Technical Support Document

Indiana
Area Designations for the 2010 SO_2 Primary National Ambient Air Quality Standard

Summary

Pursuant to section 107(d) of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (EPA, or the Agency) must designate areas as either "unclassifiable," "attainment," or "nonattainment" for the 2010 one-hour sulfur dioxide (SO_2) primary national ambient air quality standard (NAAQS). The CAA defines a nonattainment area as one that does not meet the NAAQS or that contributes to a violation in a nearby area. An attainment area is defined as any area other than a nonattainment area that meets the NAAQS. Consistent with past practice, EPA intends to designate areas demonstrated or reasonably presumed to be attaining as "unclassifiable/attainment." Unclassifiable areas are defined as those that cannot be classified on the basis of available information as meeting or not meeting the NAAQS.

Indiana submitted updated recommendations on September 16, 2015, ahead of a July 2, 2016, deadline for EPA to designate certain areas established by the U.S. District Court for the Northern District of California. This deadline is the first of three deadlines established by the court for EPA to complete area designations for the 2010 SO_2 NAAQS. Table 1 below lists Indiana's recommendations and identifies the counties or portions of counties in Indiana that EPA intends to designate by July 2, 2016, along with the intended designation, based on an assessment and characterization of air quality through ambient air quality data, air dispersion modeling, other evidence and supporting information, or a combination of the above.

Area	Indiana's Recommended Area Definition	EPA's Intended Area Definition	EPA's Intended Designation
Areas recommended as attainment:			
Gibson Co.	Full county	Full county	Unclassifiable/ attainment
Jefferson Co.	Full county	Madison Township*	Nonattainment*
LaPorte Co.	Full county	Full county	Unclassifiable/ attainment
Posey Co.	Full county	Marrs Township*	Nonattainment*
Spencer Co.	Full county	Ohio Township north of UTM 4187.580 km northing, and Carter, Clay, Grass,	Unclassifiable/ attainment

		Hammond, Harrison, and Jackson Townships	

*As discussed below, if the limits in Indiana's commissioner's orders become federally enforceable adequately in advance of EPA's promulgation of final designations, EPA anticipates designating these and other portions of Jefferson and Posey Counties as unclassifiable/attainment.

Background

On June 3, 2010, EPA revised the primary (health based) SO_2 NAAQS by establishing a new one-hour standard at a level of 75 parts per billion (ppb) which is attained when the three-year average of the 99th percentile of one-hour daily maximum concentrations does not exceed 75 ppb. This NAAQS was published in the Federal Register on June 22, 2010 (75 FR 35520) and is codified at 40 CFR 50.17. EPA determined this is the level necessary to protect public health with an adequate margin of safety, especially for children, the elderly, and those with asthma. These groups are particularly susceptible to the health effects associated with breathing SO_2. The two prior primary standards of 140 ppb evaluated over 24 hours, and 30 ppb evaluated over an entire year, codified at 40 CFR 50.4, remain applicable.[1] However, EPA is not currently designating areas on the basis of either of these two primary standards. Similarly, the secondary standard for SO_2, set at 500 ppb evaluated over 3 hours has not been revised, and EPA is also not currently designating areas on the basis of the secondary standard.

General Approach and Schedule

Section 107(d) of the Clean Air Act requires that not later than one year after promulgation of a new or revised NAAQS, state governors must submit their recommendations for designations and boundaries to EPA. Section 107(d) also requires EPA to provide notification to states no less than 120 days prior to promulgating an initial area designation that is a modification of a state's recommendation. If a state does not submit designation recommendations, EPA will promulgate the designations that it deems appropriate. If a state or tribe disagrees with EPA's intended designations, they are given an opportunity to demonstrate why any proposed modification is inappropriate.

