TECHNICAL SUPPORT DOCUMENT

FOR

SO_2 DESIGNATION RECOMMENDATIONS FOR ELECTRIC POWER FACILITY AREAS:

Newton Power Station, Hennepin Power Station, Marion Power Station, Joppa Steam Coal Power Plant, and Wood River Power Station

AQPSTR 15-04

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1.0 Introduction/Background

On March 2, 2015, the U.S. District Court for the Northern District of California issued a court order accepting a consent decree between the U.S. Environmental Protection Agency (U.S. EPA), Sierra Club, and Natural Resources Defense Council resolving litigation concerning the deadline for U.S. EPA to complete area designations for the 2010 1-hour SO_2 National Ambient Air Quality Standard (NAAQS). Per the court order, U.S. EPA will complete the area designations in three additional rounds: the first round by July 2, 2016, the second round by December 31, 2017, and the final round by December 31, 2020. For each round, U.S. EPA will identify additional areas as either nonattainment, unclassifiable/attainment, or unclassifiable.

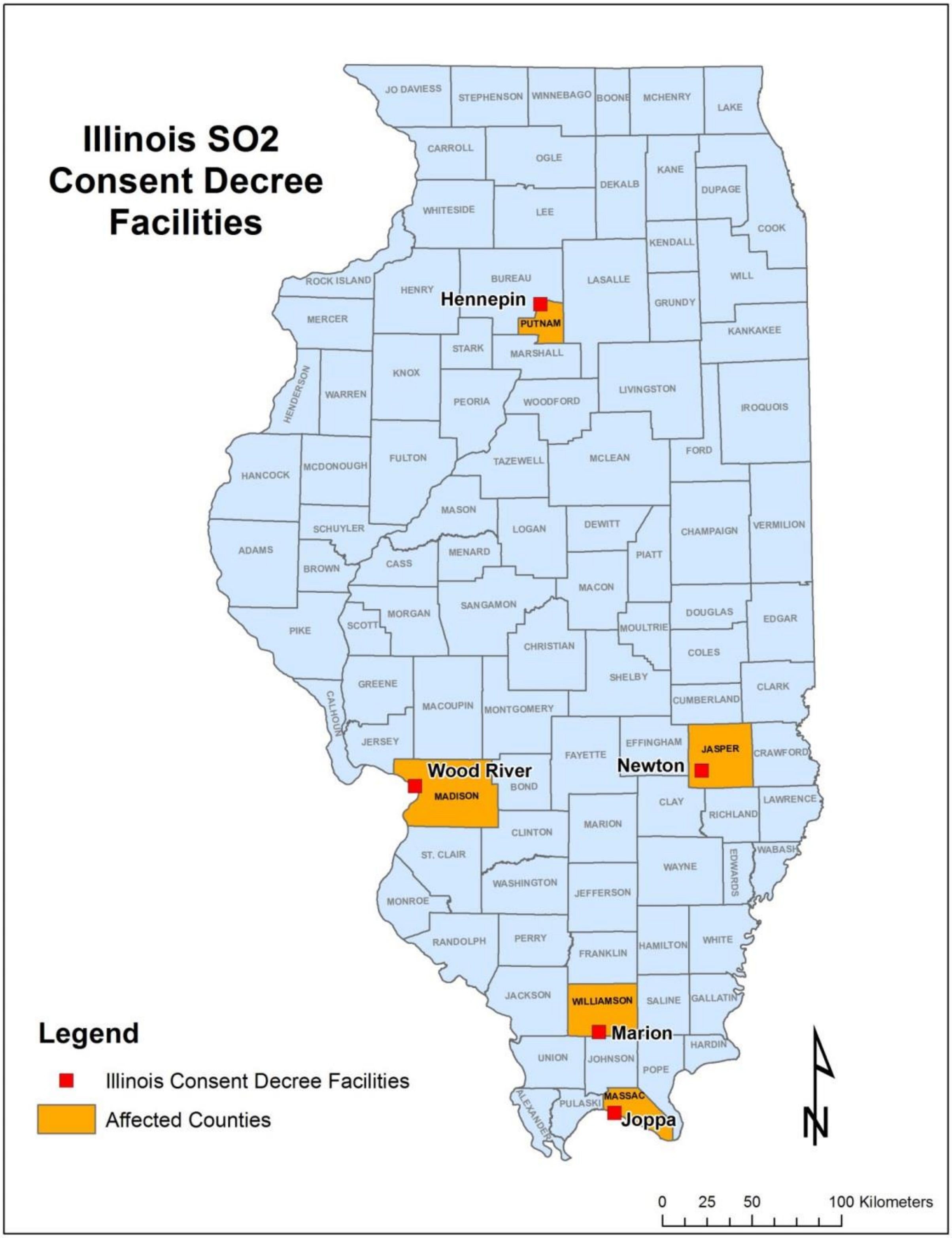
For the first round of designations, U.S. EPA will designate two groups of areas: 1) areas with newly monitored violations of the 2010 SO_2 standard, and 2) areas that contain stationary sources that according to U.S. EPA's Air Markets Database either emitted more than 16,000 tons of SO_2 in 2012 or emitted more than 2,600 tons of SO_2 and had an emission rate of 0.45 pounds of SO_2 per million BTU (lbs/mmBTU) or higher in 2012 and that had not been announced for retirement as of March 2, 2015.

U.S. EPA identified five electric generating facilities in Illinois that meet the stationary source criteria established in the court's order. These five facilities are listed in Table 1 and their locations are shown in Figure 1. This report provides Illinois' area designation recommendations for each of these five facilities, and the technical justification for those recommendations.

Table 1
Illinois Consent Decree Facilities and Reported 2012 Emissions

State	County	Facility Name	2012 SO_2 Emissions (tons)	2012 SO_2 Emissions Rate (lbs/mmBTU)
Illinois	Jasper	Newton Power Station	16,519	0.590
Illinois	Putnam	Hennepin Power Station	5,906	0.501
Illinois	Williamson	Marion Power Station	5,850	0.489
Illinois	Massac	Joppa Steam Coal Power Plant	16,991	0.475
Illinois	Madison	Wood River Power Station	6,756	0.476

Figure 1


Illinois SO2
Consent Decree
Facilities
Hennepin
PUTNAM
Wood River
MADISON
Newton
JASPER
Marion
WILLIAMSON
MASSAC
Joppa
Legend
Illinois Consent Decree Facilities
Affected Counties
N
0 25 50 100 Kilometers

1.1 Consent Decree Designation Timeline

The court order stipulates a compressed timeline for states to submit updated recommendations to U.S. EPA, and for U.S. EPA to review this information and make final area designations. This timeline is as follows:

- States submit updated recommendations based on 2012-2014 monitoring data and new actual emissions-based modeling to U.S. EPA by September 18, 2015.
- U.S. EPA notifies states of any intended modifications to their area designations (120-day letters) no later than March 2, 2016.
- U.S. EPA publishes public notice of state recommendations and the U.S. EPA's intended modifications and initiates a 30-day public comment period on or about February 3, 2016
- The 30-day public comment period ends on or about March 4, 2016.
- States must respond to any modifications proposed by U.S. EPA on or about April 8, 2016.
- U.S. EPA finalizes the first round of SO_2 area designations made under the court's order, no later than July 2, 2016.

1.2 Federal Guidance

The Illinois Environmental Protection Agency (Illinois EPA) relied on guidance provided in a memorandum issued March 20, 2015, by Stephen D. Page, Director, Office of Air Quality Planning and Standards at U.S. EPA. This memorandum replaces the original designation guidance for the 2010 SO_2 NAAQS, which was issued on March 24, 2011. In this guidance, U.S. EPA recommends that states analyze the following five factors when considering boundaries for the updated area designations: ambient air quality data or dispersion modeling, emissions and emissions-related data, meteorology, geography/topography, and jurisdictional boundaries. Due to the localized nature of SO_2 impacts, U.S. EPA considers county boundaries as the logical starting point, or presumptive boundary, for determining SO_2 nonattainment areas. However, U.S. EPA also provides states with the flexibility to designate nonattainment areas consisting of only a portion of a county when supported by an examination of the five factors and other information. When defining partial county boundaries, states are advised to use well-defined jurisdictional lines, such as geopolitical boundaries, immovable landmarks, and readily identifiable physical features.

U.S. EPA will designate areas as being nonattainment, attainment, or unclassifiable. Section 107(d)(1) of the Clean Air Act defines an area as nonattainment if it is violating the 1-hour SO_2 NAAQS or if emission sources located within the area contribute to a violation in a nearby area. For an area to be designated as attainment, it must meet the 1-hour SO_2 NAAQS and not contribute to a violation in a nearby area. Lastly, areas can be designated as unclassifiable when U.S. EPA cannot determine based on available information whether an area is or is not meeting the 1-hour SO_2 NAAQS or whether the area is contributing to a violation in a nearby area. The air quality data used to make these determinations can come from either air monitoring networks or air dispersion modeling.

Due to the short timeframe within which the first round of area designations under the court order must be completed, U.S. EPA anticipated that air dispersion modeling would be the most reliable source of information for determining designation boundaries. However, U.S. EPA expected that states would also review their latest available SO_2 monitoring data from 2012-2014. U.S. EPA intends to also consider any certified SO_2 monitoring that might be available for 2015 before the 120-day letters are sent out.

1.3 Illinois' Five-Factor Analyses and Designation Recommendations

Per the guidance issued by U.S. EPA, this report contains Illinois' updated 1-hour SO_2 air quality data for 2012-2014, along with air dispersion modeling analyses for the Newton Power Station, Hennepin Power Station, Marion Power Station, Joppa Steam Coal Power Plant, and Wood River Power Station. The air dispersion modeling for each of these facilities was conducted in accordance with the guidance provided in the December 2013 Modeling Technical Assistance Document (TAD). In order to ensure that the air dispersion modeling conducted for area designations better simulates a monitoring approach, the Modeling TAD specifically recommends the following procedures:

- Use of actual emissions as a model input for assessing violations to provide results that reflect current actual air quality.
- Use of three years of modeling results to calculate a simulated design value consistent with the approach used to calculate three-year design values for air monitoring sites for comparison to the NAAQS.
- Placement of receptors only in locations where a monitor could be located.
- Use of actual stack heights rather than adjusting stack height values based on the Good Engineering Practice stack height policy when modeling actual emissions.

The dispersion modeling simulations evaluated the emission impacts of each of the five power plants, together with the impacts of those nearby sources and background sources contributing to ambient SO_2 levels in each modeling domain. The combined modeled impacts of these sources determined whether the NAAQS would be met. On this basis, a designation recommendation was developed for each of the study areas, with the remaining four "factors" and facility-specific information ultimately contributing to a final recommendation and boundary determination.

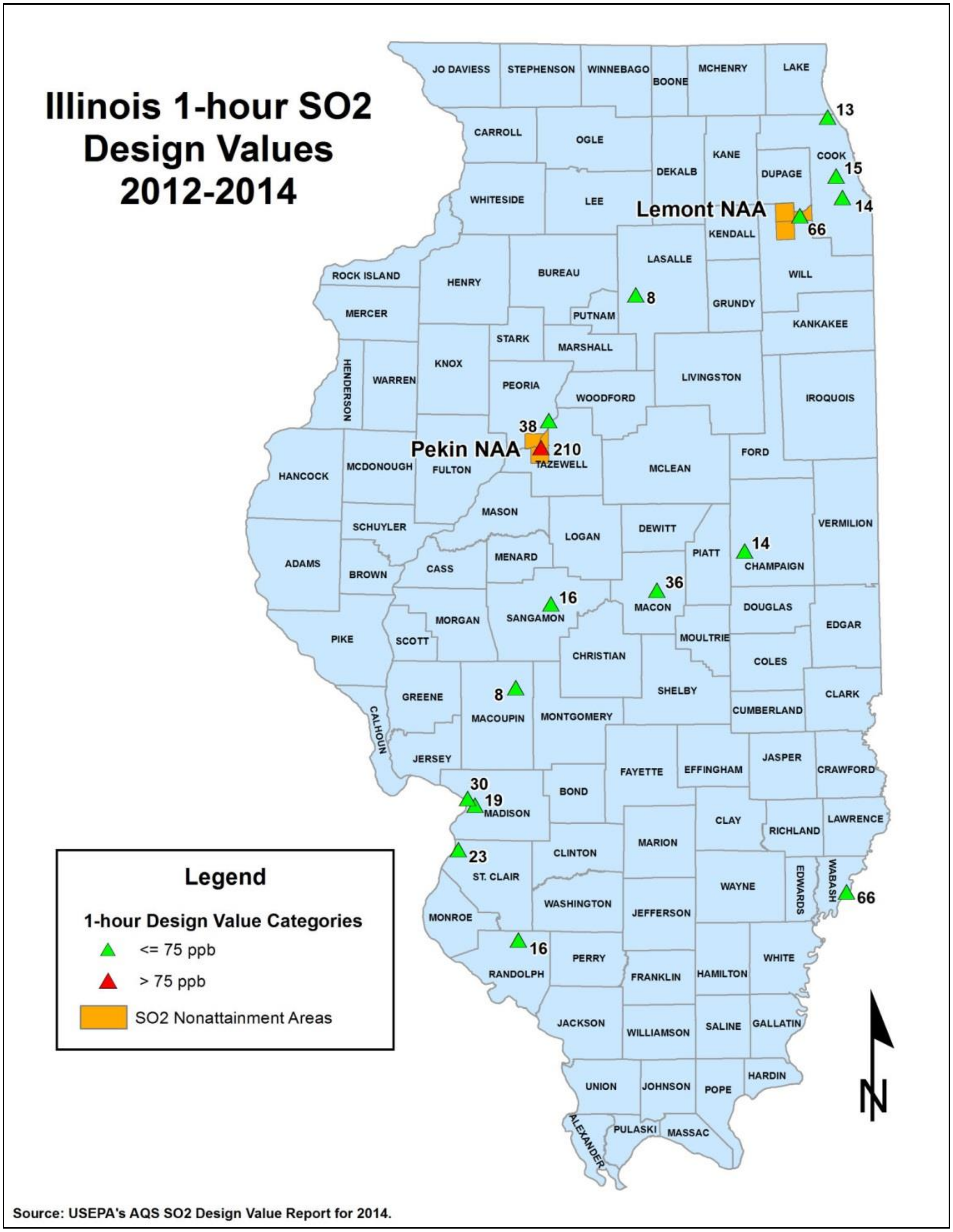
2.0 Illinois SO_2 Monitoring Data Update

Pursuant to the Consent Decree court order, U.S. EPA will first review the latest available air quality data to determine if any new areas of the country have monitored violations of the 2010 1-hour SO_2 standard. Table 2 shows the most recent three consecutive years of quality assured air monitoring data in Illinois for 2012 through 2014, along with the resulting design values. The design value is defined as the three-year average of the annual 99th percentile daily maximum 1-hour SO_2 concentrations collected at each monitor (which is generally the fourth highest daily maximum 1-hour concentration, averaged over three consecutive years). Since Illinois EPA's original SO_2 area designations were submitted to U.S. EPA in 2011, based on 2008-2010 air quality data, there has been a significant improvement in air quality statewide. At the end of 2010, four monitors were violating the 2010 1-hour SO_2 standard. By the end of 2014, there was only one monitor violating the 2010 1-hour SO_2 standard. This last violating monitor is located in the Pekin SO_2 Nonattainment Area in Tazewell County (see Figure 2) and is currently being addressed through a rulemaking proposed by the Illinois EPA. Therefore, based on the latest available 2012-2014 air quality data, there are no new areas in the State of Illinois with monitored violations of the 2010 1-hour SO_2 standard.

Table 2
Illinois 2012-2014 1-Hour SO_2 Design Values (ppb)

AQS Code	County	Site	Annual 99th Percentiles			Design Value
			2012	2013	2014	
170191001	Champaign	Bondville	14	14	15	14
170310076	Cook	Chicago - Com Ed	17	10	15	14
170311601	Cook	Lemont	108	73	16	66
170314201	Cook	Northbrook	17	10	12	13
170990007	La Salle	Oglesby	6	9	10	8
171150013	Macon	Decatur	38	33	38	36
171170002	Macoupin	Nilwood	8	7	10	8
171191010	Madison	South Roxana	17	23	18	19
171193007	Madison	Wood River WTP	30	29	30	30
171430024	Peoria	Peoria	44	32	38	38
171570001	Randolph	Houston	24	11	12	16
171630010	St. Clair	East St. Louis	24	19	25	23
171670006	Sangamon	Springfield	15	12	21	16
171790004	**Tazewell**	**Pekin**	**245**	**195**	**190**	**210**
171850001	Wabash	Mount Carmel	89	55	53	66

Figure 2


Illinois 1-hour SO2
Design Values
2012-2014
JO DAVIESS
STEPHENSON
WINNEBAGO
BOONE
MCHENRY
LAKE
CARROLL
OGLE
KANE
COOK
DEKALB
DUPAGE
WHITESIDE
LEE
Lemont NAA
KENDALL
LASALLE
WILL
ROCK ISLAND
HENRY
BUREAU
GRUNDY
MERCER
PUTNAM
KANKAKEE
STARK
MARSHALL
KNOX
HENDERSON
WARREN
PEORIA
LIVINGSTON
WOODFORD
IROQUOIS
Pekin NAA
TAZEWELL
FORD
HANCOCK
MCDONOUGH
FULTON
MCLEAN
MASON
SCHUYLER
LOGAN
DEWITT
VERMILION
ADAMS
BROWN
CASS
MENARD
PIATT
CHAMPAIGN
SANGAMON
MACON
DOUGLAS
PIKE
SCOTT
MORGAN
MOULTRIE
EDGAR
CHRISTIAN
COLES
SHELBY
CLARK
GREENE
MACOUPIN
MONTGOMERY
CUMBERLAND
CALHOUN
JERSEY
FAYETTE
EFFINGHAM
JASPER
CRAWFORD
BOND
MADISON
CLAY
RICHLAND
LAWRENCE
MARION
CLINTON
ST. CLAIR
WAYNE
EDWARDS
WABASH
WASHINGTON
MONROE
JEFFERSON
RANDOLPH
PERRY
FRANKLIN
HAMILTON
WHITE
JACKSON
WILLIAMSON
SALINE
GALLATIN
UNION
JOHNSON
POPE
HARDIN
ALEXANDER
PULASKI
MASSAC
13
15
14
66
8
38
210
14
36
16
8
30
19
23
66
16
Legend
1-hour Design Value Categories
<= 75 ppb
> 75 ppb
SO2 Nonattainment Areas
N
Source: USEPA's AQS SO2 Design Value Report for 2014.

3.0 Illinois Modeling Analyses

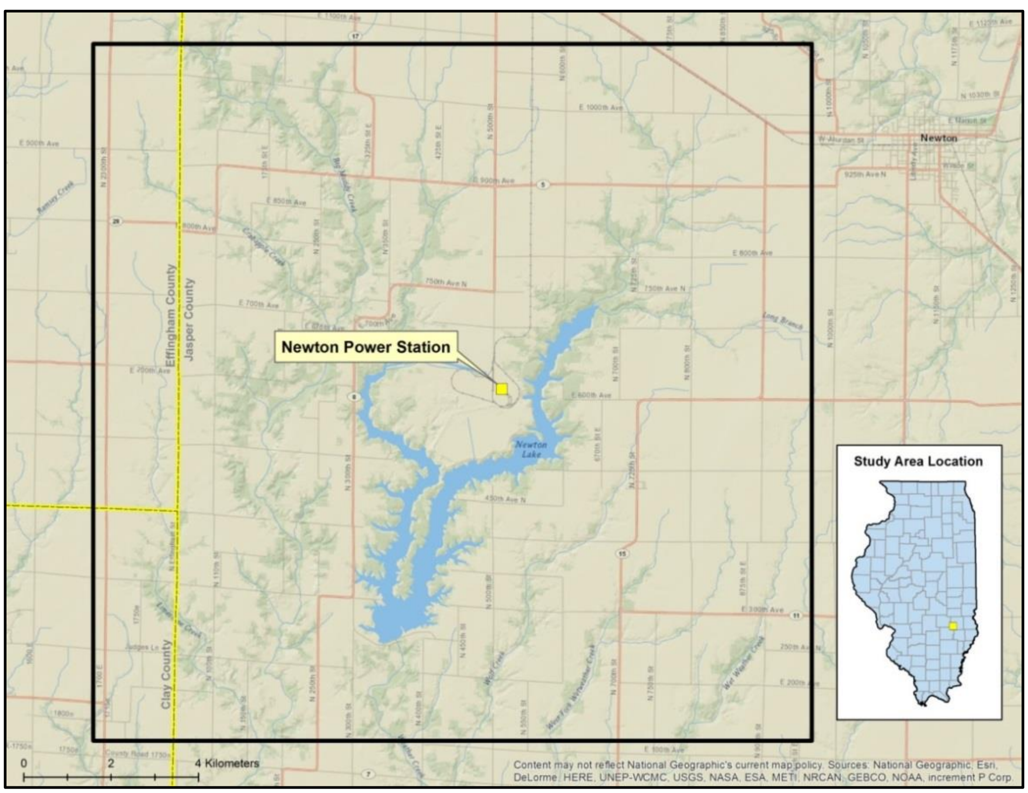
3.1 Newton Power Station (Jasper County)

The Newton area contains a stationary source that satisfies both of the conditions (only one or the other required to qualify) of the March 2, 2015, Consent Decree between U.S. EPA, Sierra Club, and the NRDC. Newton Power Station emitted greater than 16,000 tons (16,519) tons per year of SO_2 in 2012 and it also had an emission rate that exceeds 0.45 lbs/mmBtu (0.590) in 2012.

3.1.1 Study Area

The Newton Power Station (Illinois Power Generating Company), located in southeastern Illinois in the southwestern portion of Jasper County, is one of the five plants subject to the March 2015 SO_2 Consent Decree. It is approximately seven miles southwest of the city of Newton in a rural area bounded on the east and south by Newton Lake (see Figure 3). For the air quality impact analysis, the determination of the extent of the study area (i.e., receptor grid) is based primarily on three key considerations. First, the location of the SO_2 emission sources/facilities considered for modeling; second, the extent of significant concentration gradients of nearby sources; and third, sufficient receptor coverage and density to adequately capture and resolve model predicted maximum SO_2 concentrations.

Figure 3 Newton Study Area (Jasper County)



3.1.2 Model Setup and Execution

Beginning in 2005, the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) has been U.S. EPA's preferred model for near-field (out to 50 km) dispersion modeling applications in the United States. The AERMOD model itself is one part of a modeling system that includes companion pre-processing programs that prepare other inputs into the model. The model is capable of evaluating air quality impacts for averaging times that vary from 1-hour to a year and from multiple emissions sources and types, while also incorporating the influences of complex terrain, varying land use, and meteorology. The model is designed to account for planetary boundary layer turbulence structure and to effectively handle scaling concepts. Plume downwash induced by structures is also addressed in the model via the BPIP-PRIME algorithm.

3.1.2.1 Model Settings

For the Newton Study Area, as with all of the study areas, the AERMOD dispersion model was run exclusively in the regulatory default mode.. The AERMOD modeling system includes the following programs, with the latest publicly available versions indicated in parentheses:

- AERMOD (15181)
- BPIP-PRIME (04274)
- AERMET (15181), AERMINUTE (14337)
- AERMAP (11103)
- AERSURFACE (13016)

This software is downloadable from U.S. EPA's Transfer Technology Network (TTN) website.

3.1.2.2 Auer's Analysis

An important first step in establishing the model settings for the Newton Study Area was determining if the sources within the study area are located within a rural or urban dispersion regime. Generally, urban areas cause higher rates of dispersion because of increased turbulence and buoyancy caused by higher surface roughness (tall buildings) and enhanced thermal buoyancy from urban heat island effects. U. S. EPA guidance allows the use of the Auer's land use scheme within three kilometers of a source to determine the predominant dispersion regime. Essentially, if the percentage of land use types that are characteristic of an urban environment, such as light to heavy industrial, compact residential-single family or multi-family etc., is equal to or greater than 50% of the area within the three-kilometer radius circle, then the area should be classified (and modeled) as urban. If otherwise, the model can be run in rural mode. Recent versions of AERMOD do allow some flexibility to mix and match sources as rural or urban instead of an either/or approach, as select subsets of sources can be flagged to be run with the AERMOD URBANOPT option on, while leaving other sources in Rural mode.

The three-kilometer ring for the Newton Study Area is centered on the main stack at the Newton Power Station. The data source for land cover is the 2011 National Land Cover Database (NLCD), with a data cell size (raster) of 30 meters by 30 meters. The results of the Auer's analysis for the Newton Study Area are presented in Figure 4 and Table 3.

