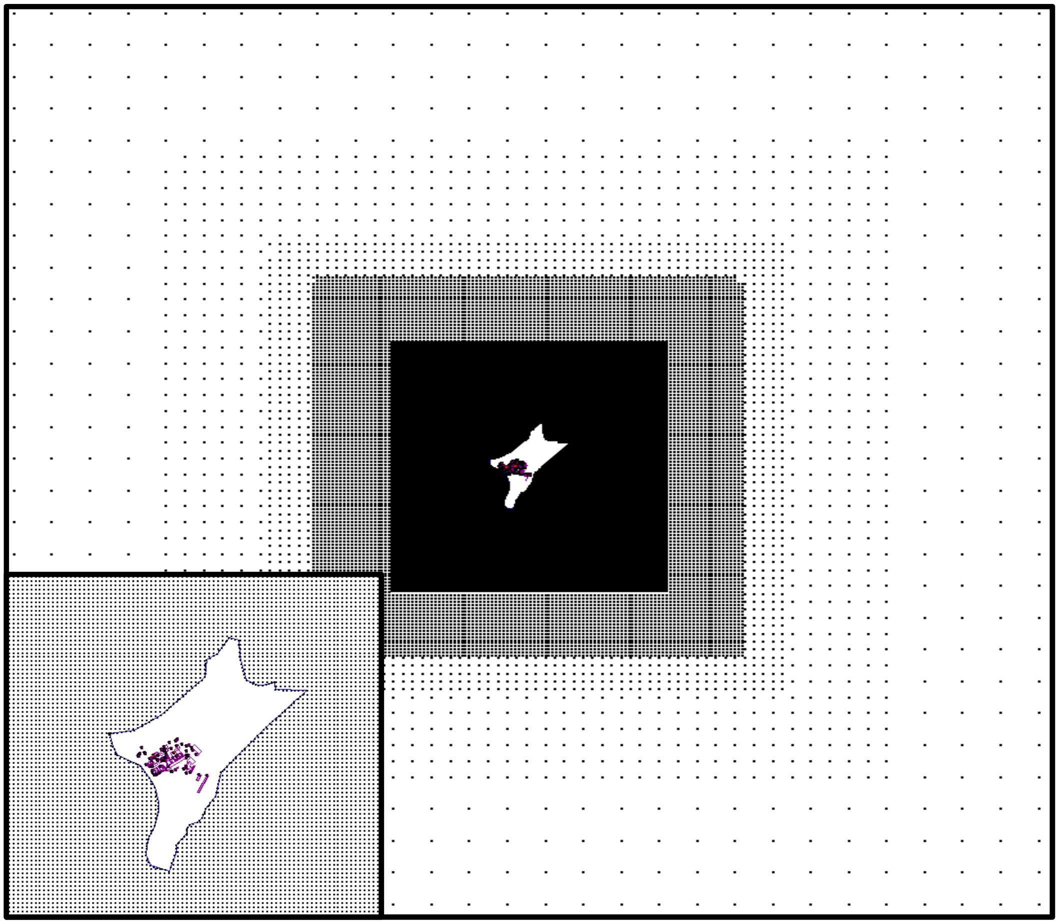

Figure 3: W.H. Conesville Power Plant facility and receptor grid. Dense grid and fenceline grid, inset.

<u>Results</u>

The dispersion modeling analysis evaluated the impact of the Conesville Power Plant facility as a design value when modeled using hourly variable SO_2 emissions. Any maximum impact exceeding 196.2 $\mu g/m^3$ would represent a modeled exceedance, inclusive the flat background. For this analysis, the maximum modeled 3-year design value, years 2013-2015 was 72.62956 $\mu g/m^3$, or 27.8 ppb. Thus, no exceedance of the standard was modeled. The results of this analysis are shown in Figure 4. Note that for clarity, only design values of 70 $\mu g/m^3$ or greater are displayed. These impacts extend approximately 3 kilometers from the egress points, with the maximum concentration occurring approximately 2.5 kilometers from the egress points. Beyond 3 kilometers, modeled design values gradually drop to near the flat background concentration as emissions from the Conesville Power Plant facility have a very minor impact.