On August 5, 2013, EPA published a final rule establishing air quality designations for 29 areas in the United States for the 2010 SO_2 NAAQS, based on recorded air quality monitoring data from 2009 - 2011 showing violations of the NAAQS (78 FR 47191). In that rulemaking, EPA committed to address, in separate future actions, the designations for all other areas for which the Agency was not yet prepared to issue designations.

Following the initial August 5, 2013 designations, three lawsuits were filed against EPA in different U.S. District Courts, alleging the Agency had failed to perform a nondiscretionary duty under the CAA by not designating all portions of the country by the June 2013 deadline. In an

[1] 40 CFR 50.4(e) provides that the two prior primary NAAQS will no longer apply to an area one year after its designation under the 2010 NAAQS, except that for areas designated nonattainment under the prior NAAQS as of August 22, 2010, and areas not meeting the requirements of a SIP Call under the prior NAAQS, the prior NAAQS will apply until that area submits and EPA approves a SIP providing for attainment of the 2010 NAAQS. No such areas with extended applicability of the prior NAAQS exist in Indiana.

effort intended to resolve the litigation in one of those cases, plaintiffs Sierra Club and the Natural Resources Defense Council and EPA filed a proposed consent decree with the U.S. District Court for the Northern District of California. On March 2, 2015, the court entered the consent decree and issued an enforceable order for EPA to complete the area designations according to the court-ordered schedule.

According to the court-ordered schedule, EPA must complete the remaining designations by three specific deadlines. By no later than July 2, 2016 (16 months from the court's order), EPA must designate two groups of areas: (1) areas that have newly monitored violations of the 2010 SO_2 NAAQS and (2) areas that contain any stationary sources that had not been announced as of March 2, 2015 for retirement and that according to EPA's Air Markets Database emitted in 2012 either (i) more than 16,000 tons of SO_2 or (ii) more than 2,600 tons of SO_2 with an annual average emission rate of at least 0.45 pounds of SO_2 per one million British thermal units (lbs SO_2/MMBTU). Specifically, a stationary source with a coal-fired unit that as of January 1, 2010 had a capacity of over 5 megawatts and otherwise meets the emissions criteria, is excluded from the July 2, 2016 deadline if it had announced through a company public announcement, public utilities commission filing, consent decree, public legal settlement, final state or federal permit filing, or other similar means of communication, by March 2, 2015, that it will cease burning coal at that unit.

The last two deadlines for completing remaining designations are December 31, 2017, and December 31, 2020. EPA has separately promulgated requirements for states and other air agencies to provide additional monitoring or modeling information on a timetable consistent with these designation deadlines. We expect this information to become available in time to help inform these subsequent designations. These requirements were promulgated on August 21, 2015 (80 FR 51052), in a rule known as the SO_2 Data Requirements Rule (DRR).

Updated designations guidance was issued by EPA through a March 20, 2015 memorandum from Stephen D. Page, Director, U.S. EPA, Office of Air Quality Planning and Standards, to Air Division Directors, U.S. EPA Regions I-X. This memorandum supersedes earlier designation guidance for the 2010 SO_2 NAAQS, issued on March 24, 2011, and it identifies factors that EPA intends to evaluate in determining whether areas are in violation of the 2010 SO_2 NAAQS. The guidance also contains the factors EPA intends to evaluate in determining the boundaries for all remaining areas in the country, consistent with the court's order and schedule. These factors include: 1) Air quality characterization via ambient monitoring or dispersion modeling results; 2) Emissions-related data; 3) Meteorology; 4) Geography and topography; and 5) Jurisdictional boundaries.