Figure 4
Auer's Analysis - Newton Study Area

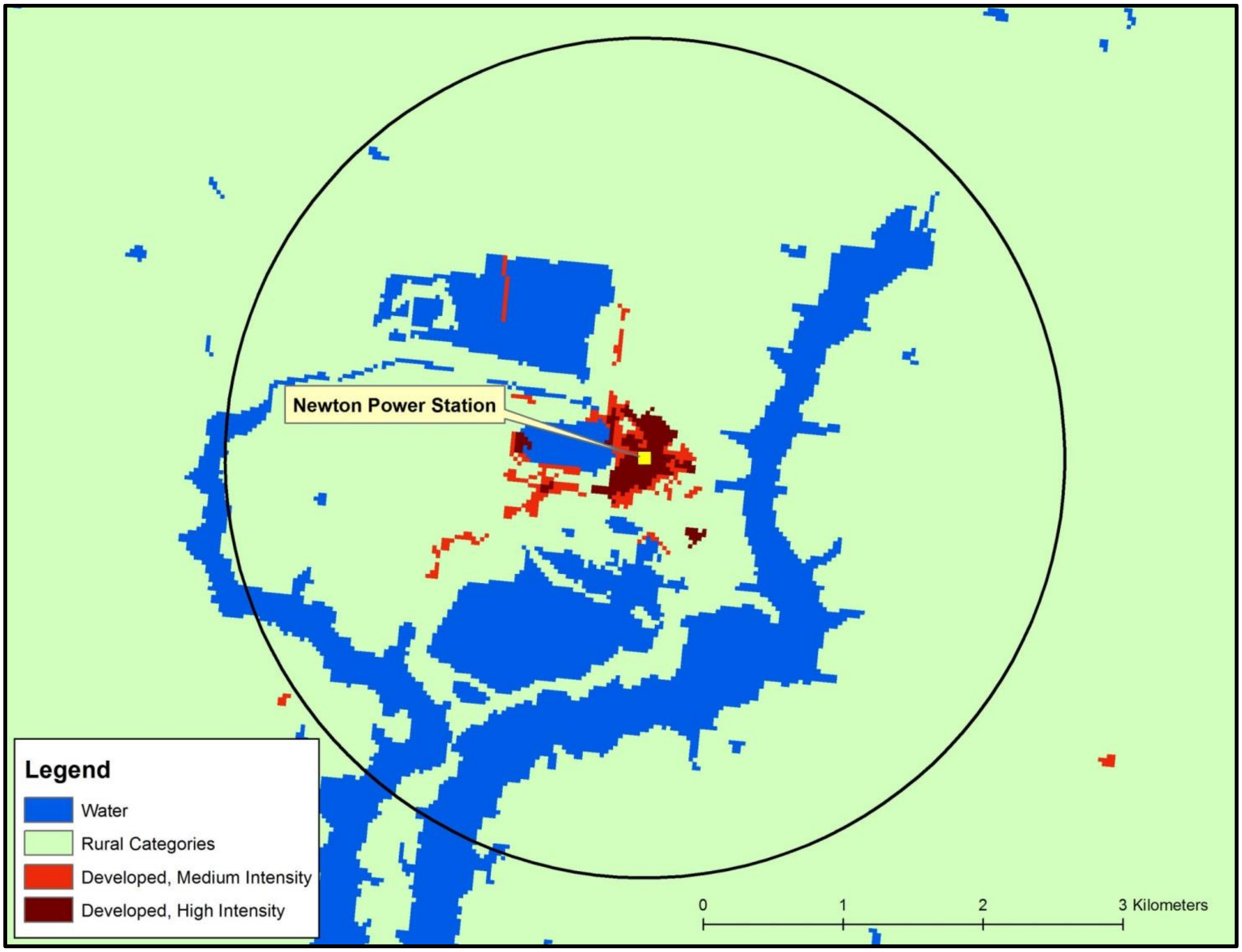


Table 3
Auer's Analysis Land Use Percentages by Category - Newton Study Area

Newton Study Area Auer's Analysis				Newton 3 km Ring		
NLCD Value	**NLCD 2011 Description**	**Auer's Code**	**Auer's Class**	**Cell Count**	**Percentage**	**Totals**
23	Developed, Medium Intensity	R2/R3	**Urban**	306	0.97%	**1.78%**
24	Developed, High Intensity	I1/I2/C1		253	0.81%	
11	Open Water	A5	**Rural**	6,370	20.29%	**98.22%**
21	Developed, Open Space	A1/R4		1,024	3.26%	
22	Developed, Low Intensity	R1		390	1.24%	
31	Barren Land (Rock/Sand/Clay)	A3		157	0.50%	
41	Deciduous Forest	A4		8,345	26.58%	
42	Evergreen Forest	A4		0	0.00%	
43	Mixed Forest	A4		0	0.00%	
52	Shrub/Scrub	A4		6	0.02%	
71	Grassland/Herbaceous	A3		1,001	3.19%	
81	Pasture/Hay	A3		2,546	8.11%	
82	Cultivated Crops	A2		10,997	35.03%	
90	Wood Wetlands	A4		0	0.00%	
95	Emergent Herbaceous Wetlands	A3		2	0.01%	
Analysis based on 30 meter by 30 meter raster cells extracted for each area.			***Total***	***31,397***	***100.00%***	***100.00%***

The Auer's analysis indicates the study area is approximately 98.2% rural and 1.8% urban; therefore the rural option applies to all emissions sources in the modeling domain.

3.1.2.3 Emissions

U. S. EPA guidance for developing designation recommendations based upon modeling specifies the use of actual emissions (as opposed to allowable) as input to produce results that reflect the existing air quality in a study area. U.S. EPA recommends using the most recent three years of actual emissions since they would best represent the emissions that would simulate the impacts of a three-year monitoring dataset for determining compliance with the NAAQS. In this application, actual emissions were used from the years 2012-2014.

In using actual emissions, U. S. EPA suggests that the best achievable characterization of the three-year hourly emissions profile be developed from continuous emissions monitoring systems (CEMS) data or from other means as described in the SO_2 NAAQS Designations Modeling TAD. If CEMS data are not available, then detailed throughput, operating schedules, and exhaust information is a next best option to create temporally varying emission profiles. AERMOD is equipped with two keyword functions, HOUREMIS and EMISFACT, which allow flexibility in terms of modeling variable emissions, depending on the depth of data on-hand. The HOUREMIS function allows the incorporation of hourly varying emissions, stack exit temperatures, and stack exit velocities into a single model-ready file. The keyword function EMISFACT can be used alone if there is insufficient information to determine hourly emissions, but enough information to approximate somewhat longer timeframe characterizations. EMISFACT allows the model to multiply a constant emissions rate by an emissions factor which can vary in a way that provides for a reasonable profile of seasonal, daily, day of week, and even hour of day characterization of emissions.

Determining which sources to model in the Newton Study Area included compiling a list of SO_2 sources within a ten-kilometer radius of the Newton Power Station from the Illinois EPA statewide inventory database, and also evaluating the potential for sources beyond 10 km to cause a significant concentration gradient within the Newton Study Area. The Newton Power Station is the only SO_2 source within the ten-kilometer study area, and there are no sources beyond ten kilometers that Illinois EPA considers to have the potential to cause significant gradient impacts within the study area. Actual emissions for the years 2012-2014 are provided in Table 4.

Table 4 Modeled Facility Actual Emissions - Newton Study Area

Company I.D.	Facility Name	SO_2 Emissions (tons per year)		
		2012	**2013**	**2014**
079808AAA	Newton Power Station	16,533.83	16,144.5	16,372.76
Total Emissions	**All Facilities**	**16,533.83**	**16,144.5**	**16,372.76**

Hourly varying 2012-2014 CEMS data, coupled with hourly-specific exit temperatures and exit velocities, were provided by Illinois Power Generating Company for use in the dispersion modeling. See Appendix A for the full emissions inventory and stack parameters, including the substitution methods employed for addressing missing or erroneous data fields. For the Newton Study Area, the HOUREMIS factor was applied to the two point sources modeled. The EMISFACT keyword was not deemed necessary for representing this facility's emissions. The hourly emissions file is included with this submittal and can be found on the DVD representing Appendix C.

3.1.2.4 Meteorology

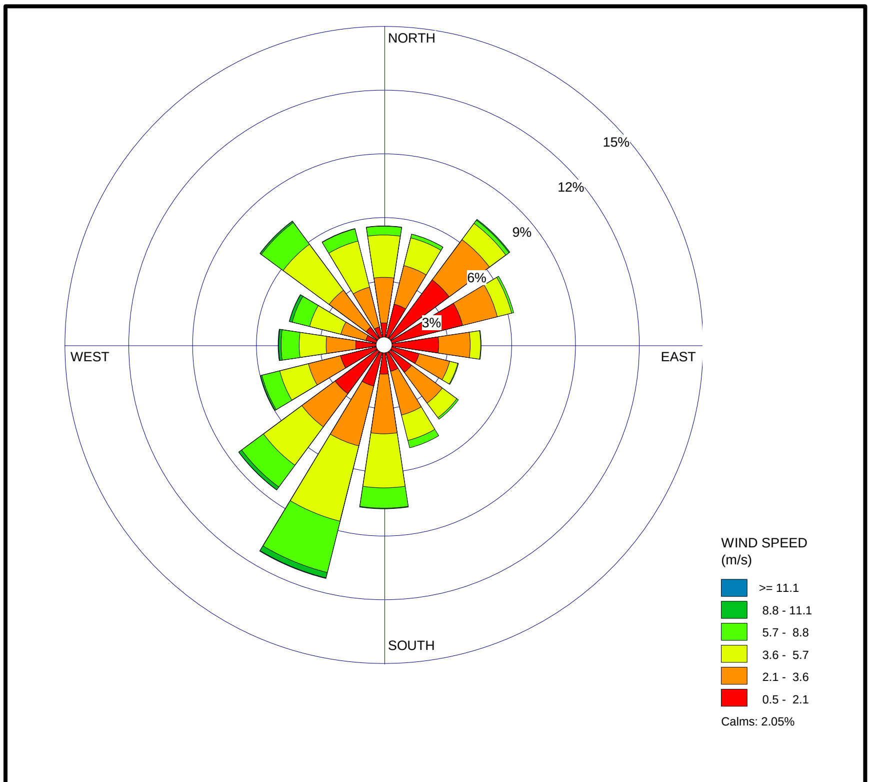
The SO_2 TAD recommends using the three most recent years of meteorology for modeling applicable to the SO_2 area designations process. In this case, data for meteorological years 2012-2014 were available. This time period aligns with the three years of hourly emissions data input into the model. This temporal linking of emissions and meteorology in the model provides the best approximation of the real-world impacts which would occur during that time should a monitor have been present.

The selection of a representative meteorological station for each of the study areas was based on proximity, similarity of terrain/surface roughness, and climatological consistency. Central Illinois and central Indiana share similar topography, climate, and land use. For the Newton Study Area, National Climatic Data Center National Weather Service (NWS) surface meteorology from Evansville, Indiana

(WBAN No. 93817, 123 km to the southeast), and coincident upper air observations from Lincoln, Illinois (WBAN No. 04833, 164 km to the northwest), were selected as best representative of meteorological conditions within the study area (EVV/ILX).

The three-year surface wind rose for Evansville, Indiana, is depicted in Figure 5. The frequency and magnitude of wind speed and direction are defined in terms of where the wind is blowing from, parsed out in twelve 30-degree wind sectors. The predominant wind direction during the three-year time period represented in the modeling is from the southwest, occurring approximately 11.3% of the time. The highest percentage wind speed range, occurring 25.3% of the time, was in the 3.6 – 5.7 m/s range.

Figure 5
Evansville, Indiana, Cumulative Annual Wind Rose
2012-2014



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Direction Wind is blowing from.	**Start Date: 1/1/2012 - 00:00** **End Date: 12/31/2014 - 23:00**	MODELER:	
	CALM WINDS: **2.05%**	TOTAL COUNT: **26201 hrs.**	
	AVG. WIND SPEED: **3.23 m/s**	DATE: **8/31/2015**	PROJECT NO.:

Meteorological data from the above surface and upper air stations were used in generating AERMOD-ready files with the AERMET processor, a part of the AERMOD software suite. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs.

The methodology and settings performed in the processing of the raw meteorological data into AERMOD-ready format followed the guidelines set forth in the draft guidance, Regional Meteorological Data Processing Protocol, U.S. EPA Region 5 and States (February 1, 2013). Surface characteristics such as Albedo, Bowen Ratio, and Surface Roughness (Zo) were developed using AERSURFACE, an AERMET companion preprocessor.

The surface meteorological wind field data is input to AERMET from two separate sources. Hourly surface meteorological data records are read by AERMET and include all the necessary elements for meteorological 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 compared to more stable meteorological data categories not prone to wide ranging changes. Indeed, wind data that portrays calm conditions for the hour is not usable for modeling proposes and must be passed over by AERMOD when modeling is being performed. In order to better represent actual wind conditions at the meteorological tower, wind data of one minute duration was provided from the same instrument tower, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE. This data is subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that approach actual conditions and reduce the frequency of reported calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce more concentration data output. As a guard against excessively high concentrations that could be produced in very light wind conditions, Illinois EPA set a minimum threshold of 0.5 m/s 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 one minute wind data.

The AERMOD-ready ".sfc" and ".pfl" meteorological data files are included in this submittal via the DVD representing Appendix C.

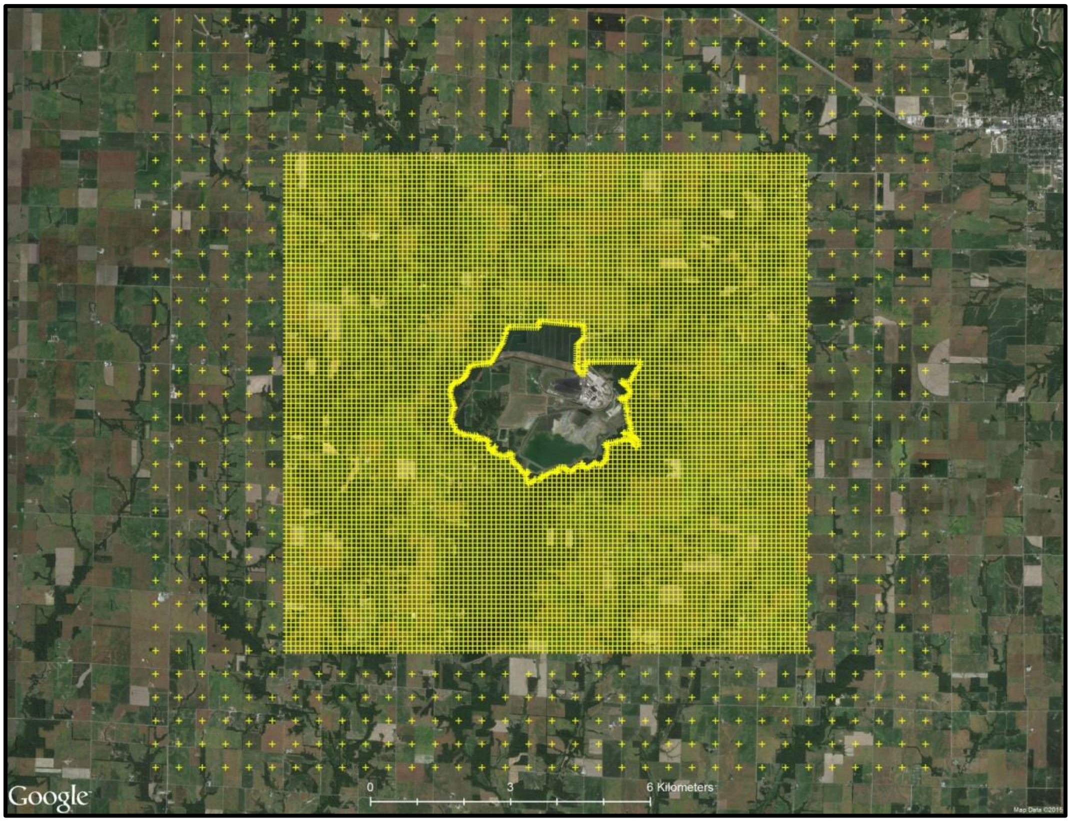
3.1.2.5 Receptor Network/Terrain

The receptor grid for Newton was designed to be of sufficient density and size to capture all relevant concentration gradients from modeled sources and to adequately resolve the maximum predicted SO_2 design value concentration. In the case of the Newton Study Area, the Newton Power Station was the only source modeled. Thus, the receptor grid includes fine to coarse spacing in a Cartesian grid network extending outward in all directions from the facility fenceline. Receptor spacing was approximately:

- 50 meters along the fenceline
- 100 meters from the fenceline out to 5.0 kilometers
- 500 meters from 5.0 kilometers out to 8.0 kilometers

The Newton Study Area receptor grid is presented in Figure 6. A total of 12,165 receptors comprised the network, covering the southwestern section of Jasper County and small portions of Effingham and Clay counties. The terrain in the study area is best described as flat to gently rolling. To account for terrain changes, the AERMAP terrain program was used to specify terrain elevations and hill scale height for all the receptors. The source of the elevation data incorporated into the model is from the USGS National Elevation Database (NED).

Figure 6 Receptor Grid – Newton Study Area



3.1.2.6 Background SO_2

The regional SO_2 sources not explicitly modeled in AERMOD were characterized as background contributors to SO_2 in the study area and represented via background monitoring data. U.S. EPA recommends inclusion into the model data from the nearest representative background SO_2 monitor operated by federal, state, local, or tribal organizations. The Nilwood, Illinois, monitor was selected for the Newton study area. The Nilwood monitor is located approximately 142 kilometers northwest of the study area in rural Macoupin County. The monitor, operated and maintained by Illinois EPA, has hourly SO_2 concentrations which have been validated for the three years modeled in this analysis (2012-2014).

For this modeling application, Illinois EPA incorporated temporally-varying background 1-hour concentrations developed from the Nilwood, Illinois, monitor. The values developed for input into AERMOD are based on the 99th percentile monitored concentrations and vary by season and hour. The seasons are characterized as: Winter (Dec-Jan-Feb), Spring (Mar-Apr-May), Summer (Jun-Jul-Aug), and Fall (Sep-Oct-Nov). The second highest value for each hour of the day (24 values) by season was averaged for the years 2012-2014 to derive 96 distinct 1-hour SO_2 background concentration values, in total for the four seasons. The latest version of AERMOD allows inclusion of these hourly varying background values directly into the AERMOD runstream file via the SEASONHR keyword. For model results reported here, the maximum impacts *include* the contribution from background SO_2 in the modeled design value. A table of the background SO_2 hourly varying values by season is provided in Appendix B.

3.1.3 Summary of Results

The AERMOD simulation for the Newton Study Area included two stacks, nine structures, one fenceline, and 12,165 receptors. The model simulated the years 2012-2014, combining emissions, meteorology, terrain, and background SO_2 levels into the model to calculate a maximum 99th percentile 1-hour SO_2 concentration for each receptor in the grid. The results presented in Table 5 report the magnitude and geographic location of the highest predicted concentration.

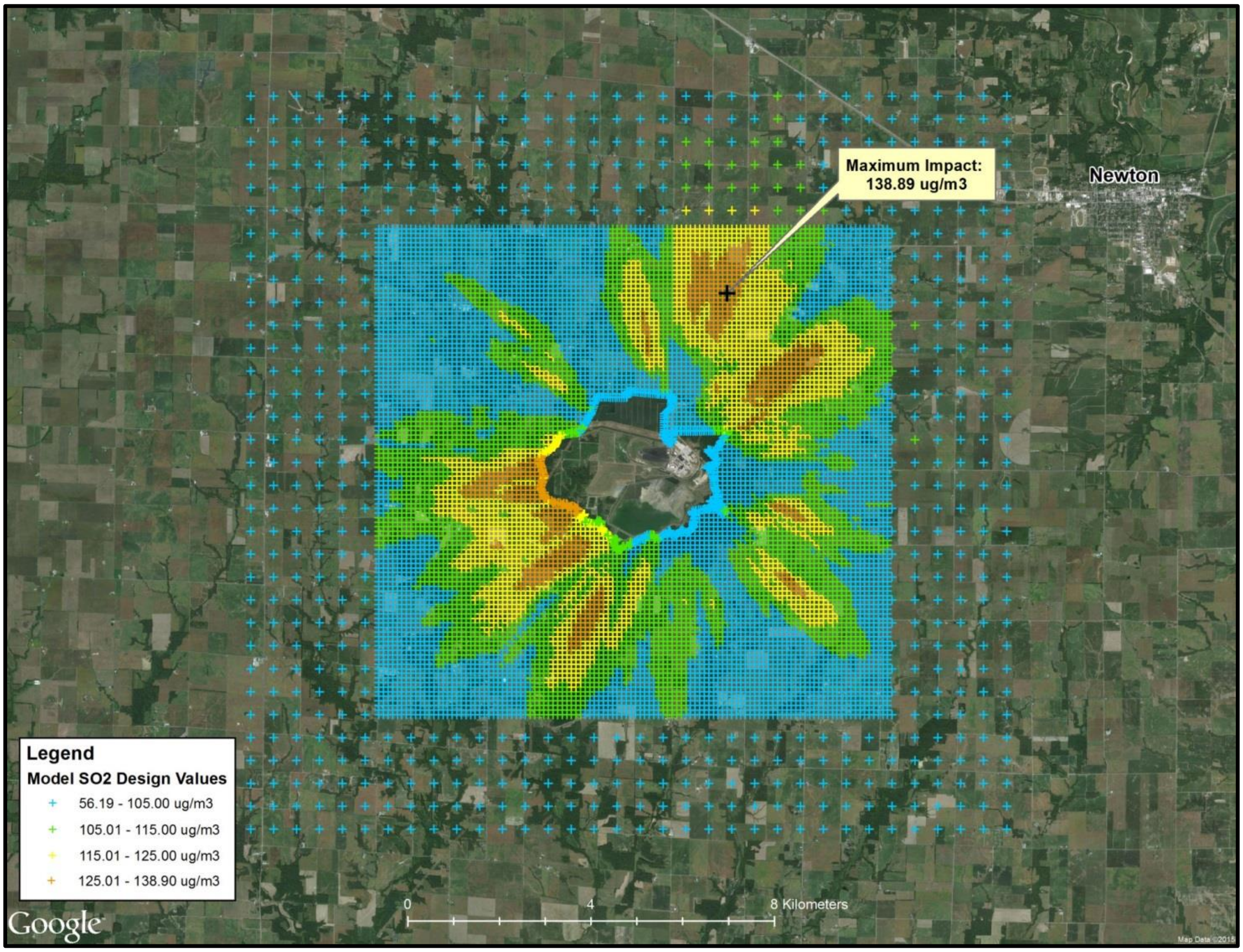
Table 5
Maximum Predicted 99th Percentile 1-Hour SO_2 Concentration
Newton Study Area

Averaging Period	Data Period	Receptor Location (Meters)		SO_2 Concentration (µg/m^3)	
		East	North	Modeled	NAAQS
99th Percentile 1-Hour Average	2012-2014	390400	4314200	**138.89**	**196.23***

* Equivalent to the 75 ppb standard

The maximum predicted 99th percentile 1-hour average concentration within the modeling domain is **138.89** µg/m3, or 53.0 ppb. The maximum occurred within the dense 100-meter grid approximately 3.85 km northeast of the Newton Power station main stack. The colored contour map of maximum 99th percentile concentrations presented in Figure 7 depicts the maximum predicted concentration for each receptor in the study area and indicates the location of the overall predicted maximum.

Figure 7
Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations - Newton Study Area



3.1.4 Designation Recommendation

Based on the modeling results, the extent of the study area, and consideration of other SO_2 sources in the multi-county area, Illinois EPA recommends that Jasper County be designated as **attainment** for the 1-hour SO_2 standard.