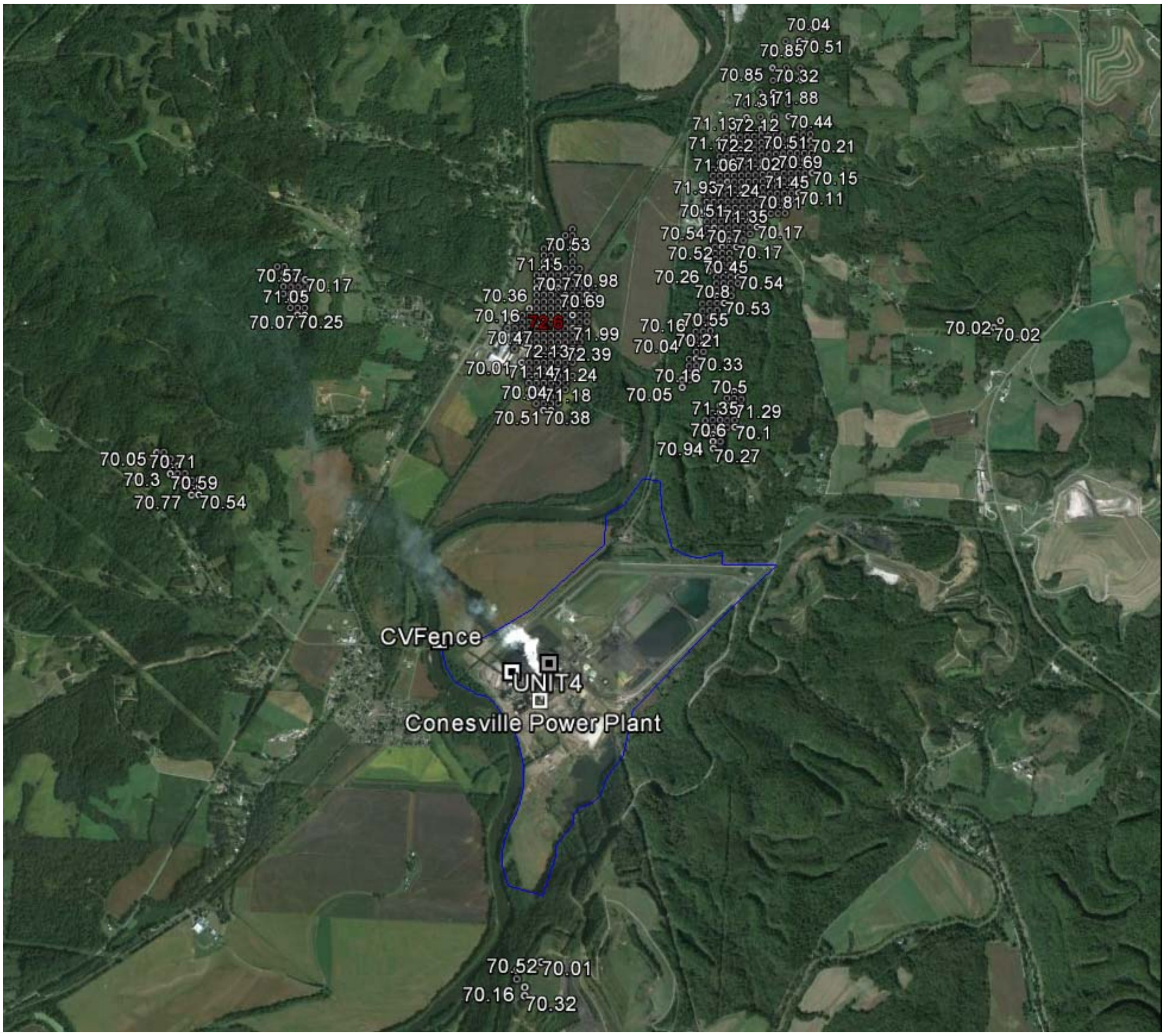

Figure 4: Maximum SO_2 impacts, Conesville Power Plant facility, 2013-2015, including background. Concentrations in $\mu g/m^3$.

The maximum modeled concentration, 72.62956 $\mu g/m^3$, or 27.8 ppb including background, was modeled approximately 2.5 kilometers to the North of the egress point at the Conesville Power Plant.

The dispersion modeling analysis for the designation of the area surrounding the Conesville facility, including a flat background demonstrates no modeled exceedances of the 2010 SO_2 standard based on the 2013-2015 period. Dispersion modeling performed with the AERMOD model accounts for multiple aspects of the five-factor analysis emphasized by U.S. EPA in designating areas. As such, Ohio EPA asserts that the modeling results presented here should carry significant weight in the designation process.