Based on ambient air quality data collected between 2012 and 2014, no violations of the 2010 SO_2 NAAQS have been recorded in any undesignated part of the state.[2] However, there are five

[2] For designations based on ambient air quality monitoring data that violates the 2010 SO_2 NAAQS, the consent decree directs EPA to evaluate data collected between 2013 and 2015. Absent complete, quality assured and certified data for 2015, the analyses of applicable areas for EPA's intended designations will be informed by data collected between 2012 and 2014. States with monitors that have recorded a violation of the 2010 SO_2 NAAQS during these years have the option of submitting complete, quality assured and certified data for calendar year 2015 by April 19, 2106 to EPA for evaluation. If after our review, the ambient air quality data for the area indicates that

sources in the state meeting the emissions criteria of the consent decree for which EPA must complete designations by July 2, 2016. In this draft technical support document, EPA discusses its review and technical analysis of Indiana's updated recommendations for the areas that we must designate. EPA also discusses any intended modifications from the state's recommendations based on all available data before us.

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

1) 2010 SO_2 NAAQS – The primary NAAQS for SO_2 promulgated in 2010. This NAAQS is 75 ppb, based on the three year average of the 99th percentile of the annual distribution of daily maximum one-hour average concentrations. See 40 CFR 50.17.
2) Design Value - a statistic computed according to the data handling procedures of the NAAQS (in 40 CFR part 50 Appendix T) that, by comparison to the level of the NAAQS, indicates whether the area is violating the NAAQS.
3) Designated nonattainment area – an area which EPA has determined has violated the 2010 SO_2 NAAQS or contributed to a violation in a nearby area. A nonattainment designation reflects considerations of state recommendations and all of the information discussed in this document. EPA's decision is based on all available information including the most recent 3 years of air quality monitoring data, available modeling analysis, and any other relevant information.
4) Designated unclassifiable area – an area which EPA cannot determine based on all available information whether or not it meets the 2010 SO_2 NAAQS.
5) Designated unclassifiable/attainment area – an area which EPA has determined to have sufficient evidence to find either is attaining or is likely to be attaining the NAAQS. EPA's decision is based on all available information including the most recent 3 years of air quality monitoring data, available modeling analysis, and any other relevant information.
6) Modeled violation – a violation based on air dispersion modeling.
7) Recommended attainment area – an area a state or tribe has recommended that EPA designate as attainment.
8) Recommended nonattainment area – an area a state or tribe has recommended that EPA designate as nonattainment.
9) Recommended unclassifiable area – an area a state or tribe has recommended that EPA designate as unclassifiable.
10) Recommended unclassifiable/attainment area – an area a state or tribe has recommended that EPA designate as unclassifiable/attainment.
11) Violating monitor – an ambient air monitor meeting all methods, quality assurance and siting criteria and requirements whose valid design value exceeds 75 ppb, based on data analysis conducted in accordance with Appendix T of 40 CFR part 50.

Technical Analysis for the A.B. Brown Area

no violation of the NAAQS occurred between 2013 and 2015, the consent decree does not obligate EPA to complete the designation. Instead, we will designate the area and all other previously undesignated areas in the state on a schedule consistent with the prescribed timing of the court order, i.e., by December 31, 2017, or December 31, 2020.

Introduction

Posey County, Indiana contains a stationary source that according to EPA's Air Markets Database emitted in 2012 either more than 16,000 tons of SO_2 in 2012 or more than 2,600 tons of SO_2 and had an annual average emission rate of at least 0.45 pounds of SO_2 per one million British thermal units (lbs SO_2/MMBTU). As of March 2, 2015, this stationary source had not met the specific requirements for being "announced for retirement." Specifically, the A.B. Brown Generating Station ("A.B. Brown") emitted 7,091 tons of SO_2 in 2012, and had an emissions rate of 0.521 lbs SO_2/MMBTU in 2012. Pursuant to the March 2, 2015 court-ordered schedule, EPA must designate the area surrounding the facility by July 2, 2016.

A.B. Brown is located in southwestern Indiana in the southeastern portion of Posey County, near the borders of Posey with Vanderburgh County in Indiana, to the east, and Henderson County in Kentucky, to the south. As seen in Figure 1 below, the facility is located approximately 8 km southwest of Evansville and 13 km east of Mount Vernon. A.B. Brown is owned by Vectren, formerly Southern Indiana Gas and Electric Company.