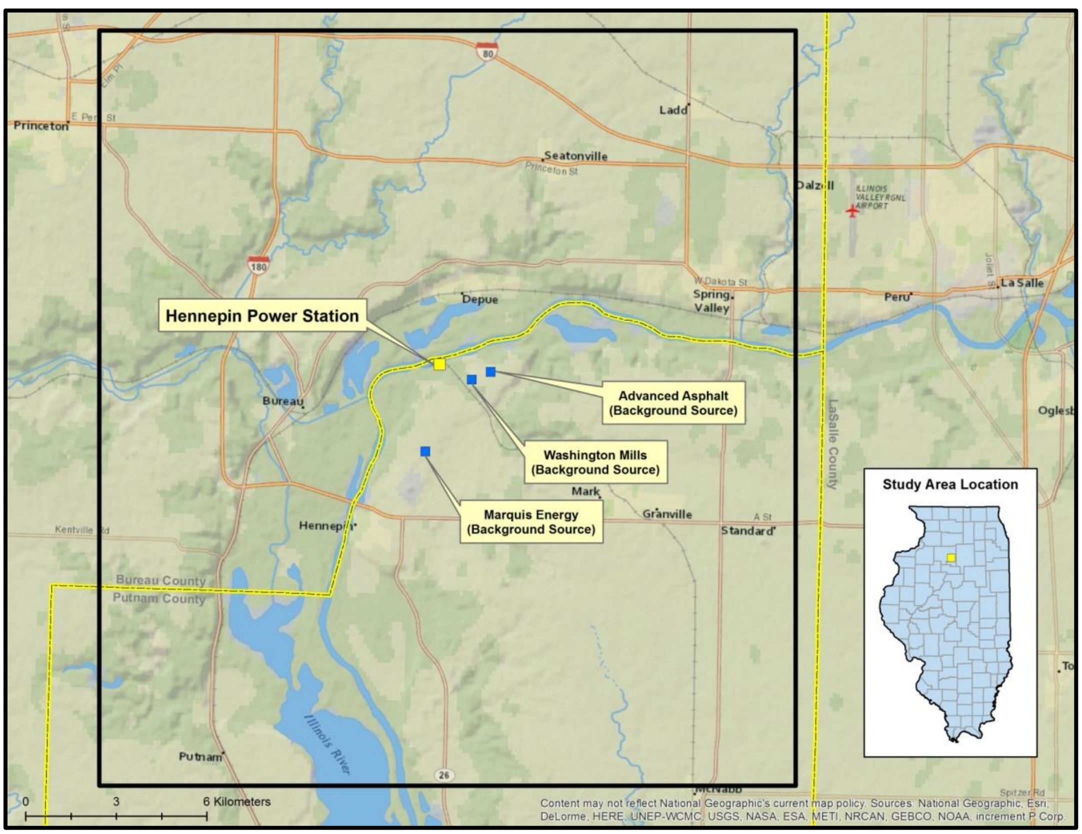
3.2 Hennepin Power Station (Putnam County)

The area near the city of Hennepin in Putnam County contains a stationary source that satisfies one of the conditions (only one or the other required to qualify) of the March 2, 2015, Consent Decree between U. S.EPA, Sierra Club, and the NRDC. A source exists that emitted less than the 16,000 tons (5,906) tons per year of SO_2 in 2012, but had an emission rate that exceeds 0.45 lbs/mmBtu (0.501) in 2012.

3.2.1 Study Area

The town of Hennepin, Illinois, is located in north-central Illinois in the northwestern portion of Putnam County. The Hennepin Power Station (Dynegy) is one of the five plants subject to the SO_2 Consent Decree. As depicted in Figure 8, the plant operates approximately 5.6 kilometers north-northeast of the town of Hennepin in a rural area bounded on the north by the Illinois River. For the air quality impact analysis, the determination of the size and extent of the study area (i.e., receptor grid) is based primarily on three key considerations: 1) the location of the SO_2 emission sources/facilities to be included in the modeling; 2) the location and extent of significant concentration gradients to be generated by SO_2 emission sources; and, 3) sufficient receptor coverage and density to adequately capture and resolve model predicted maximum SO_2 concentrations within the study area.

Figure 8 Hennepin Study Area (Putnam County)



3.2.2 Model Setup and Execution

As described in Section 3.1.2, AERMOD was used for the designation recommendation modeling. AERMOD is the dispersion modeling component of a much broader modeling system that includes multiple companion pre-processing programs that prepare other inputs into the model (BPIP-PRIME, AERMET, AERMINUTE, AERMAP, and AERSURFACE).

3.2.2.1 Model Settings

The latest version of AERMOD (version 15181) was run in the standard regulatory default mode.

3.2.2.2 Auer's Analysis

The Auer's discussion and analysis discussed in Section 3.1.1.1 was similarly applied to the Hennepin Study Area. The Auer's analysis is a methodology for determining if the sources within the study area are located within a rural or urban dispersion regime.

The three-kilometer ring applied in the Auer's analysis for the Hennepin Study Area is centered on the main stack at the Hennepin Power Station. The data source for land cover was the 2011 National Land Cover Database (NLCD), with a data cell size of 30 meters by 30 meters. The results of the Auer's analysis are presented in Figure 9 and Table 6.

Figure 9
Auer's Analysis – Hennepin Study Area

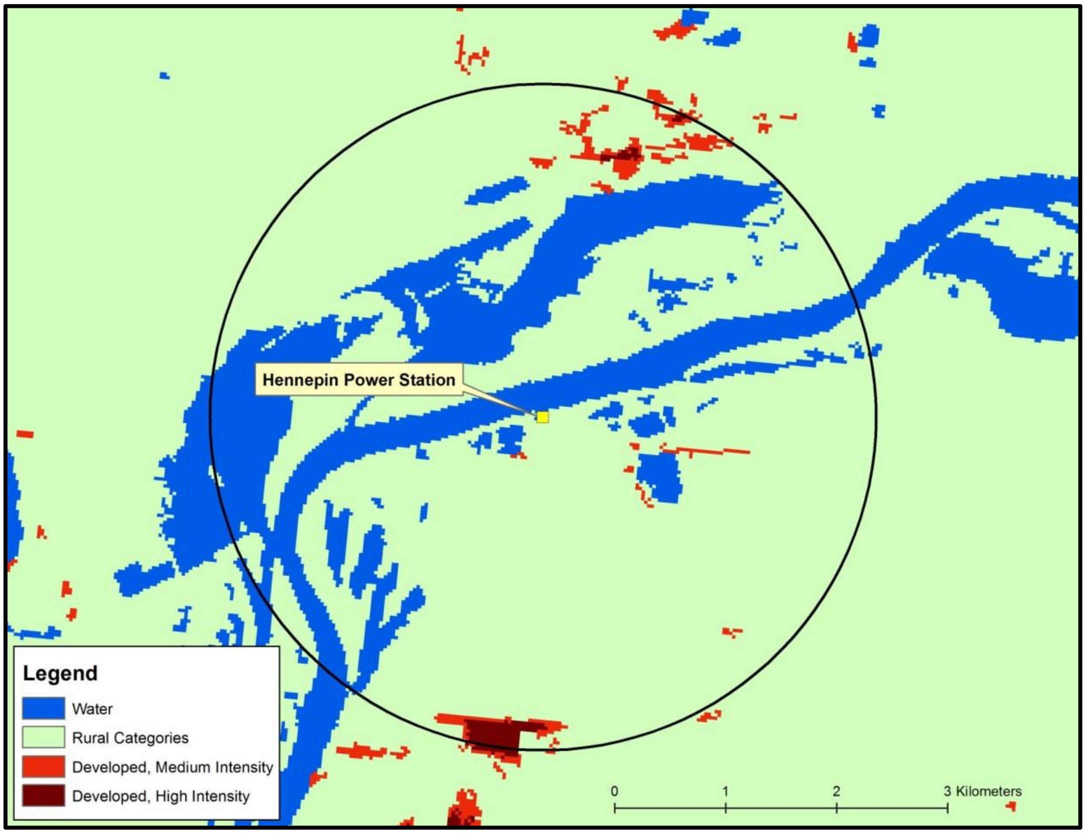


Table 6
Auer's Analysis Land Use Percentages by Category – Hennepin Study Area

SO_2 NAA Modeling Auer's Analysis - NLCD 2011				Hennepin 3 km Ring		
NLCD Value	**NLCD 2011 Description**	**Auer's Code**	**Auer's Class**	**Cell Count**	**Percentage**	**Totals**
23	Developed, Medium Intensity	R2/R3	**Urban**	417	1.33%	**1.86%**
24	Developed, High Intensity	I1/I2/C1		166	0.53%	
11	Open Water	A5	**Rural**	7,222	23.01%	**98.14%**
21	Developed, Open Space	A1/R4		738	2.35%	
22	Developed, Low Intensity	R1		1,338	4.26%	
31	Barren Land (Rock/Sand/Clay)	A3		338	1.08%	
41	Deciduous Forest	A4		4,063	12.94%	
42	Evergreen Forest	A4		0	0.00%	
43	Mixed Forest	A4		0	0.00%	
52	Shrub/Scrub	A4		48	0.15%	
71	Grassland/Herbaceous	A3		1,797	5.72%	
81	Pasture/Hay	A3		141	0.45%	
82	Cultivated Crops	A2		8,861	28.23%	
90	Wood Wetlands	A4		5,302	16.89%	
95	Emergent Herbaceous Wetlands	A3		962	3.06%	
Analysis based on 30 meter by 30 meter raster cells extracted for each area.			***Grand Totals:***	***31,393***	***100.00%***	

The Auer's analysis indicates the study area is approximately 98.1% rural and 1.9% urban; therefore the rural option was applied to all emissions sources in the modeling domain.

3.2.2.3 Emissions

U. S. EPA guidance for the modeling of emissions for designation recommendations allows for use of actual emissions as input (as opposed to allowable) into the model to produce results that reflect the current existing air quality in a study area. U.S. EPA recommends using the most recent 3 years of actual emissions since they would best represent the emissions that would simulate the impacts of a 3-year monitoring dataset for determining compliance with the NAAQS. In this application, actual emissions were used from the most recent available years (2012-2014).

The determination of sources to model in the Hennepin Study Area consisted of compiling a list from the state inventory database of SO_2 sources within a 10 km radius of the Hennepin Power Station, while also evaluating the potential for sources beyond 10 km to cause a significant concentration gradient within the area. In the case of Hennepin, four facilities were identified within this area with SO_2 emissions (refer to Figure 8). The four facilities were considered to have a potential impact in the near-field where maximum concentrations are expected. There were no sources beyond 10 km that Illinois EPA considers to have the potential to cause significant gradient impacts within the study area. The facilities and their modeled actual SO_2 tonnages for 2012-2014 are presented in Table 7.

Table 7
Modeled Facility Actual Emissions - Hennepin Study Area

Company I.D.	Facility Name	SO_2 Emissions (tons per year)		
		2012	2013	2014
155010AAA	Hennepin Power Station	5,911.25	4,274.35	3,965.36
155801AAC	Washington Mills	890.20	929.43	1,035.01
155801AAJ	Advanced Asphalt	13.63	13.62	5.46
155010AAJ	Marquis Energy	8.56	9.30	4.05
Total Emissions	**All Facilities**	**6823.64**	**5226.70**	**5009.88**

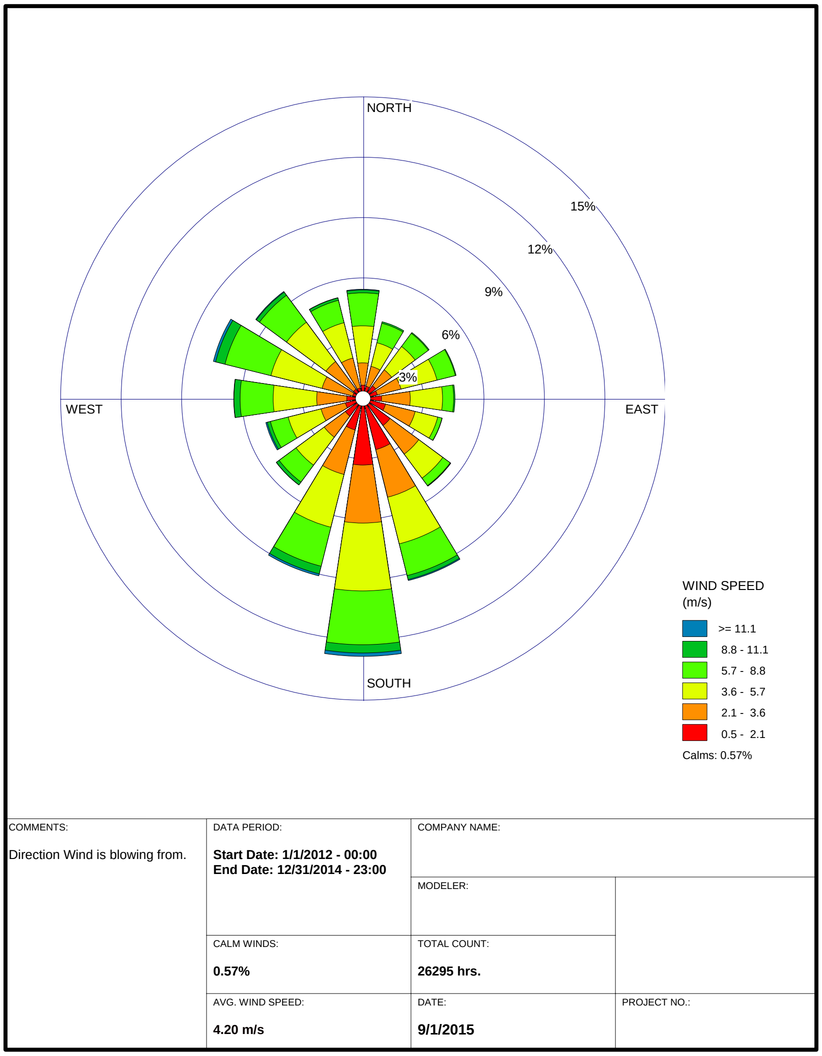
Emissions profiles for the Hennepin inventory were developed using a combination of the AERMOD keywords HOUREMIS and EMISFACT. Illinois EPA used hourly varying 2012-2014 CEMS SO_2 emissions data provided by the Hennepin Power Station together with hourly-specific exit temperatures and exit velocities. For Washington Mills, hourly varying emissions, temperatures, and exit velocities were obtained for the largest emitting furnace stack (99.9% of the facility emissions). For the two smaller emitting units, Washington Mills provided operating information that allowed Illinois EPA to construct an hourly varying emissions rate coupled with constant temperature and exit velocity values. An hourly profile was developed for Advanced Asphalt's sources based on company reported seasonal throughput. A combination of seasonal emissions factors (EMISFACT) and an hourly emissions profile was used for Marquis Energy sources. Please reference Appendix A for the full emissions inventory and stack parameters, including the substitution methods employed for addressing missing or erroneous data fields. For the Hennepin Study Area, a total of 12 point sources were modeled. The HOUREMIS factor was applied to the seven point sources modeled and EMISFACT to four sources. One source was modeled with a conservative constant hourly emission rate for the three-year period. The hourly emissions file is included in this submittal via the DVD representing Appendix C.

3.2.2.4 Meteorology

The SO_2 TAD recommends using the three most recent years of meteorology for use in the SO_2 Phase II Designation modeling. For the Hennepin Study Area, the National Climatic Data Center National Weather Service (NWS) surface meteorology from Rockford, Illinois (WBAN No. 94822, 111 km to the north), and coincident upper air observations from Davenport, Iowa (WBAN No. 94982, 110 km to the northwest), were selected as best representative of meteorological conditions within the study area.

The three-year surface wind rose for Rockford, Illinois, is depicted in Figure 10. The frequency and magnitude of wind speed and direction are defined in terms of where the wind is blowing from, parsed out in twelve 30-degree wind sectors. The predominant wind direction during the three-year time period used in the modeling is from the south, occurring approximately 12.8% of the time. The highest percentage wind speed range, occurring 31.4% of the time, was in the 3.6 – 5.7 m/s range.

Figure 10
Rockford, Illinois, Cumulative Annual Wind Rose
2012-2014



Meteorological data from the above surface and upper air stations were used in generating AERMOD-ready files with the AERMET processor, a part of the AERMOD software suite. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. The methodology and settings performed in the processing of the raw meteorological data into AERMOD-ready format followed the same procedure as in the Newton Study Area. Please refer to Section 3.1.2.4 for more details on the meteorological input procedure utilized. The Hennepin Study Area AERMOD-ready ".sfc" and ".pfl" meteorological electronic files are included in this submittal via the DVD representing Appendix C.

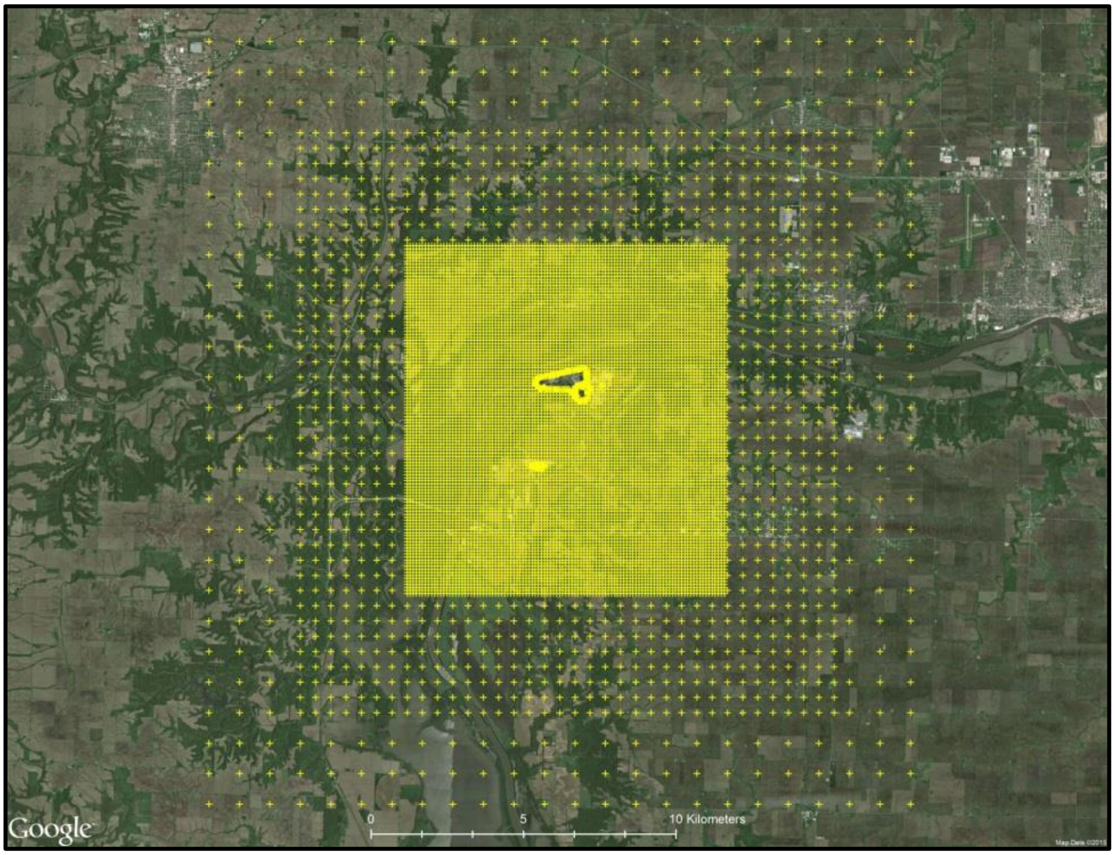
3.2.2.5 Receptor Network/Terrain

The receptor grid for Hennepin was designed to be of sufficient density and size to capture all relevant concentration gradients from modeled sources and to adequately resolve the maximum predicted SO_2 design value concentration. In the case of the Hennepin Study Area, three of the four facilities (Hennepin Power Station/Washington Mills/Advance Asphalt) are located nearly adjacent to one another along the Illinois River. The fourth facility, Marquis Energy, is located roughly three kilometers to the south-southwest of the other facilities. Therefore, to ensure adequate capture of predicted maximums the receptor grid's dense 100-meter spacing was extended outward from each fenceline to a distance of at least 3 kilometers from each facility. The study area receptor spacing was approximately:

- 50 meters along the fenceline (four facilities)
- 100 meters from the fenceline out to a distance of approximately 4.0 kilometers
- 500 meters from 4.0 kilometers out to a distance of approximately 8.0 kilometers
- 1,000 meters from 8.0 kilometers out to a distance of approximately 11 kilometers

The Hennepin Study Area receptor grid is presented in Figure 11. The receptor network, consisting of 13,430 receptors, covers the northern two-thirds of Putnam County and the southeast portion of Bureau County. The study area terrain is best characterized as flat to gently rolling. To account for terrain changes, the AERMAP terrain program was used to generate terrain elevations and hill height scales for all the receptors. The source of the elevation data incorporated into the model is from the USGS National Elevation Database (NED).

Figure 11
Receptor Grid – Hennepin Study Area



3.2.2.6 Background SO_2

The regional sources not explicitly modeled in AERMOD, but best characterized as background contributors to SO_2 near or in the study area, are addressed via background monitoring data. U.S. EPA recommends inclusion into the model data from the nearest representative background SO_2 monitor operated by state, local, or tribal organizations. The Oglesby, Illinois, monitor was selected for the Hennepin study area. The Oglesby monitor is located approximately 23 km east of the study area in western LaSalle County in the town of Oglesby. The monitor, operated and maintained by Illinois EPA, has validated hourly SO_2 concentrations for the three years modeled in this analysis (2012-2014).

For this modeling application, Illinois EPA employed temporally-varying background 1-hour concentrations developed from the Oglesby, Illinois, monitor. The values developed for input into AERMOD for background SO_2 are based on the 99^{th} percentile monitored concentrations vary by season and hour in the same method as described in the previously discussed study area. The seasons are characterized as: Winter (Dec-Jan-Feb), Spring (Mar-Apr-May), Summer (Jun-Jul-Aug), and Fall (Sep-Oct-Nov). The second highest value for each hour of the day (24 values) by season was averaged for 2012-2014 to derive 96 distinct 1-hour SO_2 concentrations background values total for the four seasons. For model results reported here, the maximum impacts *include* the contribution from background SO_2 into the modeled design value. A table of the background SO_2 seasonally and hourly varying values utilized in the Hennepin Study Area modeling is provided in Appendix B.

3.2.3 Summary of Results

The AERMOD simulation for the Hennepin Study Area evaluated seven stacks, 90 structures, four fencelines, and 13,429 receptors. The model simulated the years 2012-2014, combining emissions, meteorology, terrain, and background SO_2 levels into the model to calculate a predicted maximum 99^{th} percentile 1-hour SO_2 concentration for each receptor in the grid. The results presented in Table 8 report the magnitude and geographic location of the highest predicted concentration.

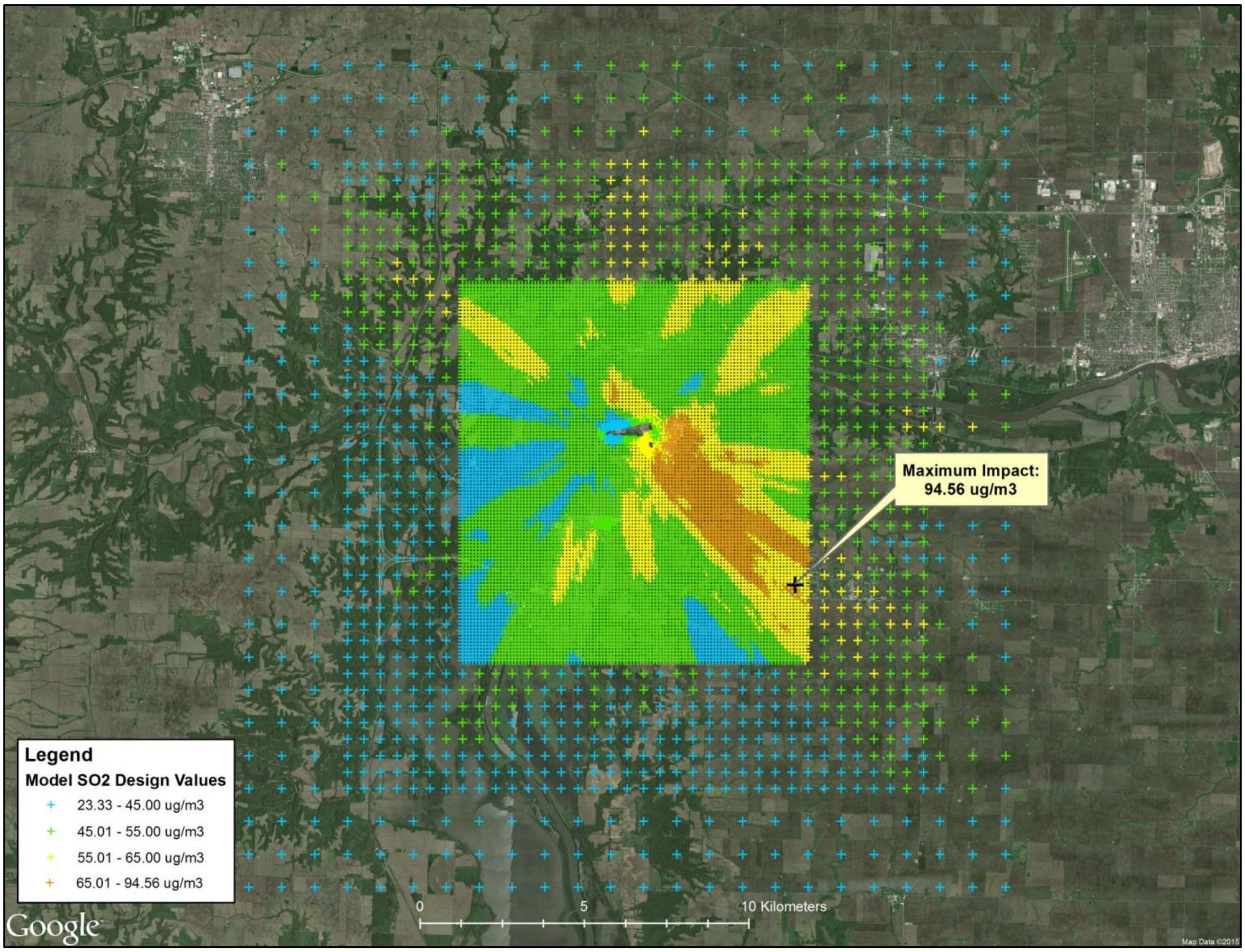
Table 8
Maximum Predicted 99^{th} Percentile 1-Hour SO_2 Concentration
Hennepin Study Area

Averaging Period	Data Period	Receptor Location (Meters)		SO_2 Concentration (µg/m3)	
		East	North	Modeled	NAAQS
99^{th} Percentile 1-Hour Average	2012-2014	311600	4570200	**94.56**	**196.23***

* Equivalent to the 75 ppb standard

The maximum predicted 99^{th} percentile 1-hour average concentration within the modeling domain is **94.56** µg/m^3, or 36.1 ppb. The maximum occurred within the dense 100-meter grid at an elevated location 7.2 km southeast of the Hennepin Power Station. The highest predicted concentration in the near-field from the power plant was **89.59** µg/m^3, located about two kilometers east-southeast of the Hennepin Power Station and just east of the Advanced Asphalt facility. The colored contour map illustrated in Figure 12 provides a color-coded maximum predicted concentration for each receptor in the study area and indicates the location of the predicted maximum.

Figure 12
Maximum Predicted 99th Percentile 1-Hour SO_2 - Hennepin Study Area



3.2.4 Designation Recommendation

Based on the Illinois EPA's modeling results, the extent of the study area, and consideration of other SO_2 sources in the multi-county area, Illinois EPA recommends that Putnam and Bureau Counties be designated as **attainment** for the 1-hour SO_2 standard.

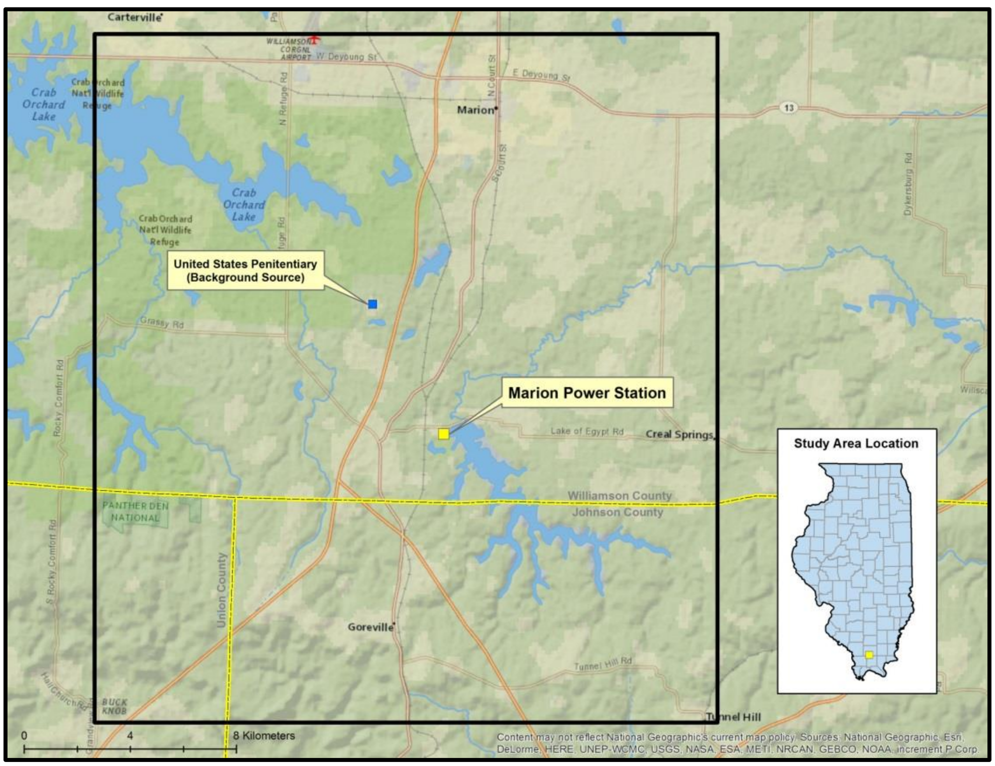
3.3 Marion Power Station (Williamson County)

The area south of the city of Marion in Williamson County contains a stationary source that satisfies one of the conditions (only one or the other required to qualify) of the March 2, 2015, Consent Decree between U.S. EPA, Sierra Club, and the NRDC. The Marion Power Station emitted less than the 16,000 tons (5,850) tons per year of SO_2, but had an emission rate that exceeds 0.45 lbs/mmBtu (0.489) in 2012.

3.3.1 Study Area

The town of Marion, Illinois, is located in southern Illinois in the central portion of Williamson County. The Marion Power Station (Southern Illinois Power Cooperative or SIPCO) is one of the five plants subject to SO_2 Consent Decree. As depicted in Figure 13, the plant operates approximately 11 kilometers south-southwest of town in a rural area bounded on the east side by the Lake of Egypt, and a golf course on the southeast. The determination of the size and extent of the study area (i.e. receptor grid) was based on the same considerations assessed in the previous study areas.

Figure 13 Marion Study Area (Williamson County)



3.3.2 Model Setup and Execution

As described in Section 3.1.2, AERMOD was used for the designation recommendation modeling. AERMOD is the dispersion modeling component of a much broader modeling system that includes multiple companion pre-processing programs that prepare other inputs into the model (BPIP-PRIME, AERMET, AERMINUTE, AERMAP, and AERSURFACE).

3.3.2.1 Model Settings

The latest version of AERMOD (version 15181) was run in the standard regulatory default mode.

3.3.2.2 Auer's Analysis

The Auer's discussion and analysis discussed in Section 3.1.1.1 was similarly applied to the Marion Study Area. The Auer's analysis is a methodology for determining if the sources within the study area are located within a rural or urban dispersion regime.

The three-kilometer ring applied in the Auer's analysis for the Marion Study Area was centered on the Marion Power Station. The data source for land cover was the 2011 National Land Cover Database (NLCD), with a data cell size of 30-meters by 30-meters. The results of the Auer's analysis are presented in Figure 14 and Table 9.

Figure 14
Auer's Analysis - Marion Study Area

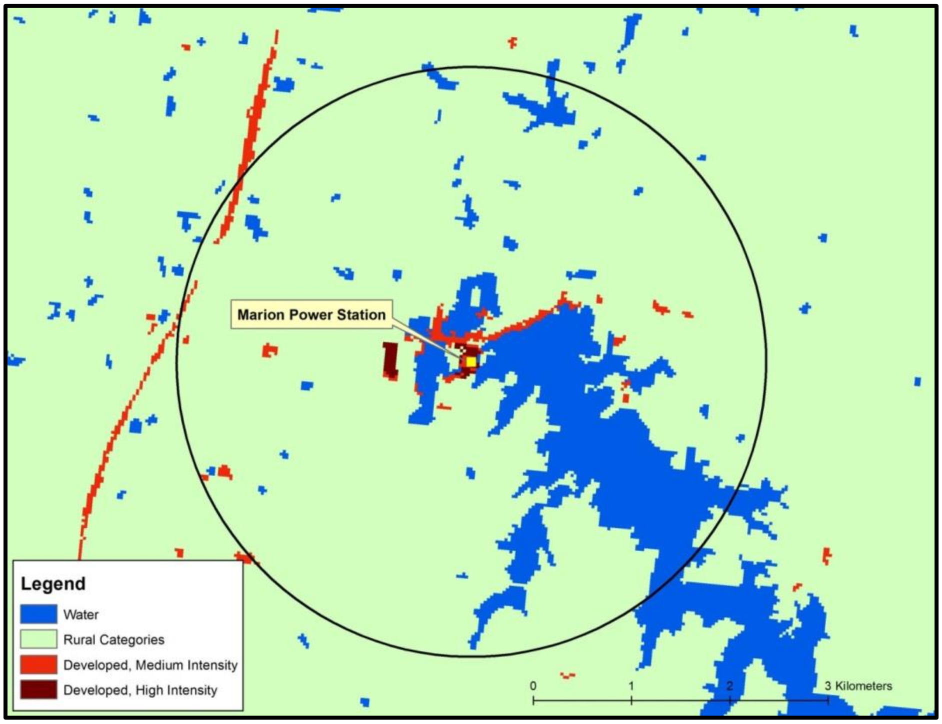


Table 9
Auer's Analysis Land Use Percentages by Category – Marion Study Area

SO_2 NAA Modeling Auer's Analysis - NLCD 2011				Marion 3 km Ring		
NLCD Value	**NLCD 2011 Description**	**Auer's Code**	**Auer's Class**	**Cell Count**	**Percentage**	**Totals**
23	Developed, Medium Intensity	R2/R3	**Urban**	388	1.24%	**1.54%**
24	Developed, High Intensity	I1/I2/C1		96	0.31%	
11	Open Water	A5	**Rural**	4,735	15.08%	**98.46%**
21	Developed, Open Space	A1/R4		1,684	5.36%	
22	Developed, Low Intensity	R1		2,549	8.12%	
31	Barren Land (Rock/Sand/Clay)	A3		57	0.18%	
41	Deciduous Forest	A4		10,349	32.95%	
42	Evergreen Forest	A4		562	1.79%	
43	Mixed Forest	A4		0	0.00%	
52	Shrub/Scrub	A4		0	0.00%	
71	Grassland/Herbaceous	A3		254	0.81%	
81	Pasture/Hay	A3		9,744	31.02%	
82	Cultivated Crops	A2		991	3.16%	
90	Wood Wetlands	A4		0	0.00%	
95	Emergent Herbaceous Wetlands	A3		0	0.00%	
Analysis based on 30 meter by 30 meter raster cells extracted for each area.			***Grand Totals:***	***31,409***	***100.00%***	

The Auer's analysis indicates the study area is approximately 98.5% rural and 1.5% urban; therefore the rural option applies to all emissions sources in the modeling domain.

3.3.2.3 Emissions

The determination of sources to model in the Marion Study Area consisted of compiling a list from the state inventory database of SO_2 sources within a ten-kilometer radius of the Marion Power Station, while also evaluating the potential for sources beyond ten kilometers to cause a significant concentration gradient within the area. In the case of Marion, there were two facilities identified within the ten-kilometer area with SO_2 emissions. The Marion Power Station, located 11 kilometers south-southwest of the city of Marion, and the United States (U.S.) Penitentiary, located approximately six kilometers northwest of the power station. The two facilities were considered to have a potential impact in the near-field where maximum concentrations are expected. There were no sources beyond ten kilometers that Illinois EPA considers to have the potential to cause significant gradient impacts within the study area. The facility and their modeled tons per year 2012-2014 are presented in Table 10.

Table 10
Modeled Facility Emissions – Marion Study Area

Company I.D.	Facility Name	SO_2 Emissions (tons per year)		
		2012	2013	2014
199856AAC	Marion Power Station (SIPCO)	5512.11	5512.11	5512.11
155801AAC	United States Penitentiary	0.18	0.18	0.18
Total Emissions	**All Facilities**	**5512.29**	**5512.29**	**5512.29**

The four Marion Power Station stacks were modeled at maximum actuals expected from the source. The other facility in the modeling, United States Penitentiary, had no detailed hourly throughput or operating schedule data available, thus the conservative worst-case year emissions were applied to each year and spread uniformly throughout every hour. Please reference Appendix A for the full emissions inventory and stack parameters. For the Marion Study Area, a total of eight point sources were modeled. The hourly emissions file is included in this submittal via the DVD representing Appendix C.

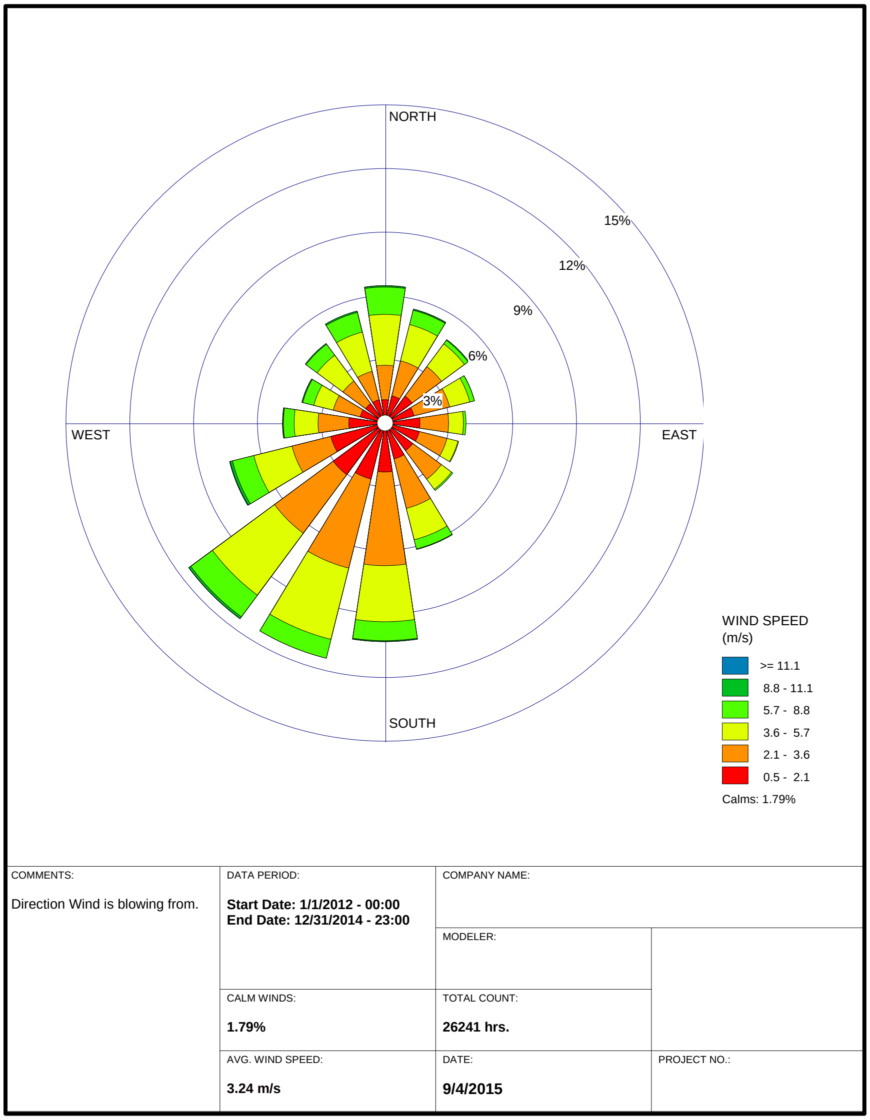
3.3.2.4 Meteorology

The SO_2 TAD recommends using the three most recent years of meteorology for use in the SO_2 Phase II Designation modeling.

The selection of a representative meteorological station for each of the study areas was based on proximity, similarity of terrain/surface roughness, and climatological consistency. For the Marion Study Area, National Climatic Data Center National Weather Service (NWS) surface meteorology from Paducah, Kentucky (WBAN No. 3816, 64 km to the southeast), and coincident upper air observations from Nashville, Tennessee (WBAN No. 13897, 260 km to the southeast), was selected as best representative of meteorological conditions within the study area (PAH/NAS).

The three-year surface wind rose for Paducah, Kentucky, is depicted in Figure 15. The frequency and magnitude of wind speed and direction are defined in terms of where the wind is blowing from, parsed out in twelve 30-degree wind sectors. The predominant wind direction during the three-year time period used in the modeling is from the southwest, occurring approximately 11.4% of the time. The highest percentage wind speed range, occurring 32.9% of the time, was in the 2.1 – 3.6 m/s range.

Figure 15
Paducah, Kentucky, Cumulative Annual Wind Rose
2012-2014



Meteorological data from the above surface and upper air stations was used in generating AERMOD-ready files with the AERMET processor, a part of the AERMOD software suite. The output meteorological data created by the AERMET processor is considered suitable for being applied in AERMOD for regulatory modeling applications. The methodology and settings performed in the processing of the raw meteorological data into AERMOD-ready format followed the same procedure as in the Newton Study Area. Please refer to Section 3.1.2.4 for more details on the development procedure utilized for the meteorological inputs. The Marion Study Area AERMOD-ready ".sfc" and ".pfl" meteorological electronic files are included in this submittal via the DVD representing Appendix C.

3.3.2.5 Receptor Network/Terrain

The receptor grid for Marion was designed to be of sufficient density and size to capture all relevant concentration gradients from modeled sources and to adequately resolve the maximum predicted SO_2 design value concentration. The terrain to the south of the Marion Power Station contains forested, complex terrain, thus the receptor grid was extended a sufficient distance to ensure the maximums were captured. The receptor grid's dense 100-meter spacing, using a Cartesian gridding method, was extended outward from each fenceline to at least five kilometers distance from each facility (extent may vary slightly by direction). The study area receptor spacing was approximately:

- 50 meters along the fenceline (two facilities)
- 100 meters from the fenceline out to approximately 5.0 kilometers
- 500 meters from 5.0 kilometers out to approximately 8.0 kilometers
- 1,000 meters from 8.0 kilometers out to approximately 10 kilometers

The Marion Study Area receptor grid is presented in Figure 16. The receptor count totaled 25,118 receptors, covering central and south-central Williamson County, the northeast corner of Union County, and the northwest and north-central part of Johnson County. The terrain in the study area is best characterized as complex to gently rolling (south to north). To account for terrain changes, the AERMAP terrain program was used to develop terrain and hill scale height for all the receptors. The source of the elevation data incorporated into the model is from the USGS National Elevation Database (NED).

Figure 16
Receptor Grid – Marion Study Area

3.3.2.6 Background SO_2

The regional sources not explicitly modeled in AERMOD, but best characterized as background contributors to SO_2 near or in the study area, are addressed via background monitoring data. U.S. EPA recommends inclusion into the model data from the nearest representative background SO_2 monitor operated by state, local, or tribal organizations. The Houston, Illinois, monitor was selected for the Marion study area. The Houston monitor is located approximately 94 kilometers northwest of the study area in northern Randolph County in the small town of Houston. The monitor, operated and maintained by Illinois EPA, has validated hourly SO_2 concentrations for the three years modeled in this analysis (2012-2014).

For this modeling application, Illinois EPA incorporated temporally-varying background 1-hour concentrations developed from the Houston, Illinois, monitor. The values developed for inputs are based on the 99^{th} percentile monitored concentrations and vary by hour and season in the same manner as discussed previously for the other study areas. Modeled concentrations *include* the contribution of the background values. A table of the background SO_2 seasonally and hourly varying values utilized in the Marion Study Area modeling is provided in Appendix B.

3.3.3 Summary of Results

The AERMOD simulation for the Marion Study Area comprised eight stacks, 37 structures, two fencelines, and 25,118 receptors. The model simulated 2012-2014, while taking into account maximum actual emissions expected from the source, combining such emissions, meteorology, terrain, and background SO_2 levels into the model to calculate a maximum 99th percentile 1-hour SO_2 concentration for each receptor in the grid. The results presented in Table 11 report the magnitude and geographic location of the highest predicted concentration.

Table 11
Maximum Predicted 99th Percentile 1-Hour SO_2 Concentration
Marion Study Area

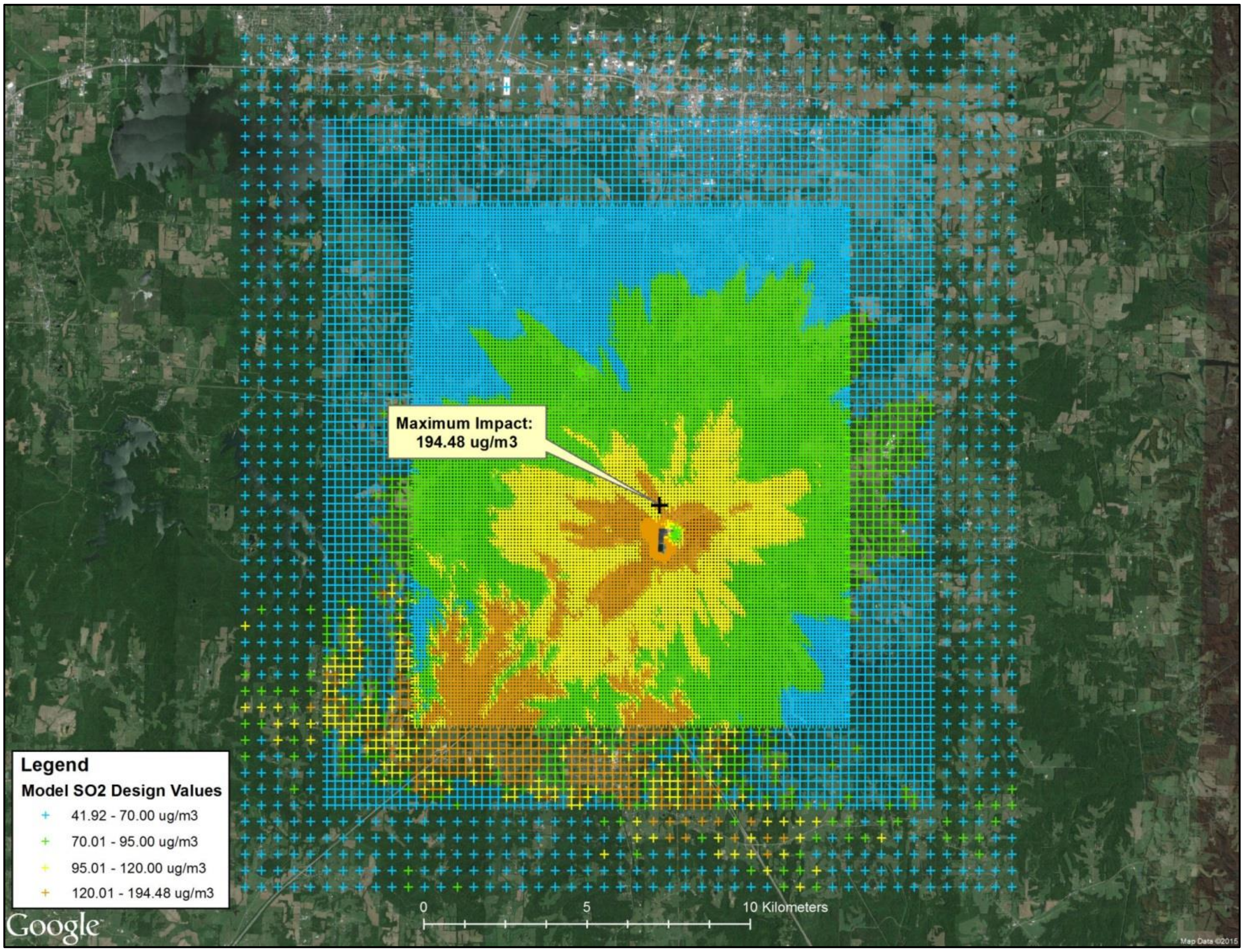
Averaging Period	Data Period	Receptor Location (Meters)		SO_2 Concentration (µg/m^3)	
		East	North	Modeled	NAAQS
99th Percentile 1-Hour Average	2012-2014	327200	4166200	**194.48**	**196.32***

* Equivalent to the 75 ppb standard

The maximum predicted 99th percentile 1-hour average concentration within the modeling domain is **194.48** µg/m^3, or 74.3 ppb. The maximum occurred within the dense 100-meter grid 1.2 km north-northwest of the Marion Power Station. The color coded contour map in Figure 17 depicts maximum predicted concentrations for each receptor in the study area and indicates the location of the predicted maximum.