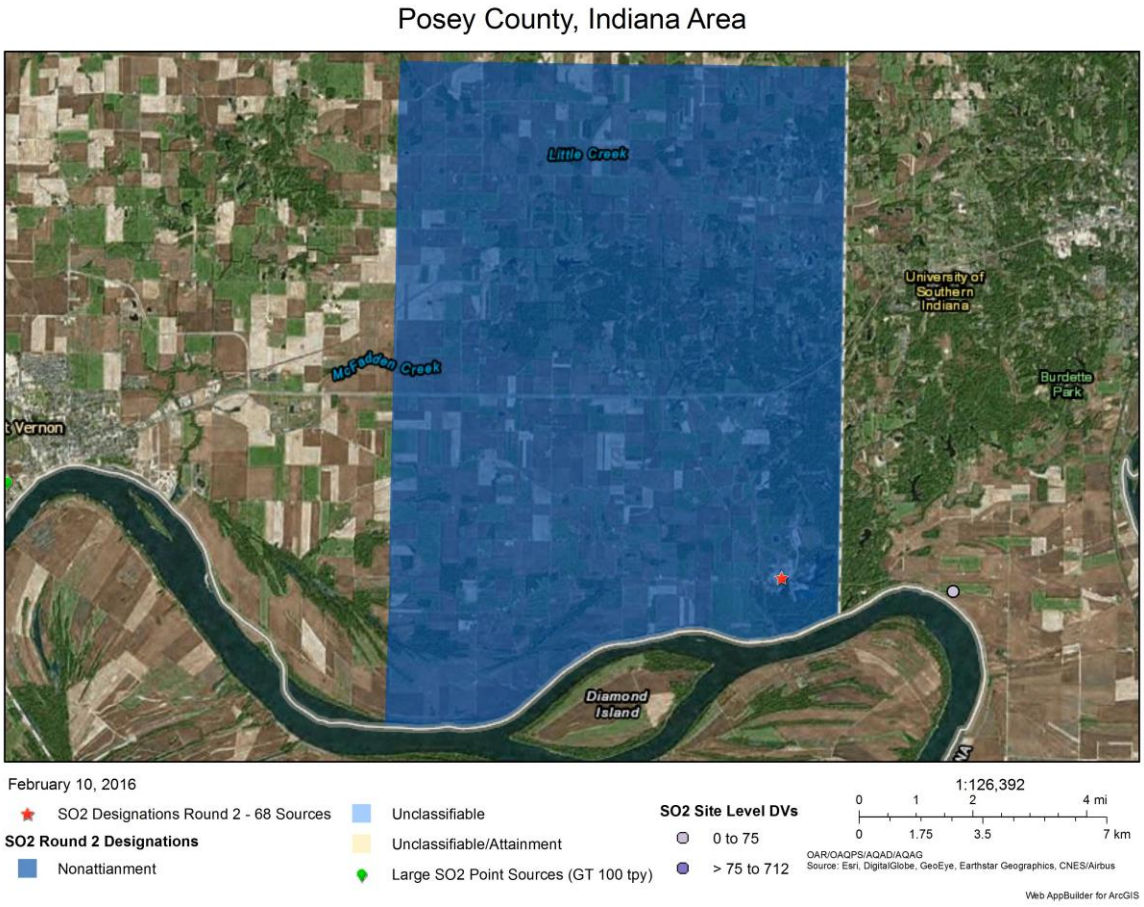
In its submission, Indiana recommended that the area surrounding A.B. Brown, specifically the entirety of Posey County, be designated as attainment based on an assessment and characterization of air quality from the facility and other nearby sources which may have a potential impact in the area of analysis where maximum concentrations of SO_2 are expected. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD. Indiana's submittal states that modeling using A.B. Brown's actual emissions indicated a violation of the SO_2 standard, but modeling with the limits identified in the submittal indicated that the area would attain the standard once A.B. Brown complied with those limits.