Figure 17

Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations - Marion Study Area



3.3.3 Designation Recommendation

Based on the modeling results, the extent of the study area, and consideration of other SO_2 sources in the multi-county area, Illinois EPA recommends that Williamson County be designated **attainment** for the 1-hour SO_2 standard.

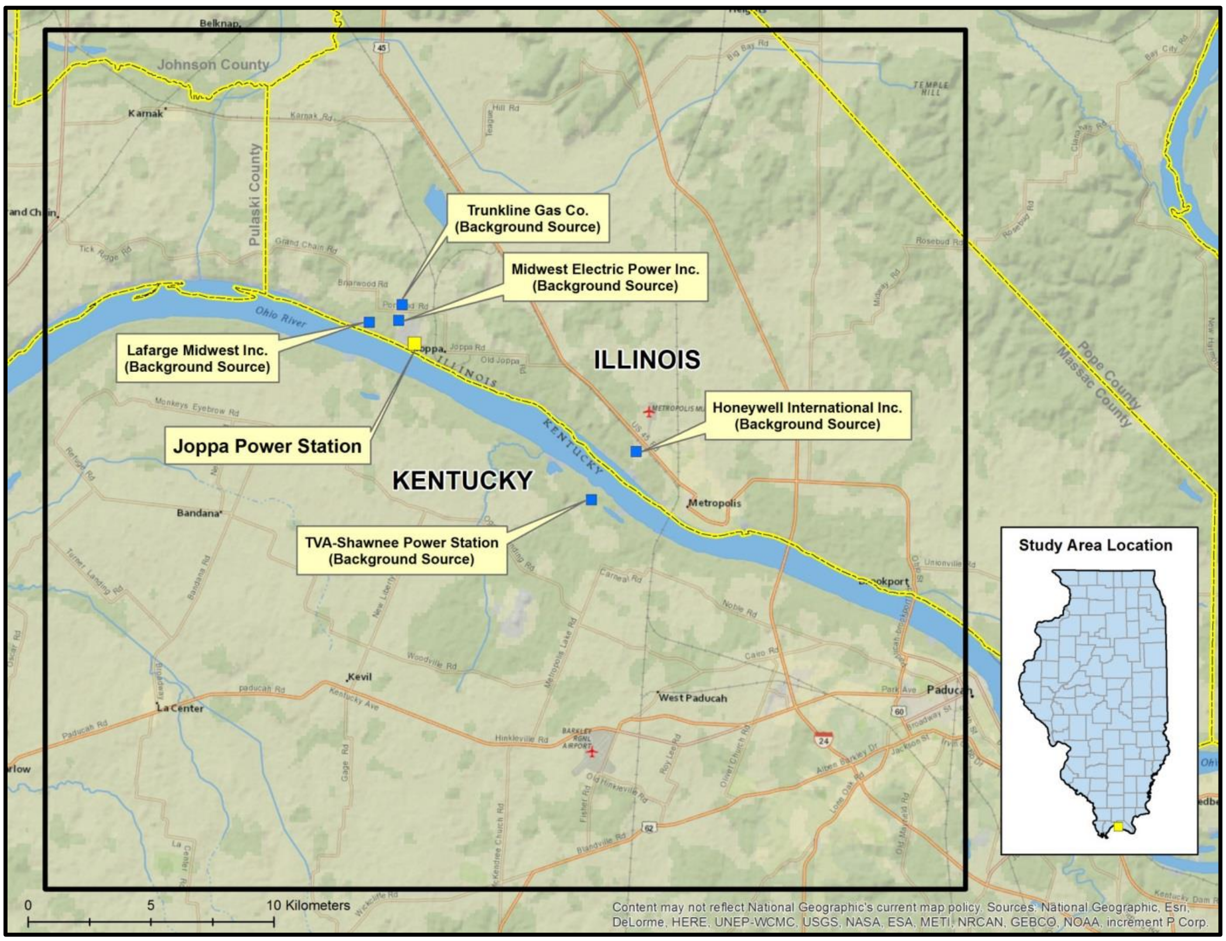
3.4 Joppa Steam Coal Power Plant (Massac County)

The area west of the town of Joppa in Massac County contains a stationary source that satisfies one of the conditions (only one or the other required to qualify) of the March 2, 2015, Consent Decree between U.S. EPA, Sierra Club, and the NRDC. The Joppa Power Station emitted greater than the 16,000 tons (16,991) tons per year of SO_2, and had an emission rate that exceeds 0.45 lb/mmBtu (0.475) in 2012.

3.4.1 Study Area

The town of Joppa, Illinois, is located in southern Illinois in the western portion of Massac County. The Joppa Power Station is one of the five plants subject to the SO_2 Consent Decree. As depicted in Figure 18, the plant is located approximately 1.0 kilometer west-northwest of town in a rural area bounded on the south by the Ohio River. The size and extent of the study area (i.e. receptor grid) was based on the same considerations described for previous study areas.

Figure 18
Joppa Study Area (Massac County)



3.4.2 Model Setup and Execution

As described in Section 3.1.2, AERMOD was used for the designation recommendation modeling. AERMOD is the dispersion modeling component of a much broader modeling system that includes multiple companion pre-processing programs that prepare other inputs into the model (BPIP-PRIME, AERMET, AERMINUTE, AERMAP, and AERSURFACE).

3.4.2.1 Model Settings

The latest version of AERMOD (version 15181) was run in its standard regulatory default mode.

3.4.2.2 Auer's Analysis

The Auer's discussion and analysis discussed in Section 3.1.1.1 was similarly applied to the Joppa Study Area. The Auer's analysis is a methodology for determining if the sources within the study area are located within a rural or urban dispersion regime.

The three-kilometer ring applied in the Auer's analysis for the Marion Study Area is centered on the Marion Power Station. The data source for land cover was the 2011 National Land Cover Database (NLCD), with a data cell size of 30-meters by 30-meters. The results of the Auer's analysis are presented in Figure 19 and Table 12.

Figure 19
Auer's Analysis - Joppa Study Area

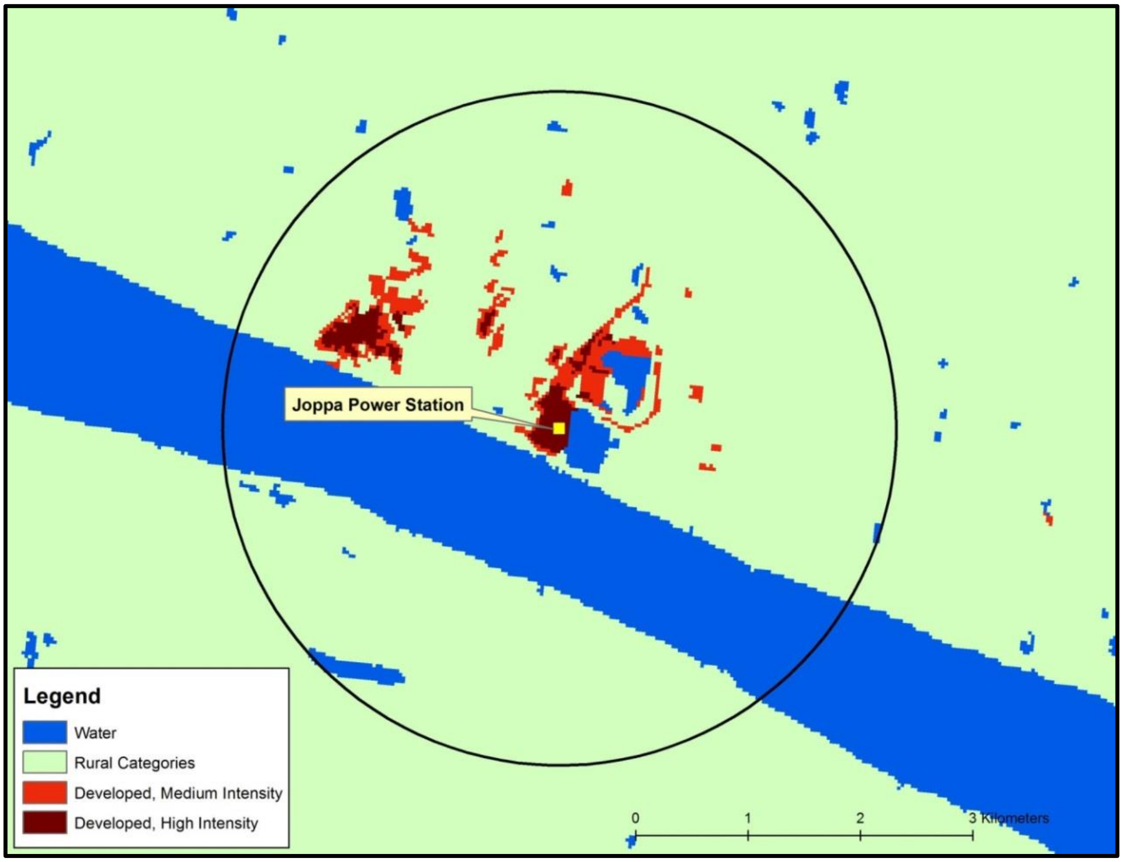


Table 12
Auer's Analysis Land Use Percentages by Category – Joppa Study Area

SO_2 NAA Modeling Auer's Analysis - NLCD 2011				Joppa 3 km Ring		
NLCD Value	NLCD 2011 Description	Auer's Code	Auer's Class	Cell Count	Percentage	Totals
23	Developed, Medium Intensity	R2/R3	Urban	825	2.63%	3.99%
24	Developed, High Intensity	I1/I2/C1		427	1.36%	
11	Open Water	A5	Rural	7,189	22.89%	96.01%
21	Developed, Open Space	A1/R4		1,756	5.59%	
22	Developed, Low Intensity	R1		1,196	3.81%	
31	Barren Land (Rock/Sand/Clay)	A3		163	0.52%	
41	Deciduous Forest	A4		6,400	20.38%	
42	Evergreen Forest	A4		0	0.00%	
43	Mixed Forest	A4		0	0.00%	
52	Shrub/Scrub	A4		0	0.00%	
71	Grassland/Herbaceous	A3		0	0.00%	
81	Pasture/Hay	A3		7,677	24.44%	
82	Cultivated Crops	A2		3,623	11.53%	
90	Wood Wetlands	A4		1,963	6.25%	
95	Emergent Herbaceous Wetlands	A3		191	0.61%	
Analysis based on 30 meter by 30 meter raster cells extracted for each area.			***Grand Totals:***	***31,409***	***100.00%***	

The Auer's analysis indicates the study area is approximately 96% rural and 4% urban; therefore the rural option applies to all emissions sources in the modeling domain.

3.4.2.3 Emissions

As discussed in previous sections, the most recent three years of actual emissions were used to best represent the emissions that would simulate the air quality for a three-year monitoring dataset in determining compliance with the NAAQS. In this application, actual emissions were used from the most recently available years (2012-2014).

Determining sources to model in the Joppa Study Area consisted of compiling a list from the state inventory database of SO_2 sources within a ten-kilometer radius of the Joppa Power Station, while also evaluating the potential for sources beyond ten kilometers to cause a significant concentration gradient within the area. In the case of the Joppa Study Area, there were six facilities identified within the ten-kilometer area with SO_2 emissions. The Joppa Power Station, Lafarge Midwest International, Inc. Trunkline Gas Company, and Midwest Electric Power are all located within a short distance from each other. The Honeywell International Inc. and the Tennessee Valley Authority (TVA) Shawnee Power Plant (Kentucky) are located approximately ten kilometers southeast of the other facilities. These six facilities were considered to have a potential impact in the study area where maximum concentrations are expected. There were no sources beyond ten kilometers that Illinois EPA considers to have the potential to cause significant concentration gradient impacts within the study area. The facilities and associated annual actual emission tonnages (2012-2014) are listed in Table 13.

Table 13
Modeled Facility Actual Emissions – Joppa Study Area

Company I.D.	Facility Name	SO_2 Emissions (tons per year)		
		2012	2013	2014
127855AAC	Joppa PS (Electric Energy Inc.)	17,007.07	16,557.74	18,229.24
127855AAA	Lafarge Midwest Inc.	552.60	553.28	491.65
127899AAA	Midwest Electric Power Inc. (MEPI)	5.68	0.00	0.00
127855AAB	Trunkline Gas Company	0.866	0.866	0.866
127854AAD	Honeywell International Inc.	162.51	58.73	143.15
2114500006	TVA – Shawnee Power Plant	27,114.87	27,210.73	29,734.54
Total Emissions	**All Facilities**	**44,843.60**	**44,381.46**	**48,599.45**

Emissions profiles for the Joppa inventory were developed using the AERMOD keyword HOUREMIS and from applying a direct worst-case actual year for one of the facilities. Illinois EPA used hourly varying 2012-2014 CEMS SO_2 emissions data provided by the Joppa Power Station for its boiler stacks, along with hourly-specific exit temperatures and exit velocities. For Lafarge, the emissions from the two cement kiln stacks constitute 99.9% of the facility emissions, therefore those two sources were modeled with company provided hourly varying emissions, temperature, and exit velocity. MEPI provided hourly varying emissions for their operating units/stacks for the three-year period. Trunkline's emissions were constructed from contained in the company's Annual Emissions Reports, including yearly emissions data and seasonal throughput. Seasonal emissions were averaged over the three years, multiplied by a scalar (via EMISFACT keyword in AERMOD), and then applied to the three-year modeling period. Nearly all of Honeywell's facility SO_2 emissions (99.9%) exhaust from the waste incinerator unit. A three-year hourly profile was constructed for the three years based on seasonal throughput. CEMS data obtained via U.S. EPA's CAMD database was used to construct hourly emissions rates for the TVA-Shawnee Boiler Stacks. For all sources in the Joppa inventory that lacked CEMS data, Illinois EPA used a constant value for exit temperature and exit velocity for each hour of the modeled period. These constant values were obtained either from the Illinois EPA database or from company-provided emission report submittals. Please reference Appendix A for the full emissions inventory and stack parameters, including the substitution methods employed for addressing missing or erroneous data fields for CEMS data. For the Joppa Study Area, a total of 17 point source stacks were modeled. AERMOD's HOUREMIS keyword was applied to 12 of the point sources. The EMISFACT keyword was applied to the remaining five sources. The hourly emissions file is included in this submittal via the DVD representing Appendix C.

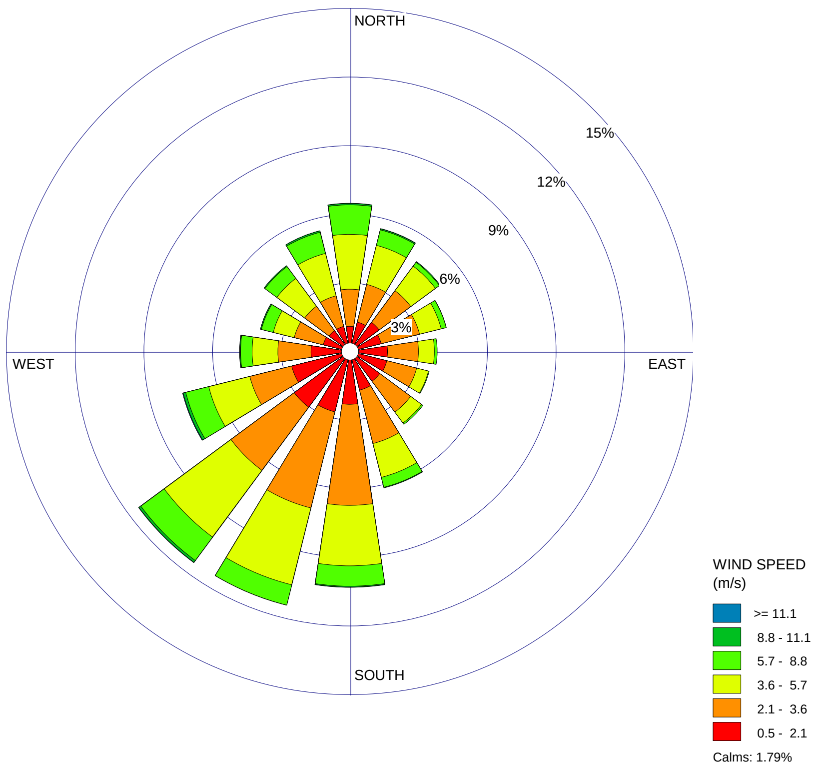
3.4.2.4 Meteorology

The SO_2 TAD recommends using the three most recent years of meteorology for use in SO_2 area designations modeling.

The selection of a representative meteorological station for each of the study areas was based on proximity, similarity of terrain/surface roughness, and climatological consistency. For the Joppa Study Area, the National Climatic Data Center National Weather Service (NWS) surface meteorology from Paducah, Kentucky (WBAN No. 3816, 18 km to the southeast), and coincident upper air observations from Nashville, Tennessee (WBAN No. 13897, 228 km to the southeast), were selected as best representative of meteorological conditions within the study area (PAH/NAS).

The three-year surface wind rose for Paducah, Kentucky, is depicted in Figure 20. The frequency and magnitude of wind speed and direction are defined in terms of where the wind is blowing from, parsed out in twelve 30-degree wind sectors. The predominant wind direction during the three-year time period used for the modeling is from the southwest, occurring approximately 11.4% of the time. The highest percentage wind speed range, occurring 32.9% of the time, was in the 2.1 – 3.6 m/s range.

Figure 20
Paducah, Kentucky, Cumulative Annual Wind Rose
2012-2014



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Direction Wind is blowing from.	**Start Date: 1/1/2012 - 00:00** **End Date: 12/31/2014 - 23:00**	MODELER:	
	CALM WINDS: **1.79%**	TOTAL COUNT: **26241 hrs.**	
	AVG. WIND SPEED: **3.24 m/s**	DATE: **9/4/2015**	PROJECT NO.:

Meteorological data from the above surface and upper air stations were used in generating AERMOD-ready files with the AERMET processor, a part of the AERMOD software suite. The output meteorological data created by the AERMET processor is considered suitable for use in AERMOD in regulatory modeling applications. The methodology and settings invoked in processing the raw meteorological data into AERMOD-ready format followed the same procedure as in the Newton Study Area. Please refer to Section 3.1.2.4 for more details on the development procedure utilized for the meteorological inputs. The Joppa Study Area AERMOD-ready ".sfc" and ".pfl" meteorological files are included in this submittal via the DVD representing Appendix C.

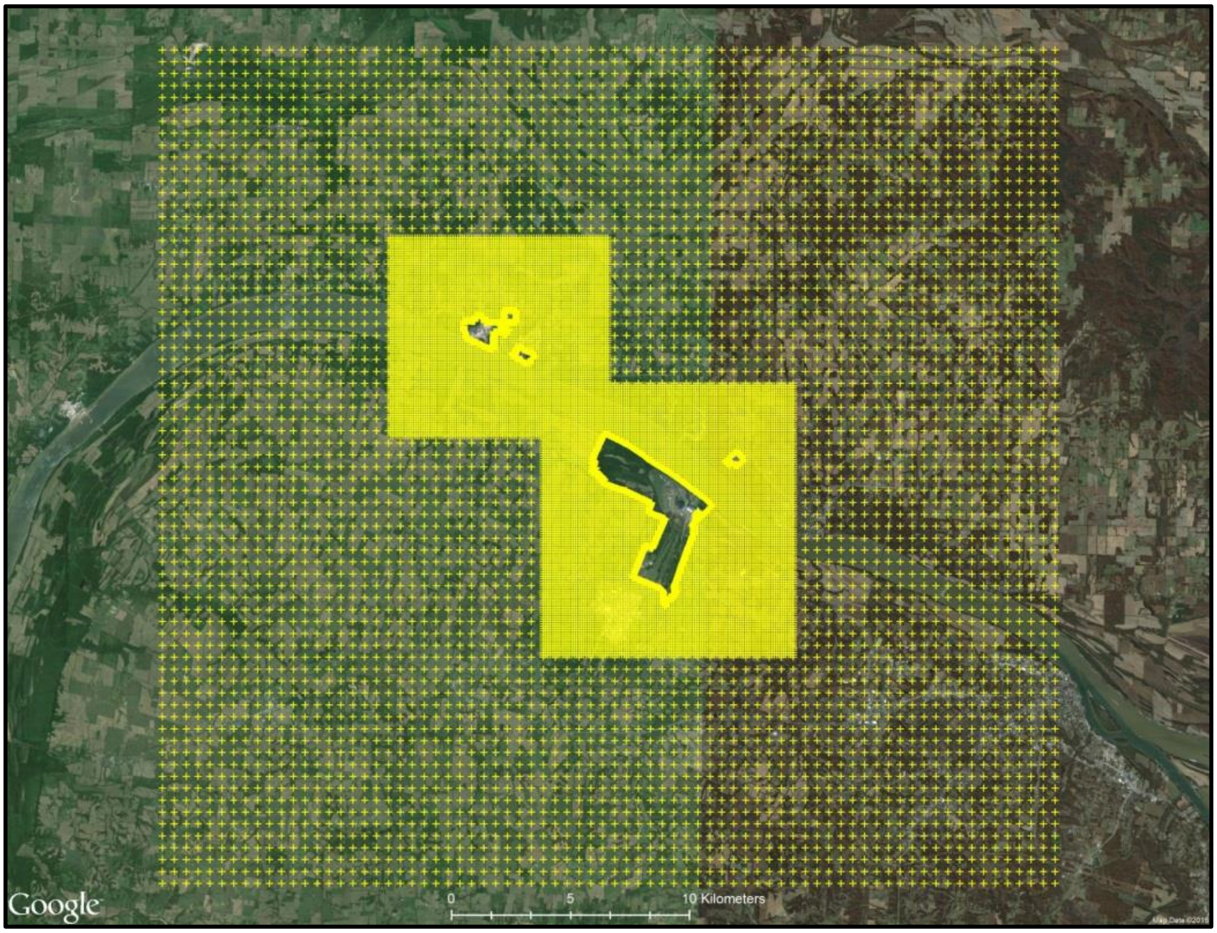
3.4.2.5 Receptor Network/Terrain

The receptor grid for the Joppa Study Area was designed to be of sufficient density and size to capture all relevant concentration gradients from modeled sources and to adequately resolve the maximum predicted SO_2 design value concentration. The receptor grid's dense 100-meter spacing was created in two distinct sections, one that surrounds the grouping of sources around the Joppa Power Station, and another that captures the impacts around the Honeywell/TVA plants. In general, the fine 100-meter Cartesian grid was extended outward from each fenceline to at least three kilometers distance from each facility (extent may vary slightly by direction). The entire study area receptor spacing was approximately:

- 50 meters spacing along the fenceline (six facilities)
- 100 meters out to approximately 3.0 kilometers
- 500 meters from 3.0 kilometers out to approximately 8.0 kilometers
- 1,000 meters from 8.0 kilometers out to approximately 12 kilometers

The Joppa Study Area receptor grid is presented in Figure 21. The receptor network contained 25,649 receptors, covering northwestern Massac County in Illinois, the northeastern portion of Ballard County in Kentucky, and the northwestern portion of McCracken County in Kentucky. The terrain in the study area is best characterized as flat to gently rolling and is bisected west-to east through its central part by the Ohio River. To account for terrain changes, the AERMAP terrain program was used to generate elevations and hill height for all receptors. The source of the elevation data is the USGS National Elevation Database (NED).

Figure 21
Receptor Grid – Joppa Study Area



3.4.2.6 Background SO_2

The regional sources not explicitly modeled in AERMOD, but best characterized as background contributors to SO_2 near or in the study area, are addressed via background monitoring data. U.S. EPA recommends inclusion in the model of data from the nearest representative background SO_2 monitor operated by state, local, or tribal organizations. The Paducah, Kentucky, monitor was selected for the Joppa study area. The Paducah monitor is located approximately 18 kilometers southeast of the study area in north-central McCracken County in the city of Paducah, Kentucky. The monitor, operated and maintained by the Kentucky Division of Air Quality (KDAQ), has validated hourly SO_2 concentrations for the three years modeled in this analysis (2012-2014).

For this modeling application, Illinois EPA incorporated temporally-varying background 1-hour concentrations developed from the Paducah, Kentucky, monitor. The values developed for inputs into AERMOD for background are based on the 99th percentile monitored concentrations that vary by season and hour in the same manner as in the previously discussed study areas. For modeled design value impacts for comparison to the standard reported here, the maximum impacts *include* the contribution of background. A table of the background SO_2 seasonally and hourly varying values utilized in the Joppa Study Area modeling is provided in Appendix B.

3.4.3 Summary of Results

The AERMOD simulation for the Joppa Study Area comprised 18 stacks, 127 structures, six fencelines, and 25,649 receptors. The model simulated 2012-2014, combining emissions, meteorology, terrain, and background SO_2 levels into the model to calculate a maximum 99^{th} percentile 1-hour SO_2 concentration for each receptor in the grid. The results presented in Table 14 report the magnitude and geographic location of the highest predicted concentration.

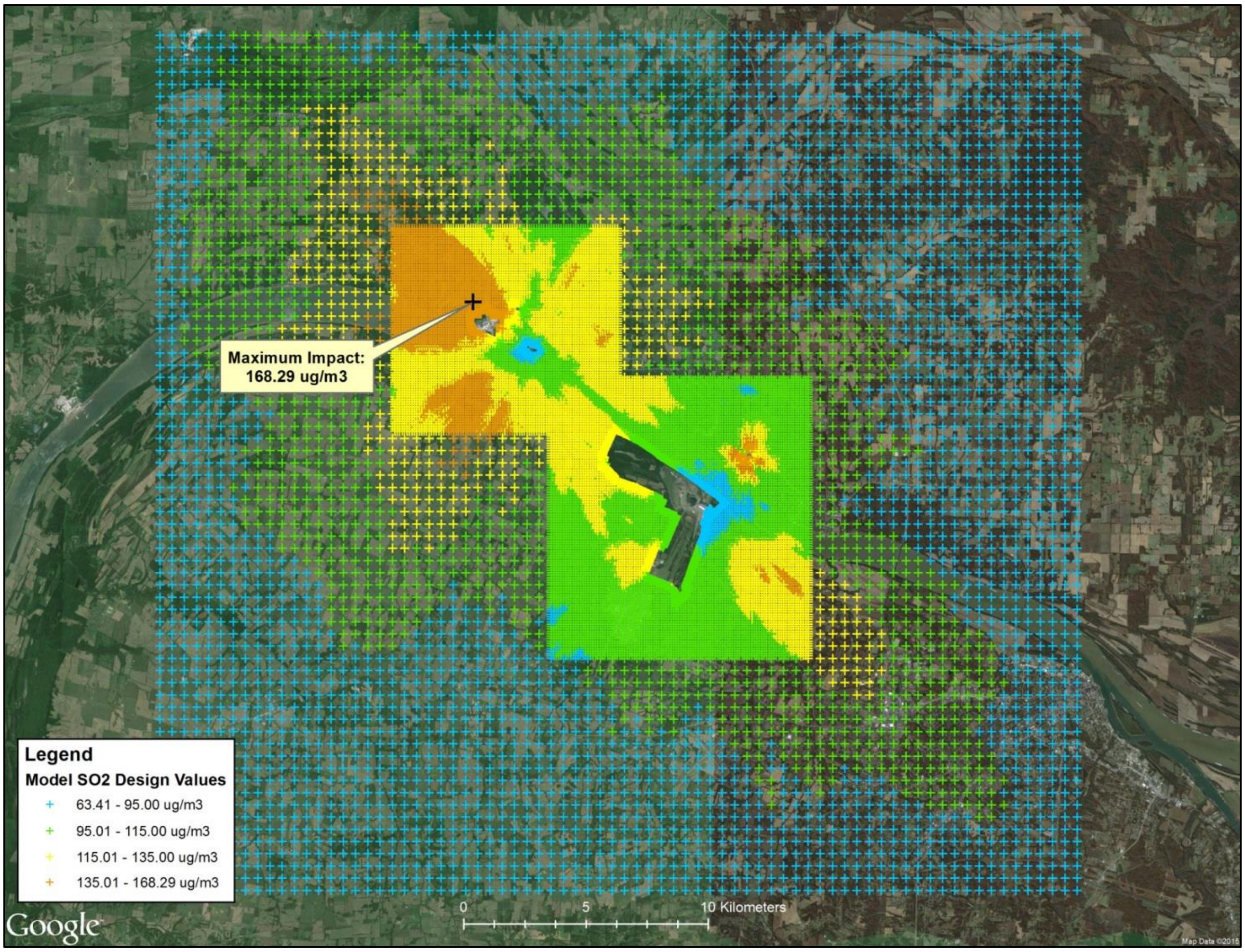
Table 14
Maximum Predicted 99^{th} Percentile 1-Hour SO_2 Concentration
Joppa Study Area

Averaging Period	Data Period	Receptor Location (Meters)		SO_2 Concentration ($\mu g/m^3$)	
		East	North	Modeled	NAAQS
99^{th} Percentile 1-Hour Average	2012-2014	332800	4121600	**168.29**	**196.23***

* Equivalent to the 75 ppb standard

The maximum predicted 99^{th} percentile 1-hour average concentration within the modeling domain is 168.29 $\mu g/m^3$, or 64.2 ppb. This maximum occurred within the dense 100-meter grid approximately 2.9 km northwest of the Joppa Power Station main stacks and 0.4 km northwest of the Lafarge northern fenceline. The colored contour map of maximum 99^{th} percentile concentrations presented in Figure 22 depicts maximum predicted concentration for each receptor in the study area and indicates the location of the predicted maximum.

Figure 22
Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations – Joppa Study Area



3.4.4 Designation Recommendation

Based on the modeling results, the extent of the study area, and consideration of other SO_2 sources in the study area, Illinois EPA recommends that Massac County be designated as **attainment** for the 1-hour SO_2 standard.

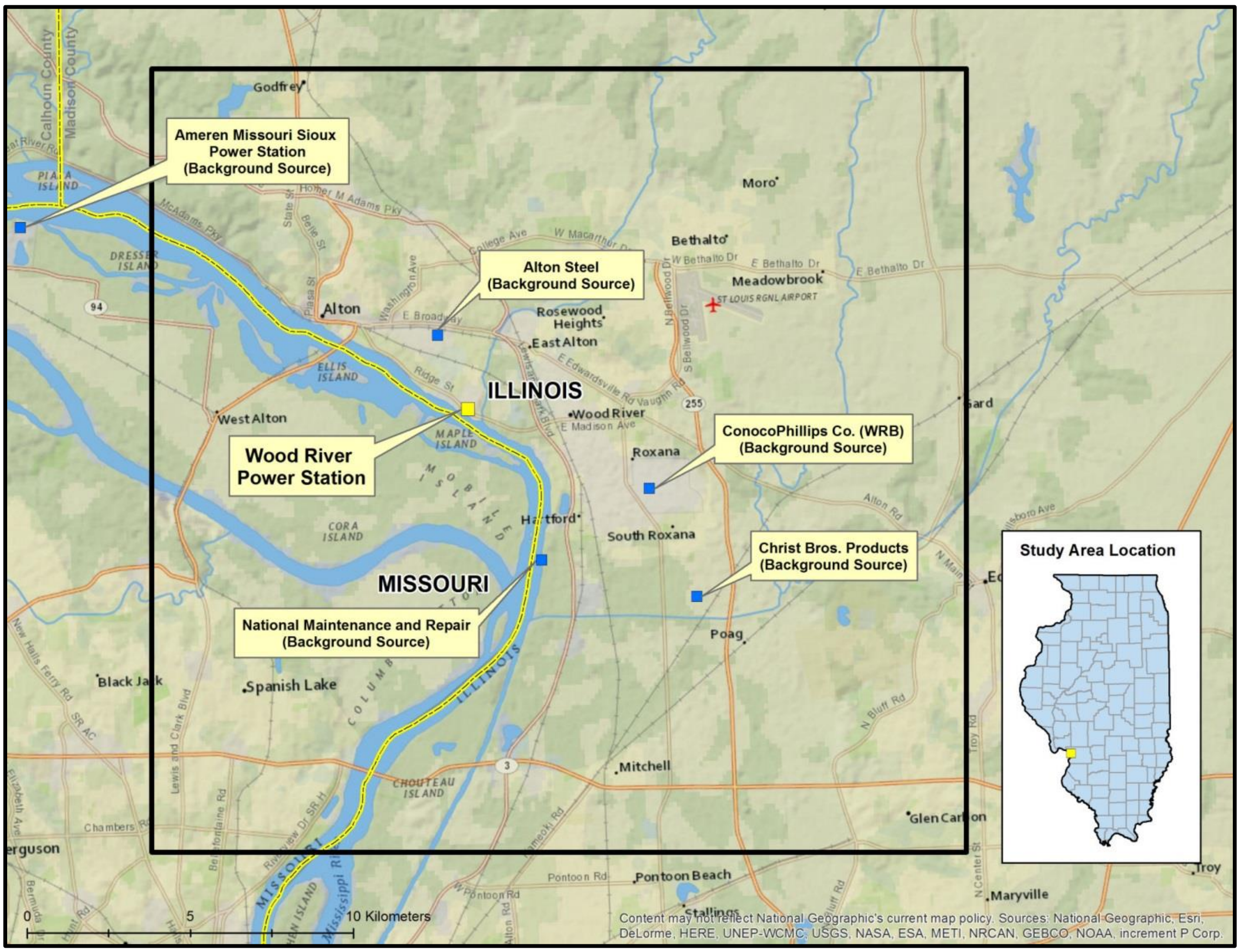
3.5 Wood River Power Station (Madison County)

Wood River in Madison County, Illinois, contains a stationary source that satisfies one of the conditions (only one or the other required to qualify) of the March 2, 2015, Consent Decree between U.S. EPA, Sierra Club, and the NRDC. The Wood River Power Station emitted less than 16,000 tons (6,756) tons per year of SO_2, but had an emission rate that exceeds 0.45 lbs/mmBtu (0.476) in 2012.

3.5.1 Study Area

The city of Wood River is part of the St. Louis Metropolitan Statistical Area (MSA) and is located northeast of the urban core east of the Mississippi River in Illinois. The Wood River Power Station is one of the five plants subject to the SO_2 Consent Decree. As depicted in Figure 23, the plant is located along the Mississippi River in western Madison County in a community with residential, commercial, and industrial areas. The size and extent of the study area (i.e., receptor grid) were based on the same considerations described previously for other study areas.

Figure 23
Wood River Study Area (Madison County)



3.5.2 Model Setup and Execution

As described in Section 3.1.2, AERMOD was used for the designation recommendation modeling. AERMOD is the dispersion modeling component of a much broader modeling system that includes multiple companion pre-processing programs that prepare other inputs into the model (BPIP-PRIME, AERMET, AERMINUTE, AERMAP, and AERSURFACE).

3.5.2.1 Model Settings

The latest version of AERMOD (version 15181) was run in the standard regulatory default mode.

3.5.2.2 Auer's Analysis

The Auer's discussion and analysis in Section 3.1.1.1 similarly apply to the Wood River Study Area. The Auer's analysis is a methodology for determining if the sources within the study area are located within a rural or urban dispersion regime.

The three-kilometer ring applied in the Auer's analysis for the Wood River Study Area was centered on the Wood River Power Station. The data source for land cover was the 2011 National Land Cover Database (NLCD), with a raster data cell size of 30 meters by 30 meters. The results of the Auer's analysis are presented in Figure 24 and Table 15. The Auer's analysis indicates the study area is approximately 80.1% rural and 19.9% urban; therefore the rural option applies to all emissions sources in the modeling domain.

Figure 24
Auer's Analysis – Wood River Study Area

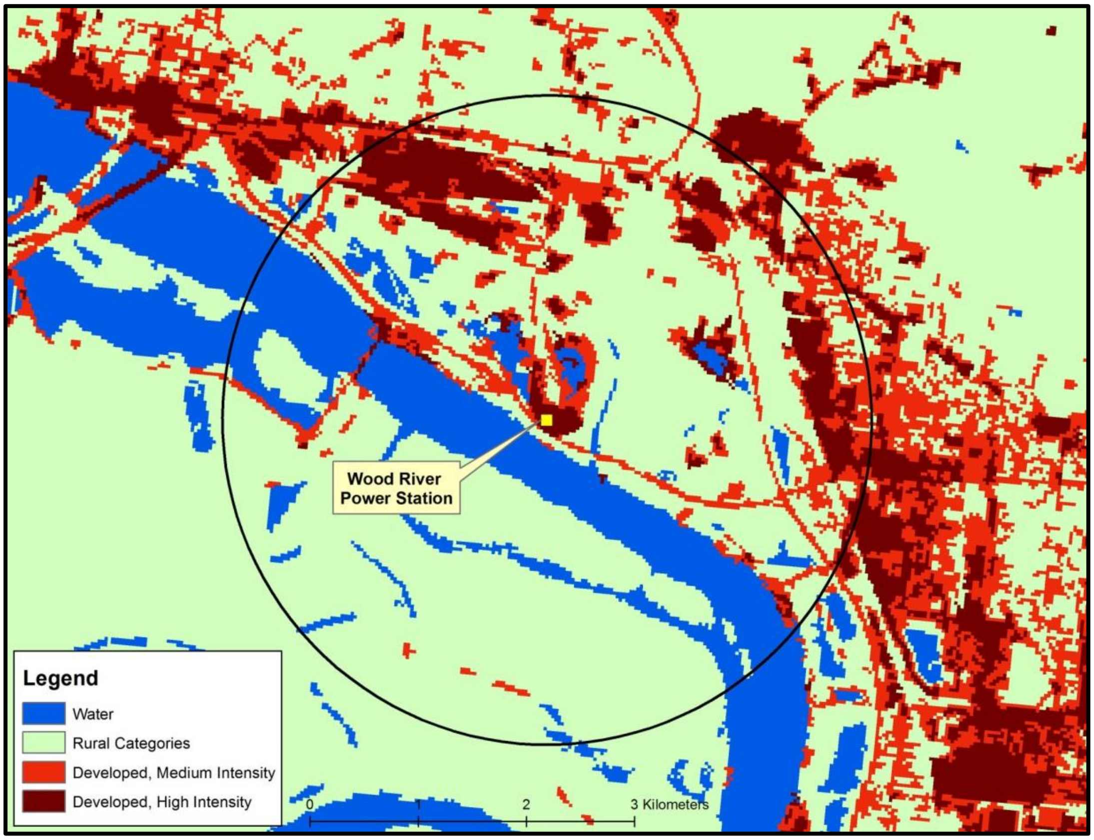


Table 15
Auer's Analysis Land Use Percentages by Category – Wood River Study Area

SO_2 NAA Modeling Auer's Analysis - NLCD 2011				Wood River 3 km Ring		
NLCD Value	NLCD 2011 Description	Auer's Code	Auer's Class	Cell Count	Percentage	Totals
23	Developed, Medium Intensity	R2/R3	Urban	3,562	11.34%	19.88%
24	Developed, High Intensity	I1/I2/C1		2,683	8.54%	
11	Open Water	A5	Rural	5,379	17.13%	80.12%
21	Developed, Open Space	A1/R4		2,644	8.42%	
22	Developed, Low Intensity	R1		4,090	13.02%	
31	Barren Land (Rock/Sand/Clay)	A3		81	26.00%	
41	Deciduous Forest	A4		5,825	1.67%	
42	Evergreen Forest	A4		0	0.00%	
43	Mixed Forest	A4		6	0.00%	
52	Shrub/Scrub	A4		69	0.22%	
71	Grassland/Herbaceous	A3		45	0.14%	
81	Pasture/Hay	A3		216	0.69%	
82	Cultivated Crops	A2		6,989	22.25%	
90	Wood Wetlands	A4		4,699	14.96%	
95	Emergent Herbaceous Wetlands	A3		421	1.34%	
Analysis based on 30 meter by 30 meter raster cells extracted for each area.			*Grand Totals:*	*31,409*	*100.00%*	

3.5.2.3 Emissions

The most recent three years of actual emissions were used to represent the emissions that would simulate the impacts of a three-year monitoring dataset for determining compliance with the NAAQS. In this application, actual emissions were used from the 2012-2014.

Determining the sources to model in the Wood River Study Area consisted of compiling a list from the state inventory database of SO_2 sources within a 10 km radius of the Wood River Power Station, while also evaluating the potential for sources beyond 10 km to cause a significant concentration gradient within the area. In the case of the Wood River Study Area, there were five facilities (see Figure 23) identified and included in the modeling within the 10 km area with actual SO_2 emissions greater than 0.5 tons per year in one of the three years evaluated. They are the Wood River Power Station, WRB Refining Inc. (formerly named ConocoPhillips), Alton Steel, Inc., Christ Brothers Products LLC, and National Maintenance and Repair facilities. The Ameren UE Sioux Power Plant, located just west of Portage Des Sioux, Missouri, was also included in the modeling due to its tall stacks and high annual emissions. It is located approximately 18 kilometers west-northwest of the center of the study area. There were seven additional facilities examined in the Wood River Study Area. All reported actual emissions of less than half a ton per year in any of the years 2012-2014, thus they are not explicitly modeled and their impacts are considered to be represented by existing background monitoring. In summary, six facilities were considered to have a potential significant impact gradient impact in the study area where maximum concentrations are expected. Each facility and its modeled actual emissions for 2012-2014 are presented in Table 16.

Table 16
Modeled Facility Actual Emissions – Wood River Study Area

Company I.D.	Facility Name	SO_2 Emissions (tons per year)		
		2012	2013	2014
119020AAE	Wood River Power Station	6,719.49	7,662.27	7,034.66
119090AAA	WRB Refining LLC	1,966.48	1,203.08	1,103.42
119010AAE	Alton Steel, Inc.	42.75	38.00	39.35
119097AAB	Christ Brothers Products	7.20	7.20	7.20
1190801AAE	National Maintenance and Repair	3.93	3.93	3.93
183-0001	Ameren Missouri Sioux Power Station	2,658.45	2,799.27	1,483.75
Total Emissions	**All Facilities**	**11,398.30**	**11,713.75**	**9,672.31**

Emissions profiles for the Wood River inventory were developed using AERMOD keyword HOUREMIS, EMISFACT, and, in some instances when lacking sufficient info to construct hourly profiles, conservatively applying the worst-case actual year to each of the three years. Illinois EPA used hourly varying 2012-2014 CEMS SO_2 emissions data provided by the Wood River Power Station for its boiler stacks in the dispersion modeling, including temporally varying exit temperature and exit velocity. For the Units 1-3 stack, a conservative worst-case emissions year was applied to all three years. WRB Refining provided three years of hourly varying emissions, temperature, and exit velocity for their operating units/stacks for the modeling period. For Alton Steel, operating schedule and yearly emissions provided by the company for the Electric Arc Furnace (EAF) and Ladle Metallurgy Furnace (LMF) exhaust emissions allowed Illinois EPA to construct a three-year emissions profile. For the two other sources at the facility, a conservative worst-case emissions year was applied to all three years. The worst-case emissions year was applied for the entire simulation for Christ Brothers and National Maintenance and Repair. Hourly CEMS SO_2 emissions data were used for the Ameren Sioux Power Plant. In instances where seasonal throughput was available, emissions were allocated appropriately via the EMISFACT keyword in AERMOD and applied to the three-year period. For sources lacking hourly varying temperature or exit velocity, replacement values were obtained either from the Illinois EPA database or from company-provided emission reports. Please reference Appendix A for the full emissions inventory and stack parameters, including the substitution methods implemented for addressing missing or erroneous data fields within the CEMS data. For the Wood River Study Area, a total of 82 point source stacks were modeled. AERMOD's HOUREMIS keyword was applied to 75 of the point sources, while the remaining seven point sources received either worst-case emissions uniformly applied for the entire simulation period, or utilized EMISFACT to make seasonal adjustments to emissions. The electronic hourly emissions file is included in this submittal via the DVD located in Appendix C.

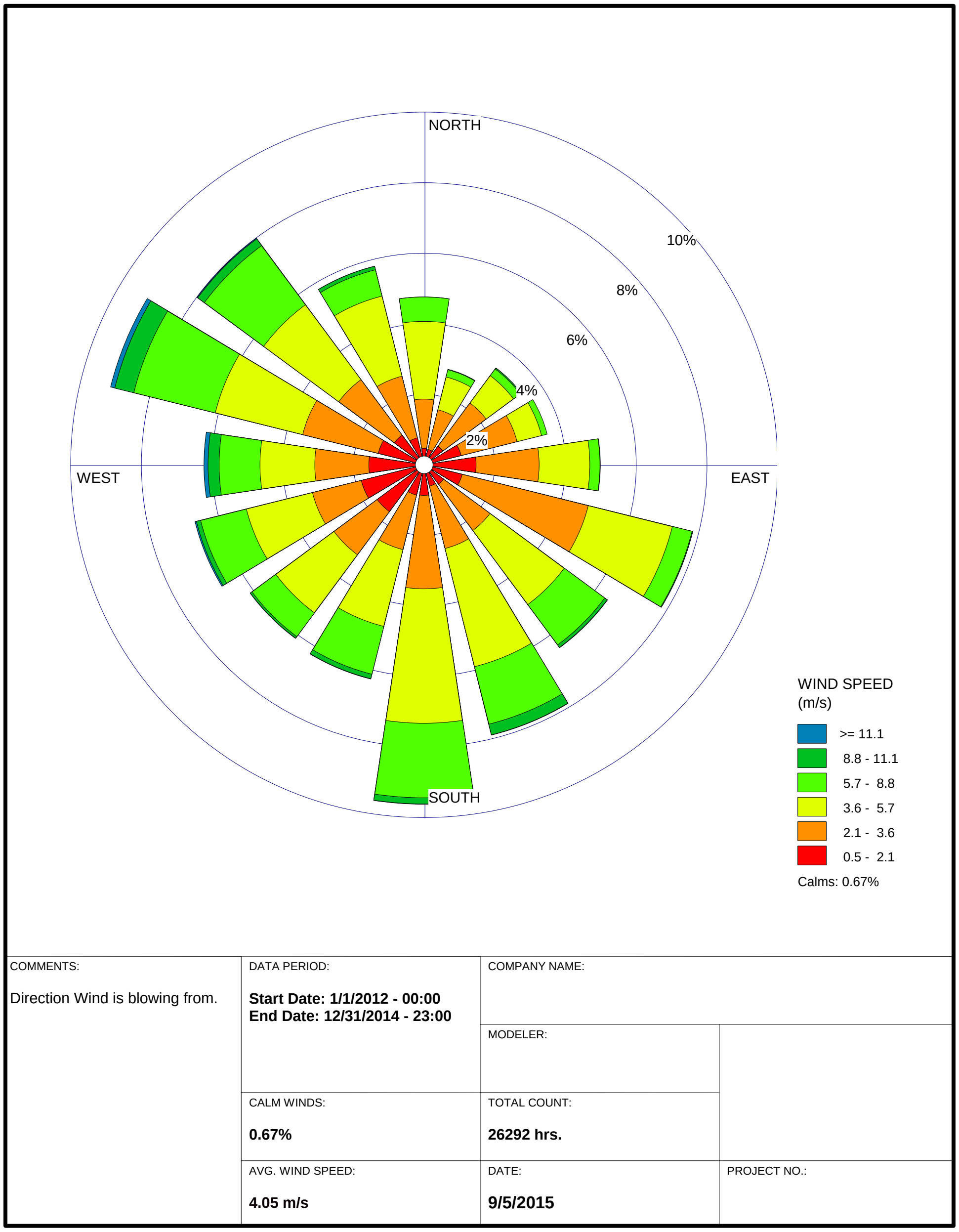
3.5.2.4 Meteorology

The SO_2 TAD recommends using the three most recent years of meteorology for use in the SO_2 Phase II Designation modeling.

The selection of a representative meteorological station for each of the study areas was based on proximity, similarity of terrain/surface roughness, and climatological consistency. For the Wood River Study Area, the National Climatic Data Center National Weather Service (NWS) surface meteorology from St. Louis, Missouri (WBAN No. 13994, 27 km to the southwest), and coincident upper air observations from Lincoln, Illinois (WBAN No. 4833, 158 km to the northeast), were selected as best representative of meteorological conditions within the study area (STL/ILX).

The three-year surface wind rose for St. Louis, Missouri, is depicted in Figure 25. The frequency and magnitude of wind speed and direction are defined in terms of where the wind is blowing from, parsed out in twelve 30-degree wind sectors. The most predominant wind direction during the three-year time period used in the modeling is from the southeast to southwest, occurring approximately 9.6% of the time. The highest percentage wind speed range, occurring 33.8% of the time, was in the 3.6 – 5.7 m/s range.

Figure 25
St. Louis, Missouri, Cumulative Annual Wind Rose
2012-2014



Meteorological data from the above surface and upper air stations were used in generating AERMOD-ready files with the AERMET processor, a part of the AERMOD software suite. The output meteorological data created by the AERMET processor is considered suitable for being applied in AERMOD for regulatory modeling applications. The methodology and settings performed in the processing of the raw meteorological data into AERMOD-ready format followed the same procedure as in the Newton Study Area. Please refer to Section 3.1.2.4 for more details on the development procedure utilized for the meteorological inputs. The Wood River Study Area AERMOD-ready ".sfc" and ".pfl" meteorological electronic files are included in this submittal via DVD located in Appendix C.