Subsequently, on January 27, 2016, Indiana submitted a draft request for a revision to its state implementation plan (SIP) to establish new emission limits for A.B. Brown. Indiana's submittal includes a signed commissioner's order establishing these limits, issued on January 11, 2016, along with evidence that Indiana has initiated the public comment process necessary for these limits to be approved as revisions to Indiana's SIP. Indiana's submittal also includes AERMOD modeling to demonstrate that these limits would provide for attainment of the SO_2 NAAQS in the area of A.B. Brown. EPA has reviewed this modeling and agrees that these limits would provide for attainment. EPA has signed a rulemaking notice proposing to approve these limits. EPA anticipates that Indiana will submit a final request to incorporate these limits into the SIP in the near future, once the state has completed its public comment process, and EPA anticipates completing its rulemaking on this request within the next few months.

The limits necessary to provide for attainment in the A.B. Brown area are not presently federally enforceable. Therefore, EPA cannot consider the prospective impact of these limits. Indiana's modeling suggests that current air quality violates the standard, and so EPA must express an intention to designate the area around A.B. Brown as nonattainment. However, if EPA has approved these limits into the SIP before it takes final action on the designation for the A.B. Brown area, EPA anticipates designating the area unclassifiable/attainment.

Figure 1 below shows EPA's intended designation for Posey County, designating one township, Marrs Township, as nonattainment. As discussed below, if the pertinent limits for A.B. Brown become federally enforceable in timely fashion, EPA anticipates designating a larger portion of Posey County as unclassifiable/attainment.

Figure 1. EPA's intended designation for Posey County, Indiana



To assist states and other interested parties in their efforts to characterize air quality through air dispersion modeling for sources that emit SO_2, EPA released its most recent version of a draft document titled, "SO_2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) in December 2013. The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in EPA's March 20, 2015 guidance, as appropriate.

<u>Detailed Assessment</u>

Air Quality Data

No quality assured ambient monitors are operated in Posey County or elsewhere near A.B. Brown.

Model Selection and Modeling Components

EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. In some instances the recommended model may be a model other than AERMOD, such as the BLP model for buoyant line sources. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRIME: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

The state used AERMOD version 15181, the most recent version. A discussion of the individual components will be referenced in the applicable discussion that follows, as appropriate.

Modeling Parameter: Rural or Urban Dispersion

The state determined that modeling for this area would most appropriately use the model in rural mode. While Indiana did not provide Auer analyses for this or any other area, this area is sufficiently distant from any urban area (approximately 10 km from the nearest edge of Evansville) and clearly warrants being modeled with rural dispersion characteristics.

Modeling Parameter: Area of Analysis (Receptor Grid)

EPA believes that a reasonable first step towards characterization of air quality in the area surrounding A.B. Brown is to determine the extent of the area of analysis, i.e., receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations. For Posey County, the state has included the two other emitters of SO_2 that are within 30 kilometers (km) of A.B. Brown in any direction, and modeled approximately 10 km north, south, east, and west of the facility. The state determined that this was the appropriate distance in order to adequately characterize air quality from the facility and other nearby sources which may have a potential impact in the area of analysis where maximum concentrations of SO_2 are expected. In addition to the A.B. Brown, the area of analysis includes SABIC Innovative Plastics and Countrymark Refining and Logistics, which are described further below.