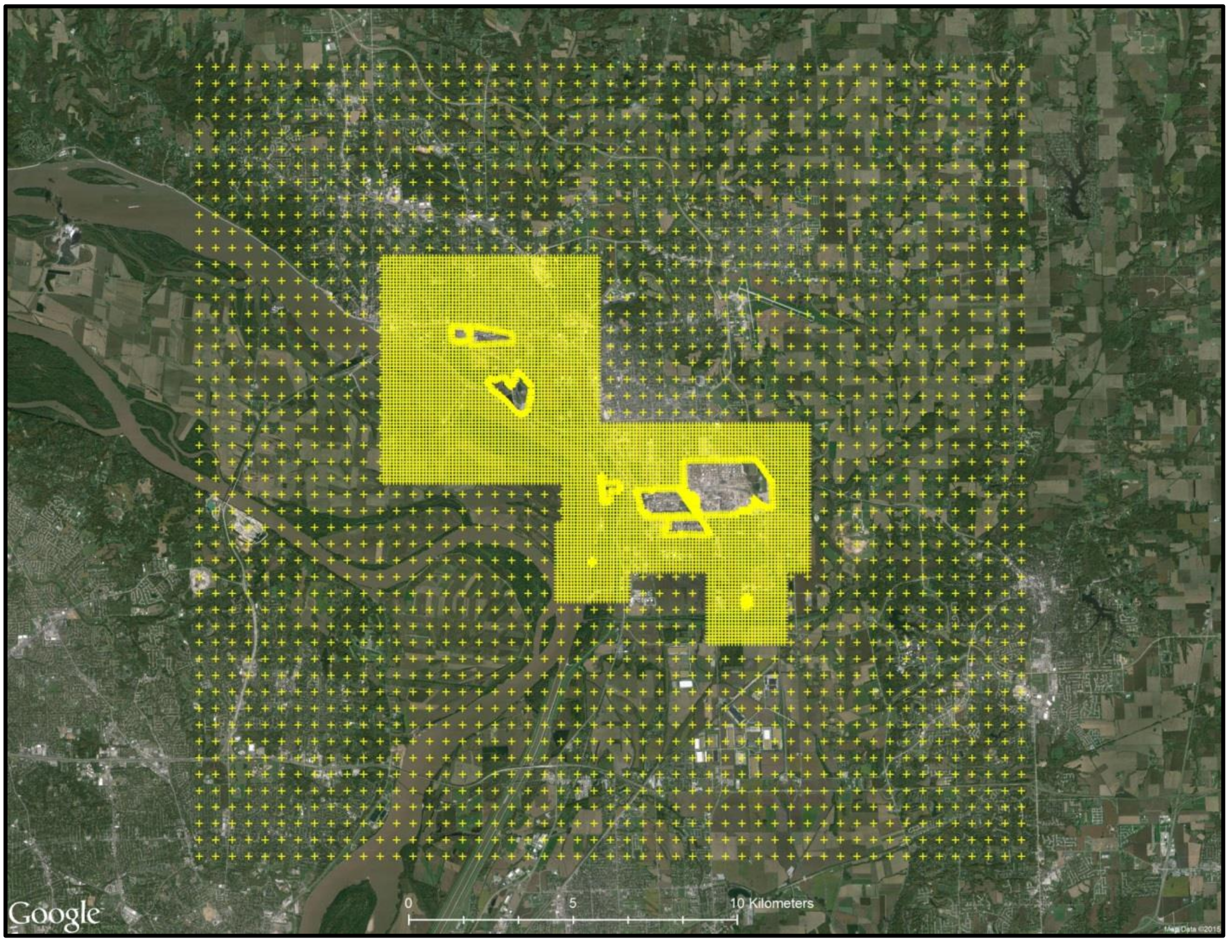
3.5.2.5 Receptor Network/Terrain

The receptor grid for the Wood River Study Area was designed to be of sufficient density and size to capture all relevant concentration gradients from modeled sources and to adequately resolve the maximum predicted SO_2 design value concentration. The receptor grid's dense 100-meter spacing was created in two distinct sections, one that surrounds the grouping of sources around the Wood River Power Station, and another that captures the impacts around the WRB Refining facility. In general, the fine 100-meter Cartesian grid was extended outward from each fenceline in the vicinity of the Power Station sources by at least two kilometers distance from each facility (extent may vary slightly by direction) and by at least one kilometer from the smaller facilities south of WRB Refining. The entire study area receptor spacing was approximately:

- 50 meters along the fenceline (six facilities)
- 100 meters from the fenceline out to 1.0 to 2.0 kilometers
- 500 meters from 1.0 to 2.0 kilometers out to 9.0 kilometers

The Wood River Study Area receptor grid is presented in Figure 26. The receptor count totaled 11,746 receptors, covering extreme west-central Madison County in Illinois, and eastern edges of St. Louis and St. Charles Counties in Missouri. The terrain in the study area is best characterized as flat to gently rolling and is bisected northeast to southeast western extent by the Mississippi River. To account for terrain changes, the AERMAP terrain program was used to develop terrain and hill scale height for all the receptors. The source of the elevation data incorporated into the model is from the USGS National Elevation Database (NED).

Figure 26
Receptor Grid – Wood River Study Area



3.5.2.6 Background SO_2

The regional sources not explicitly modeled in AERMOD, but best characterized as background contributors to SO_2 near or in the study area, are addressed via background monitoring data. U.S. EPA recommends inclusion into the model data from the nearest representative background SO_2 monitor operated by state, local, or tribal organizations. The East St. Louis, Illinois monitor was selected for the Wood River Study area. The East St. Louis monitor is located approximately 28 kilometers south of the study area in northwestern St. Clair County and is ideally suited to characterize contributions from background sources in semi-urbanized environment of the St. Louis MSA area. The monitor, operated and maintained by Illinois EPA, has validated hourly SO_2 concentrations for the three years modeled in this analysis (2012-2014).

For this modeling application, Illinois EPA employed temporally-varying background 1-hour concentrations developed from the East St. Louis, Illinois, monitor. The values developed for inputs into AERMOD for background are based on the 99th percentile monitored concentrations vary by season and hour in the same manner as in the previously discussed study areas. For modeled design value impacts for comparison to the standard reported here, the maximum impacts *include* the contribution of background. A table of the background SO_2 seasonally and hourly varying values utilized in the Wood River Study Area modeling is provided in Appendix B.

3.5.3 Summary of Results

The AERMOD simulation for the Wood River Study Area comprised 82 stacks, 527 structures, 10 fencelines, and 11,746 receptors. The model simulated 2012-2014, combining emissions, meteorology, terrain, and background SO_2 levels into the model to calculate a maximum 99th percentile 1-hour SO_2 concentration for each receptor in the grid. The results presented in Table 14 report the magnitude and geographic location of the highest predicted concentration.

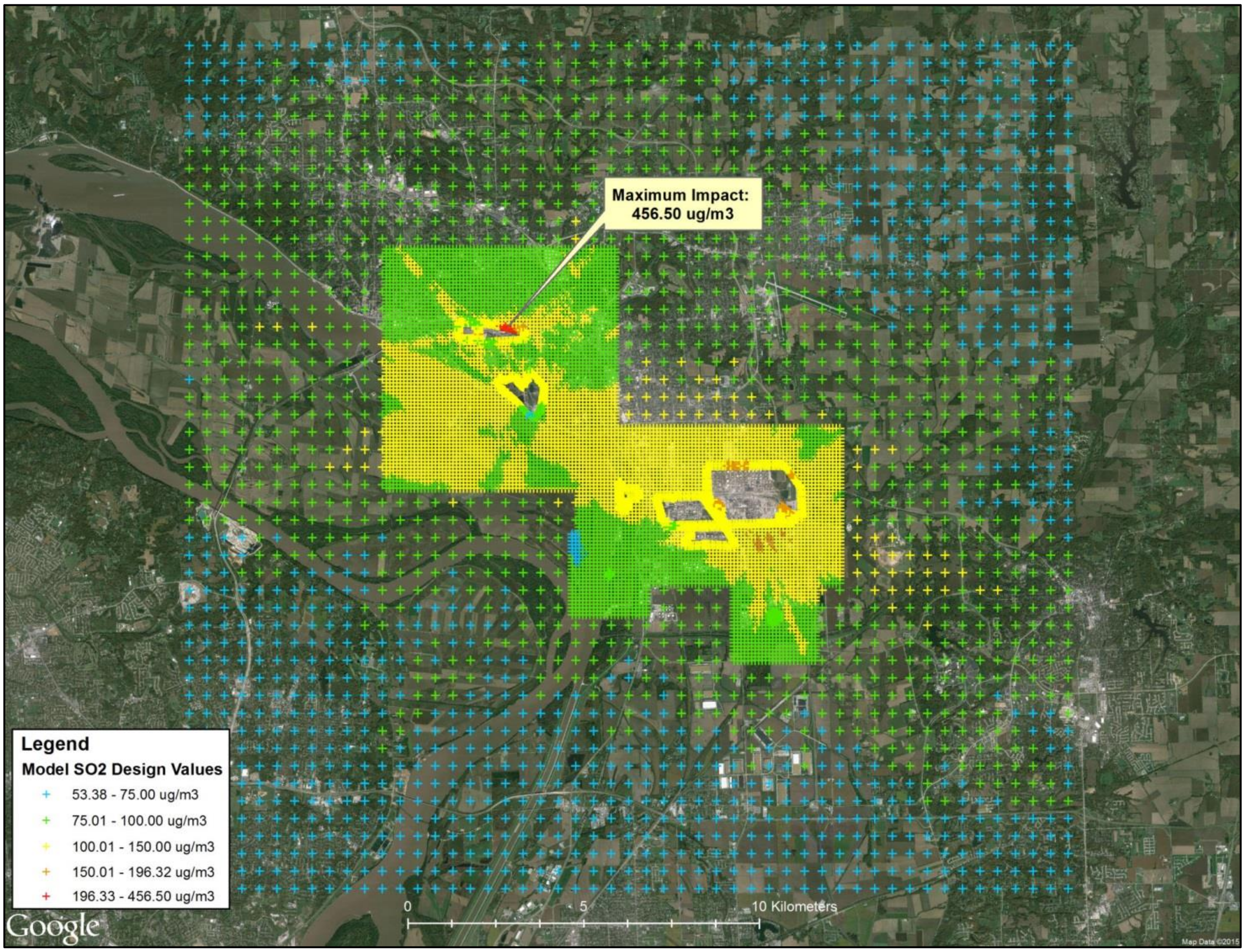
Table 17
Maximum Predicted 99th Percentile 1-Hour SO_2 Concentration
Wood River Study Area

Averaging Period	Data Period	Receptor Location (Meters)		SO_2 Concentration ($\mu g/m^3$)	
		East	North	Modeled	NAAQS
99th Percentile 1-Hour Average	2012-2014	748051	4307978	**456.50**	**196.23***

* Equivalent to the 75 ppb standard

The maximum predicted 99th percentile 1-hour average concentration within the modeling domain is 460.50 $\mu g/m^3$, or 174.2 ppb. The maximum occurred within the dense 100-meter grid approximately 2.5 kilometers northwest of the Wood River Power Station main stacks. The maximum occurred on the north fenceline of Alton Steel, Inc. The colored contour map of maximum 99th percentile concentrations presented in Figure 27 depicts maximum predicted concentration for each receptor in the study area and indicates the location of the predicted maximum.

Figure 27
Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations - Wood River Study Area

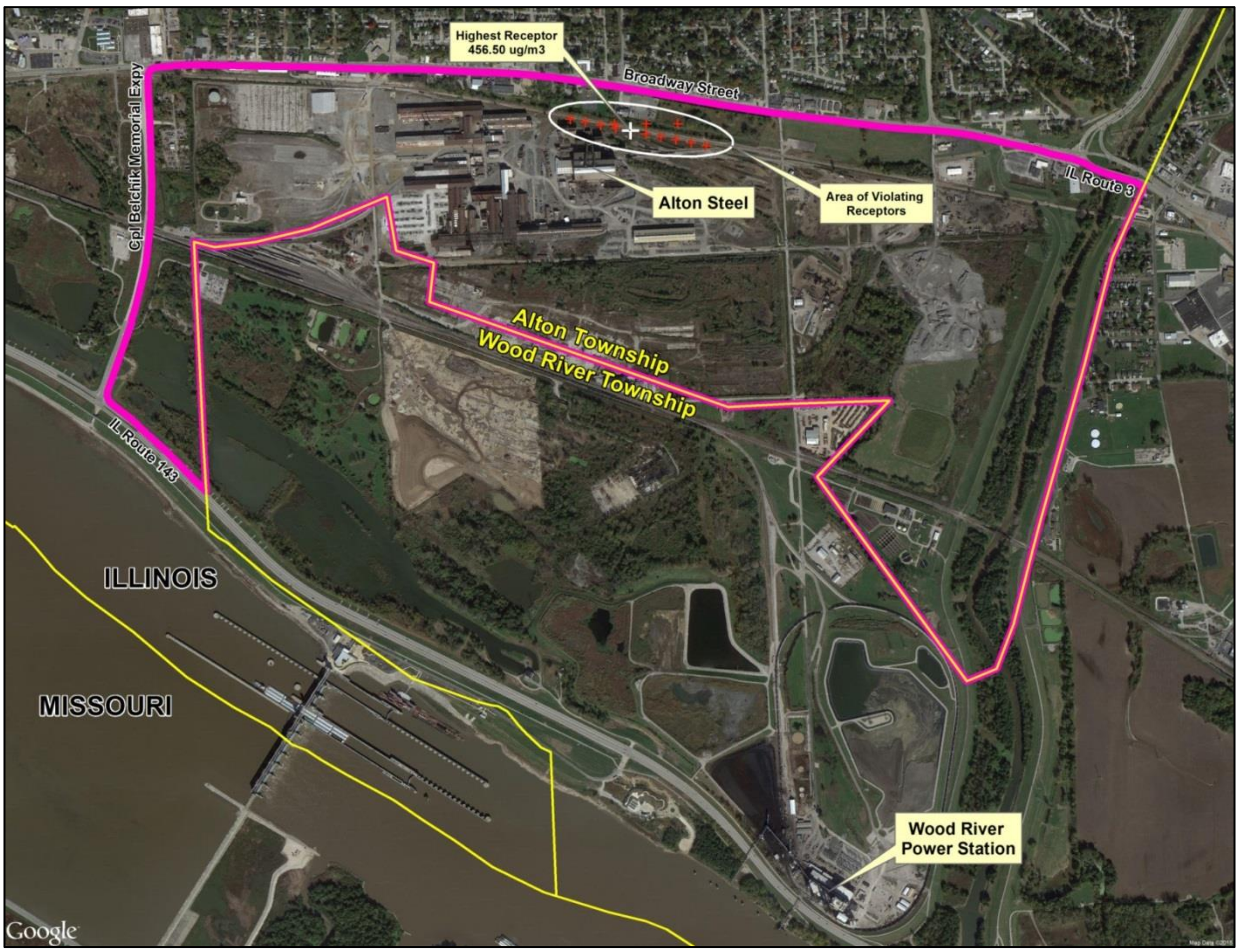


3.5.4 Designation Recommendation

The modeling results indicate there are 14 receptors along and near (within 100 meters) of the north fenceline of the Alton Steel facility predicted to exceed the 99th percentile 1-hour SO_2 standard. Culpability modeling analyses indicate that four SO_2 stacks at Alton Steel related to their LMF process are causing these violations. These four stacks point down toward the ground at a 45 degree angle from the south side of the LMF baghouse structure and are heavily influenced by downwash from the Electric Furnace Shop building. Due to the “hotspot” nature of the modeled violations and their close proximity to the Alton Steel facility, Illinois EPA recommends that a portion of Madison County be designated as **nonattainment** for the 2010 1-hour SO_2 NAAQS – specifically, that portion of southern Alton Township that is east of the Corporal Belchik Memorial Expressway, south of East Broadway Street and Illinois Route 3, and north of Illinois Route 143, as shown in Figure 28.

Per U.S. EPA's guidance, this area contains both the violating receptors and the emission sources causing or contributing to nonattainment. Illinois EPA also recommends that all of Wood River Township and that portion of Chouteau Township north of the Cahokia Diversion Channel be designated as **attainment**. Lastly, the Illinois EPA recommends that the remainder of Madison County be designated as **unclassifiable** due to the presence of additional large SO_2 emitting facilities in other parts of the county that will likely need to be addressed later by the Illinois EPA in accordance with the Data Requirements Rule (DRR).

Figure 28
Proposed Nonattainment Area Boundary for the Wood River Study Area



4.0 Summary

The Illinois EPA has conducted a five factor analysis that relies heavily upon the results of dispersion modeling to support recommendations for 1-hour SO_2 NAAQS area designations under the March, 2015, consent decree between U.S. EPA, Sierra Club, and the Natural Resources Defense Council. That analysis specifically addressed five power plants in Illinois: Newton Power Station (Jasper County), Hennepin Power Station (Putnam County), Joppa Steam Coal Power Plant (Massac County), Marion Power Station (Williamson County) and Wood River Power Station (Madison County).

With the exception of Madison County, the Illinois EPA is recommending attainment for the presumptive area boundary (countywide) in which the power plant is located. In the case of the Hennepin Power Station, the Illinois EPA is also recommending attainment status for all of Bureau County, which is located across the Illinois River from the power plant. Modeled concentrations in Bureau County were well below the NAAQS, and the aggregate contribution of all SO_2-emitting sources in Bureau County is less than five tons per year (actual emissions, based upon Illinois EPA's ICEMAN 2011 database).

Modeling conducted for the Wood River Power Station (Madison County) has yielded sub-county area recommendations for attainment, nonattainment, and unclassifiable. There is a small area in Alton Township (south of East Broadway and adjacent to the Alton Steel, Inc. facility) where modeled impacts exceed the NAAQS. This area is recommended for nonattainment; however, the Agency fully expects that corrective measures will be taken that will enable a modeling demonstration of compliance with the NAAQS by January 15, 2016. Wood River Township contains the Wood River Power Station, and this area along with that portion of Chouteau Township north of the Cahokia Diversion Channel is recommended for attainment. All other portions of Madison County are recommended as unclassifiable.

5.0 References

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U.S. EPA (August 2015) *Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide Primary National Ambient Air Quality Standard*

6.0 Appendices

Appendix A
Emission Inventories for the Study Areas

Newton Study Area Emission Inventory

AERMOD	Source Description	Receptor Location (Meters)		Stack Height	Temperature/Exit Velocity	Stack Diameter	Emissions Profile
Source ID		East	North	(m)	(K/m/s)	(m)	
0003	Unit 1 Stack (Newton PS)	389291.7	4310518.4	161.54	**See Hourly File**	5.49	A
0012	Unit 2 Stack (Newton PS)	389333.4	4310458.9	161.54	**See Hourly File**	7.32	A

A: CEMS Data, hourly varying emissions, temperature, exit velocity

In hours with mass emissions, but no temperature/flow rates, the following constants were used (based on Annual Emission Report data/Illinois EPA ICEMAN database):
0003: Exit temperature = 325.93 deg. K, Exit velocity = 24.87 m/s
0012: Exit temperature = 431.48 deg. K, Exit velocity = 23.08 m/s

Hennepin Study Area Emission Inventory

AERMOD	Source Description	Receptor Location (Meters)		Stack Height	Temperature/Exit Velocity	Stack Diameter	Emissions Profile
Source ID		East	North	(m)	(K/m/s)	(m)	(g/s)
0001	Units #1 & 2 (Hennepin PS)	306166.52	4575006.81	84.43	**See Hourly File**	4.40	A
0001AA	Drum Mix Asphalt Plant (Advanced Asphalt)	307876.16	4574736.14	10.67	**See Hourly File**	1.37	B
0002AA	Asphalt Tank Heaters/Boilers (Advanced Asphalt)	307859.69	4574716.20	4.57	**See Hourly File**	1.13	B
0004HE	RTO Stack (Marquis Energy)	305795.48	4572111.48	39.62	**See Hourly File**	1.68	B
0010WM	Silicone Carbide Baghouse Furnace (Wash Mills)	307362.24	4574653.98	32.92	**See Hourly File**	2.44	C
0014WM	Sulfurox Boiler Stack (Wash Mills)	307450.02	4574642.25	5.18	**See Hourly File**	0.305	D
0018WM	Product Dryer Combustion (Wash Mills)	307305.83	4574293.85	8.23	**See Hourly File**	0.85	D
0001HE	Boiler East Stack (Marquis Energy)	305737.18	4572069.79	24.38	449.82/13.71	1.52	E
0016HE	Boiler West Stack (Marquis Energy)	305727.08	4572070.01	24.38	449.82/13.71	1.52	E
0011HE	Loadout Flare (Marquis Energy)	305698.09	4572090.90	9.14	668.71/20.53	0.43	E
0017HE	Boiler No. 3 Stack (Marquis Energy)	305729.23	4572094.94	24.38	470.37/19.14	1.52	E
0005	Heating Boiler Stack (Hennepin PS)	306155.92	4574977.64	47.24	644.26/15.69	0.61	5.29E-04

A: CEMS Data, hourly varying emissions, temperature, exit velocity
B: Hourly Profile of Emissions based on seasonal operation/throughput from Annual Emissions Reports
C: Hourly emissions profile based on data provided by company
D: Hourly emissions profile based on yearly/monthly operation and throughput, provided by company
E: Use EMISFACT, seasonal emissions averaged over 2012-2014, multiply by scalar per season

* In hours with mass emissions, but no temperature/flow rates, the following constants were used (based on Annual Emission Report data/Illinois EPA ICEMAN database):
0001: Exit temperature = 325.93 deg. K, Exit velocity = 24.87 m/s
0001AA: Exit temperature = 427.64 deg. K, Exit velocity = 20.32 m/s
0002AA: Exit temperature = 455.97 deg. K, Exit velocity = 8.195 m/s
0004HE: Exit temperature = 466.48 deg. K, Exit velocity = 18.60 m/s
0010WM: Exit temperature = 754.32 deg. K, Exit velocity = 16.71 m/s
0014WM: Exit temperature = 355.37 deg. K, Exit velocity = 40.45 m/s
0018WM: Exit temperature = 355.37 deg. K, Exit velocity = 11.87 m/s

Marion Study Area Emission Inventory

AERMOD	Source Description	Receptor Location (Meters)		Stack Height	Temperature/Exit Velocity	Stack Diameter	Emissions Profile
Source ID		East	North	(m)	(K/m/s)	(m)	(g/s)
0003	Unit No. 4 (Marion PS)	327601.09	4165324.96	121.92	324.82/15.17	4.40	A 90.72
0011	Turbine No. 5 (Marion PS)	326901.44	4165425.60	17.07	590.37/22.85	1.37	A 7.430976
0012	Turbine No. 6 (Marion PS)	326839.03	4165425.94	17.07	590.37/22.85	1.13	A 7.430976
0013	CFB Boiler Unit (Marion PS)	327700.40	4165369.62	59.13	392.04/12.22	1.68	A 52.983
0008USP	Boiler No. 1 (U.S. Penitentiary)	324736.94	4170242.33	14.33	460.93/6.83	2.44	B 0.00128
0009USP	Boiler No. 2 (U.S. Penitentiary)	324734.73	4170239.55	13.41	460.93/33.80	0.305	B 0.00128
0010USP	Boiler No. 3 (U.S. Penitentiary)	324733.35	4170242.39	14.33	460.93/6.83	0.85	B 0.00128
0011USP	Boiler No. 3 (U.S. Penitentiary)	324725.90	4170243.57	14.33	460.93/21.45	1.52	B 0.00128

A: Maximum actuals

B: Hourly emissions profile based on reported actuals per Annual Emissions Reports, modeling assumed 365-52-24-7 operation

Joppa Study Area Emission Inventory

AERMOD	Source Description	Receptor Location (Meters)		Stack Height	Temperature/Exit Velocity	Stack Diameter	Emissions Profile
Source ID		East	North	(m)	(K/m/s)	(m)	(g/s)
0001	Boiler Units No. 1 & 2 (Joppa PS)	335066.99	4119612.77	152.4	**See Hourly File**	5.49	A
0001MP	Turbine CT-01 (MEPI)	334437.92	4120723.30	17.07	**See Hourly File**	4.51	B
0002	Boiler Units No. 3 & 4 (Joppa PS)	335109.60	4119719.05	152.4	**See Hourly File**	5.49	A
0002MP	Turbine CT-02 (MEPI)	334424.15	4120699.46	16.26	**See Hourly File**	4.51	B
0003	Boiler Units No. 3 & 4 (Joppa PS)	335153.93	4119837.40	152.40	**See Hourly File**	5.49	A
0004MP	Turbine CT-04 (MEPI)	334374.85	4120613.27	14.02	**See Hourly File**	3.35	B
0005MP	Turbine CT-05 (MEPI)	334401.35	4120598.14	14.02	**See Hourly File**	3.35	B
0052LF	Kiln No. 2 (Lafarge)	332959.00	4120523.60	76.20	**See Hourly File**	2.59	B
0062HW	Waste Gas Incinerator (Honeywell)	344072.90	4115307.26	47.24	**See Hourly File**	2.13	C
0066LF	Kiln No. 1 (Lafarge)	332967.00	4120560.10	45.72	**See Hourly File**	3.66	B
TVA_EAST	Boiler 1-5 Stack (TVA-Shawnee)	342378.96	4113169.92	242.93	**See Hourly File**	8.50	D
TVA_WEST	Boiler 6-50 Stack (TVA-Shawnee)	342059.04	4113372.78	242.93	**See Hourly File**	8.50	D
0001TG	Engine 5801 (Trunkline Gas)	334536.69	4121295.99	12.80	677.59/25.87	0.61	E
0002TG	Engine 5802 (Trunkline Gas)	334545.24	4121295.73	12.80	677.59/25.87	0.61	E
0003TG	Engine 5803 (Trunkline Gas)	334554.06	4121295.41	12.80	677.59/25.87	0.61	E
0005TG	Engine 5805 (Trunkline Gas)	334571.88	4121294.89	13.41	660.93/19.60	0.76	E
0006TG	Engine 5806 (Trunkline Gas)	334580.63	41211294.64	13.41	660.93/19.60	0.76	E
0007TG	Engine 5807 (Trunkline Gas)	334560.99	4121462.88	14.94	677.59/13.98	1.98	E

A: CEMS Data, hourly varying emissions, temperature, exit velocity
B: Hourly varying emissions, temperature, exit velocity profile based on data provided by company
C: Hourly Profile of Emissions based on seasonal operation/throughput from Annual Emissions Reports (AER's)
D: CEMS Data, hourly varying emissions obtained from U.S. EPA Air Market Program Data (CAMD)/SO_2 NAAQS Modeling Data made available from U. S. EPA specifically for modeling
E: Use EMISFACT, seasonal emissions averaged over 2012-2014, multiply by scalar per season

* In hours with mass emissions, but no temperature/flow rates, the following constants were used (based on Annual Emission Report data/Illinois EPA Database):

0052LF and 0066LF: Exit temperature = 325.93 deg. K, Exit velocity = 24.87 m/s - modulated hourly exit velocity for each year's average around the constant based on flow rate changes per CAMD.
TVA_WEST: Exit temperature = 422.09 deg. K, Exit velocity = 29.814 m/s (from KDAQ) – modulated hourly exit velocity for each year's average around the constant based on flow rate changes per CAMD.
TVA_EAST: Exit temperature = 429.87 deg. K, Exit velocity = 29.639 m/s (from KDAQ) – modulated hourly exit velocity for each year's average around the constant based on flow rate changes per CAMD.

Wood River Study Area Emission Inventory

AERMOD	Source Description	Receptor Location (Meters)		Stack Height	Temperature/ Exit Velocity	Stack Diameter	Emissions Profile
Source ID		East	North	(m)	(K/m/s)	(m)	(g/s)
0001	Unit 5 Stack (WR PS)	748683.76	4305506.89	106.68	**See Hourly File**	4.57	A
0001PS	Boiler 1 Stack (Ameren Sioux PS)	735067.23	4310829.84	151.33	**See Hourly File***	7.19	B
0002PS	Boiler 2 Stack (Ameren Sioux PS)	735065.64	4310820.32	151.33	**See Hourly File***	7.19	B
0003	Unit 4 Stack (WR PS)	748666.89	4305531.27	76.20	**See Hourly File**	5.18	A
0004WRB	CR-1 ULD HCU STK12-4 (WRB)	754868.40	4302624.00	106.68	**See Hourly File**	4.57	C
0018WRB	DU-1 Prim Htr South STK5-2 (WRB)	454326.10	4303076.20	45.72	**See Hourly File**	2.59	C
0019WRB	DU-1 Secondary Htr STK5-1 (WRB)	754325.60	4303099.10	56.39	**See Hourly File**	2.44	C
0020WRB	SMR Htr STK12-8 (WRB)	754872.30	4302749.40	60.96	**See Hourly File**	3.66	C
0024WRB	RAU Debutanizer Htr STK5-5 (WRB)	754469.50	4302942.70	22.86	**See Hourly File**	1.52	C
0027AS1	EAF Baghouse Vent 1 (Alton Steel)	747898.46	4307951.71	30.48	**See Hourly File**	7.38	D
0027AS2	EAF Baghouse Vent 2 (Alton Steel)	747956.48	4607951.71	30.48	**See Hourly File**	7.38	D
0027WRB	CAU RO Still Heater STK5-4 (WRB)	754467.40	4302962.50	25.91	**See Hourly File**	2.20	C
0043WRB	Catalytic Cracking Unit 2 (WRB)	454847.70	4302894.50	53.34	**See Hourly File**	3.35	C
0050WRB	HCF Furnace STK12-3 (WRB)	754723.80	4302515.50	54.56	**See Hourly File**	1.92	C
0052AS1	LMF Baghouse Vent 1 (Alton Steel)	747874.75	4307823.77	15.24	**See Hourly File**	1.06	D
0052AS2	LMF Baghouse Vent 2 (Alton Steel)	747878.53	4307823.77	15.24	**See Hourly File**	1.06	D
0052AS3	LMF Baghouse Vent 3 (Alton Steel)	747883.19	4307823.77	15.24	**See Hourly File**	1.06	D
0052AS4	LMF Baghouse Vent 4 (Alton Steel)	747886.84	4307823.77	15.24	**See Hourly File**	1.06	D
0056WRB	HCNHT Furnace STK12-1 (WRB)	754574.80	4302695.20	32.61	**See Hourly File**	1.22	C
0060WRB	Alky HM-1 Heater STK6-5 (WRB)	755121.20	4302814.40	28.96	**See Hourly File**	2.29	C
0061WRB	Alky HM-2 Heater STK6-6 (WRB)	754829.00	4303042.40	46.02	**See Hourly File**	1.75	C
0068WRB	Boiler 15 STK12-15 (WRB)	754858.70	4302776.00	40.23	**See Hourly File**	2.13	C
0069WRB	Blr16 STK12-16	754874.40	4302776.80	40.23	**See Hourly File**	2.13	C
0070WRB	Boiler 17 STK12-17	754901.20	4302783.60	45.72	**See Hourly File**	3.05	C

	(WRB)						
0071WRB	Boiler 18 STK6-9 (WRB)	754919.20	4302807.80	30.48	**See Hourly File**	1.89	C
0073WRB	HDU-1 Charge Heater STK13-1 (WRB)	755216.70	4302586.90	45.72	**See Hourly File**	1.52	C
0076WRB	HDU-2 Charge Heater STK12-14 (WRB)	755021.10	4302529.40	45.72	**See Hourly File**	1.77	C
0077WRB	CR-3 Stabilizer Re-boiler H-2 STK12-9 (WRB)	755013.20	4302579.70	45.72	**See Hourly File**	2.38	C
0078WRB	CR-3 Regen Heater H-3 STK12-10 (WRB)	755014.40	4302581.60	45.72	**See Hourly File**	2.38	C
0079WRB	CR-3 Charge Heater H-4 STK12-11 (WRB)	755018.30	4302570.40	45.72	**See Hourly File**	2.38	C
0080WRB	CR-3 First Interreactor Heater H-5 STK12-13 (WRB)	755018.70	4302546.80	45.72	**See Hourly File**	2.38	C
0081WRB	CR-3 Second lnterreactor Heater H-6 STK12-12 (WRB)	755018.60	4302558.00	45.72	**See Hourly File**	2.38	C
0083WRB	DHT Charge Heater STK12-5 (WRB)	755017.50	4302643.50	45.72	**See Hourly File**	1.62	C
0120WRB	F-200 F-202 F-203 F-204 F-205 STK5-3 (WRB)	754414.80	4303015.80	95.10	**See Hourly File**	4.27	C
0124WRB	VF-1 North/South Heater STK6-1 (WRB)	754718.50	4303087.60	56.39	**See Hourly File**	2.07	C
0128WRB	SRU North Oxidizer STK3-1 (WRB)	752927.80	47303076.40	38.10	**See Hourly File**	2.20	C
0144WRB	SRU South Oxidizer STK3-2 (WRB)	752928.10	4303070.40	38.10	**See Hourly File**	2.20	C
0621WRB	Distilling Flare FLR1-1 (WRB)	754277.40	4303296.20	55.21	**See Hourly File**	0.65	C
0623WRB	Arom North Flare Aromatic FLR13-1 (WRB)	755265.80	4302634.50	61.93	**See Hourly File**	0.32	C
0624WRB	Arom South Flare FLR13-2 (WRB)	755267.00	4302549.20	63.63	**See Hourly File**	0.78	C
0625WRB	North Property Flare FLR1-2 (WRB)	754485.40	4303321.20	65.48	**See Hourly File**	1.64	C
0628WRB	Boiler 4 STK9-1 (WRB)	752782.10	4302397.30	22.86	**See Hourly File**	1.22	C
0629WRB	Boiler 5 STK9-3 (WRB)	752762.93	4302362.97	22.86	**See Hourly File**	2.13	C
0633WRB	DCU Charge Heater H-20 STK10-2 (WRB)	753183.30	4302406.70	54.86	**See Hourly File**	1.52	C

AERMOD	Source Description	Receptor Location (Meters)		Stack Height	Temperature/ Exit Velocity	Stack Diameter	Emissions Profile
Source ID		East	North	(m)	(K/m/s)	(m)	(g/s)
0643WRB	Catalytic Cracking Unit No. 1 STK6-2B (WRB)	754863.70	4302894.50	53.34	**See Hourly File**	3.35	C
0685WRB	Alky Flare FLR6-1 (WRB)	755034.60	4303080.00	66.77	**See Hourly File**	1.62	C
0702WRB	VF-4 Charge Heater H-28 STK9-6 (WRB)	753053.00	4302387.20	54.86	**See Hourly File**	1.37	C
0703WRB	DCU Preheater H-36 STK10-3 (WRB)	753193.20	4302396.10	54.86	**See Hourly File**	1.83	C
0704WRB	DU-4 Charge Heater H-24 STK9-5 (WRB)	753050.90	4302412.20	54.86	**See Hourly File**	2.59	C
0705WRB	Heat Medium Furnace H-35 STK9-4 (WRB)	752802.50	4302398.30	45.72	**See Hourly File**	1.83	C
0706WRB	HP-1 Flare FLR12-2 (WRB)	755193.80	4302792.10	43.09	**See Hourly File**	0.94	C
0709WRB	HP-1 Heater STK12-6 (WRB)	755193.00	4302792.10	38.71	**See Hourly File**	2.29	C
0711WRB	ULD H-4 Re-boiler STK12-2 (WRB)	755038.00	4302710.50	39.78	**See Hourly File**	1.80	C
0712WRB	SZorb Heater STK13-3 (WRB)	755218.20	4302666.40	45.72	**See Hourly File**	2.90	C
0715WRB	Distilling West Flare FLR10-1 (WRB)	753646.00	4302545.40	61.55	**See Hourly File**	0.38	C
0716WRB	SZU Stack (0716) (WRB)	755240.90	4302682.20	13.49	**See Hourly File**	0.61	C
0717WRB	Benzene Extraction Unit Heater H-3 STK6-4 (WRB)	754922.50	4302928.90	56.39	**See Hourly File**	2.96	C
0718WRB	Lubes Flare FLR12-1 (WRB)	754609.60	4302495.50	48.79	**See Hourly File**	0.40	C
0724WRB	VOC Flare (West) FLR4-1 (WRB)	753427.00	4303072.60	10.82	**See Hourly File**	0.43	C
0725WRB	VOC Flare (East) FLR4-2 (WRB)	753440.50	4303073.00	10.82	**See Hourly File**	0.43	C
0726WRB	Coker North Flare FLR1-3 (WRB)	754946.10	4303683.30	60.96	**See Hourly File**	0.39	C
0727WRB	VF-5 Heater/H350H4 STK1-1 (WRB Refining)	754936.80	4303458.30	60.96	**See Hourly File**	3.05	C
0728WRB	Coker North Heater/H351H2 STK1-2 (WRB)	754952.70	4303304.10	64.01	**See Hourly File**	3.05	C
0729WRB	Coker North Heater/H351H1 STK1-3 (WRB)	754985.20	4303304.90	64.01	**See Hourly File**	3.05	C
0730WRB	DCNH Heater/H353H3 STK1-4 (WRB)	754903.70	4303543.30	24.38	**See Hourly File**	0.64	C
0731WRB	SRUF Oxdizr STK3-3	752913.10	4303020.00	60.66	**See Hourly File**	1.22	C

0732WRB	SRU-E Oxidizer STK3-4 (WRB)	753001.50	4303022.90	60.66	**See Hourly File**	1.22	C
0735WRB	HP-2 Flare FLR7-1 (WRB)	755262.00	4302919.70	43.09	**See Hourly File**	0.94	C
0736WRB	HP-2 Heater STK7-1 (WRB)	755262.90	4302919.70	39.62	**See Hourly File**	3.84	C
0739WRB	NHT Charge Heater H-21 STK10-1 (WRB)	753160.30	4302411.90	30.48	**See Hourly File**	1.37	C
0900WRB	CR-1 Regen Vent STK12-18 (WRB)	754883.68	4302607.56	17.68	**See Hourly File**	0.15	C
0901WRB	CR-3 Regen Vent STK 12-19 (WRB)	755029.45	4302593.48	9.14	**See Hourly File**	0.09	C
0902WRB	Misc Unit (WRB)	754669.60	4303047.00	19.81	**See Hourly File**	1.22	C
0903WRB	STK6_2	754647.80	4303005.50	19.81	**See Hourly File**	1.13	C
FLR_MVC	Barge Loading Flare (WRB Refining)	751375.17	4302867.10	12.19	**See Hourly File**	1.22	C
0031AS	14 inch rolling mill reheat furnace (Alton Steel)	747645.22	4307691.38	32.31	366.48/0.73	4.88	E 0.0076
0099AS	Caster (Alton Steel)	747849.10	4307673.65	19.81	294.26/0.001	9.00	E 8.0E-04
0001CB	Drum Mix Asphalt Stack (CBP)	755684.51	4299821.86	9.75	394.82/16.34	1.25	F
0003CB	Asphalt Tank Heaters and Boilers (CBP)	755700.20	4299839.80	9.45	486.48/11.05	1.04	F
0002NM	Cleaver Brooks boiler Stack 1 of 2 (NM)	750915.14	4300903.33	10.36	505.37/7.12	0.61	F
0004NM	Cleaver Brooks boiler Stack 2 of 2 (NM)	750918.74	4300902.96	10.36	505.37/7.12	0.61	F

A: CEMS Data, hourly varying emissions, temperature, exit velocity provided by company.
B: CEMS Data for emissions, constant temperature, varying exit velocity based on Emissions modeling Clearinghouse State-Level Hourly Sulfur Dioxide Data- flow modulation around a constant.
http://www.epa.gov/ttn/chief/emch/index.html
C: Hourly varying emissions, temperature, exit velocity based on data provided by company
D: Uniformly distributed hourly emissions based on company provided daily operating schedule per year, used constant for temperature/exit velocity profile based on Illinois EPA Database/AER data provided by company
E: Distribute worst-case actual Annual Emissions year, to all 3years, applied uniformly for each hour
F: Use worst-case Annual Emissions year 2012-2014 for all 3 years, apply EMISFACT seasonally, and multiply by scalar per season.

* In hours with mass emissions, but no temperature/flow rates, the following constants were used (based on Annual Emission Report data/Illinois EPA ICEMAN database):
0001: Exit temperature = 416.48 deg. K, Exit velocity = 19.798 m/s
0003: Exit temperature = 394.26 deg. K, Exit velocity = 8.511 m/s
0001PS: Exit temperature = 330.37 deg. K, Exit velocity = 16.62 m/s – modulated hourly exit velocity for each year's average around the constant based on flow rate changes per U.S EPA SO_2 NAAQS CAMD derived inventory.
0003PS: Exit temperature = 330.37 deg. K, Exit velocity = 16.62 m/s – modulated hourly exit velocity for each year's average around the constant based on flow rate changes per U.S EPA SO_2 NAAQS CAMD derived inventory.

Appendix B
Background SO_2 Data for Modeling

Nilwood*, Illinois Monitor
Season* and Hourly Varying Background SO_2
<u>Newton Study Area</u>

Hour of Day	SO_2 Concentration (µg/m3)			
	Winter	Spring	Summer	Fall
1	7.77	4.01	3.84	4.62
2	7.50	4.19	5.32	4.80
3	8.55	4.25	3.93	5.67
4	7.68	5.06	5.58	4.80
5	7.59	4.10	4.80	5.67
6	7.50	4.45	6.02	5.50
7	7.24	4.89	7.33	5.58
8	7.15	8.11	8.64	5.76
9	8.81	10.91	10.03	8.73
10	12.13	11.60	12.04	9.51
11	15.36	13.44	11.43	13.79
12	13.00	12.30	10.91	15.53
13	13.96	10.47	8.29	15.01
14	13.61	8.73	8.64	12.56
15	11.95	7.59	8.38	10.38
16	11.60	9.07	6.19	9.95
17	11.52	7.42	7.68	9.07
18	10.30	6.46	6.72	8.38
19	7.50	6.46	4.89	6.63
20	9.86	3.84	4.89	5.41
21	9.07	4.62	5.06	5.50
22	6.63	4.10	4.01	5.76
23	7.24	3.58	3.32	5.41
24	7.59	3.66	4.97	5.15

* Monitor Latitude/Longitude Coordinates: (+39.396075 –89.80974)
** Seasons defined as: Winter (Dec, Jan, Feb), Spring (Mar, Apr, May), Summer (Jun, Jul, Aug), Fall (Sep, Oct, Nov)

Oglesby*, Illinois Monitor
Season** and Hourly Varying Background SO_2
Hennepin Study Area

Hour of Day	SO_2 Concentration (µg/m3)			
	Winter	Spring	Summer	Fall
1	5.85	7.07	4.54	4.62
2	6.11	7.33	5.06	4.62
3	4.45	6.02	3.49	3.66
4	5.15	6.19	2.70	4.36
5	6.19	4.97	2.09	6.46
6	6.28	6.89	2.44	6.89
7	5.58	6.54	4.80	5.06
8	6.63	9.42	7.59	4.36
9	8.55	11.17	9.34	5.58
10	10.64	11.60	9.16	6.98
11	10.47	12.39	10.64	10.56
12	12.83	12.30	8.20	9.25
13	14.31	9.16	7.59	9.16
14	14.92	9.51	6.72	9.42
15	11.52	8.90	7.33	7.85
16	10.38	6.54	6.72	8.03
17	11.08	7.15	7.68	7.94
18	8.81	7.24	6.89	7.07
19	8.64	8.64	7.15	5.67
20	6.98	8.20	4.80	7.33
21	7.94	9.16	4.80	5.50
22	6.37	9.34	5.67	5.58
23	6.02	7.94	4.71	4.54
24	5.76	6.72	4.62	4.80

* Monitor Latitude/Longitude Coordinates: (+41.29301 -89.04942)
** Seasons defined as: Winter (Dec, Jan, Feb), Spring (Mar, Apr, May), Summer (Jun, Jul, Aug), Fall (Sep, Oct, Nov)

Houston*, Illinois Monitor
Season** and Hourly Varying Background SO_2
Marion Study Area

Hour of Day	SO_2 Concentration (µg/m3)			
	Winter	Spring	Summer	Fall
1	5.76	6.46	4.71	5.41
2	6.46	7.42	5.76	6.37
3	7.50	7.38	4.71	6.63
4	10.12	7.33	4.45	5.93
5	9.86	6.98	4.62	6.81
6	12.65	8.03	4.80	7.77
7	10.73	8.73	7.24	7.68
8	13.00	11.26	9.51	10.82
9	13.96	14.13	17.01	10.03
10	14.48	19.81	20.94	19.54
11	19.28	18.41	27.05	17.28
12	19.37	22.51	32.81	21.03
13	18.58	15.44	26.87	19.72
14	24.61	13.61	16.49	20.94
15	26.87	11.43	17.01	13.18
16	18.06	15.79	16.23	16.23
17	16.14	15.36	14.83	12.91
18	15.09	12.83	8.99	10.30
19	12.48	8.46	8.38	9.34
20	10.38	9.07	5.41	8.81
21	7.68	6.63	3.75	9.07
22	9.69	6.19	5.32	8.38
23	11.17	7.24	3.58	5.06
24	7.50	7.24	3.93	4.89

* Monitor Latitude/Longitude Coordinates: (+38.17628 -89.78846)
** Seasons defined as: Winter (Dec, Jan, Feb), Spring (Mar, Apr, May), Summer (Jun, Jul, Aug), Fall (Sep, Oct, Nov)

Paducah[*], Kentucky Monitor
Season[**] and Hourly Varying Background SO_2
Joppa Study Area

Hour of Day	SO_2 Concentration (µg/m3)			
	Winter	Spring	Summer	Fall
1	11.34	7.85	6.11	5.24
2	13.09	10.47	3.49	4.36
3	12.22	5.24	3.49	6.11
4	15.71	7.85	2.62	4.36
5	13.08	7.85	3.49	5.24
6	10.47	5.24	5.24	5.24
7	8.73	5.24	6.98	6.98
8	10.47	9.60	10.47	11.34
9	11.34	10.47	17.45	12.22
10	17.45	13.09	16.58	17.45
11	18.32	31.41	14.83	25.30
12	19.20	24.43	28.79	21.81
13	27.05	27.92	29.67	28.79
14	32.28	17.45	21.81	24.43
15	20.94	13.09	24.43	34.03
16	21.81	16.58	20.94	27.92
17	25.30	17.45	23.56	20.94
18	27.92	12.22	19.20	16.58
19	13.96	9.60	18.32	8.73
20	13.96	5.24	13.09	6.11
21	9.60	2.62	6.98	6.11
22	10.47	3.49	5.24	6.98
23	10.47	5.24	4.36	6.11
24	9.60	6.11	5.24	5.24

* Monitor Latitude/Longitude Coordinates: (+37.05822 -88.57251)
** Seasons defined as: Winter (Dec, Jan, Feb), Spring (Mar, Apr, May), Summer (Jun, Jul, Aug), Fall (Sep, Oct, Nov)

East St. Louis*, Illinois Monitor
Season** and Hourly Varying Background SO_2
Wood River Study Area

Hour of Day	SO_2 Concentration (µg/m3)			
	Winter	Spring	Summer	Fall
1	22.60	16.14	13.70	10.73
2	19.11	13.00	14.48	10.12
3	12.39	14.83	13.61	14.57
4	13.44	17.54	19.28	10.38
5	10.56	24.17	18.41	11.69
6	16.05	15.88	13.79	9.51
7	18.15	19.81	15.27	10.91
8	26.26	18.24	27.48	24.34
9	18.41	23.03	34.81	22.69
10	23.91	18.50	31.50	39.09
11	29.67	27.48	26.61	28.27
12	23.65	19.63	19.37	23.47
13	31.76	16.40	26.26	18.85
14	25.74	17.10	19.89	23.38
15	21.20	15.18	12.65	18.35
16	21.55	12.39	13.370	15.71
17	18.50	18.50	11.60	19.20
18	20.77	15.53	12.74	24.87
19	14.83	13.26	10.30	15.09
20	10.12	13.61	9.07	9.60
21	8.90	11.95	12.39	6.81
22	11.69	9.86	10.12	10.03
23	13.70	10.30	11.26	9.07
24	28.36	13.79	9.51	10.82

* Monitor Latitude/Longitude Coordinates: (+38.61203 -90.16048)

** Seasons defined as: Winter (Dec, Jan, Feb), Spring (Mar, Apr, May), Summer (Jun, Jul, Aug), Fall (Sep, Oct, Nov)

Appendix C
Model Input/Output Files for the Study Areas

DVD Media