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

- Receptors along the fenceline every 50 meters

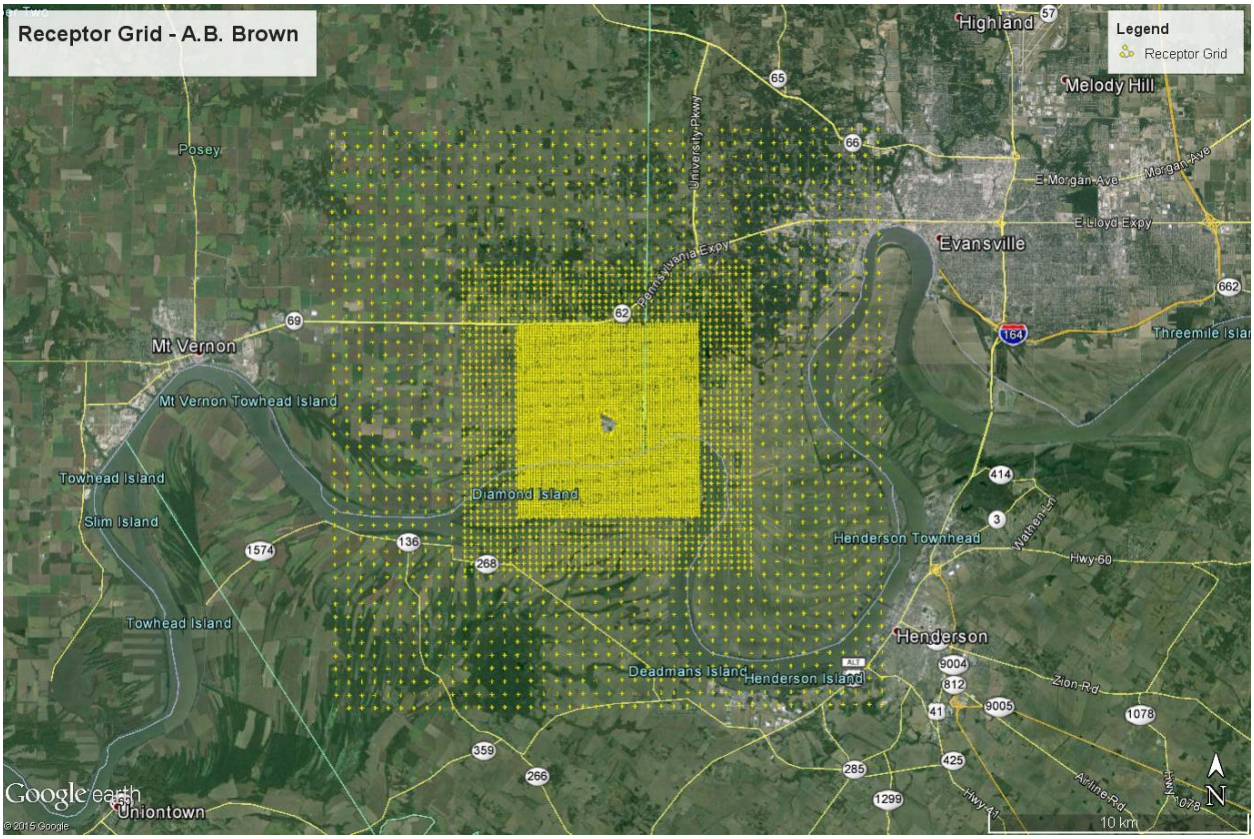
- Receptors every 100 meters out to a distance of 3 km from A.B. Brown
- Receptors every 250 meters from 3 km to 5 km
- Receptors every 500 meters from 5 km to 10 km

The receptor network contained 7,908 receptors, and the network covered eastern Posey County and nearby portions of northern Henderson County, Kentucky, and western Vanderburgh County, Indiana, although Indiana made no designation recommendations with respect to any portion of these other counties.

Indiana did not seek to identify areas where it might be infeasible to place a monitor, and instead conservatively placed receptors according to the above array without respect to feasibility of monitoring. The impacts of the area's geography and topography will be discussed later within this document.

Figure 2, prepared based on information provided with the state's recommendation, shows the state's chosen receptor grid for the area of analysis.

Figure 2: *Receptor Grid for the A.B. Brown Area of Analysis*



Modeling Parameter: Source Characterization

The state characterized A.B. Brown in accordance with the best practices outlined in the Modeling TAD. Specifically, the submitted modeling, reflecting allowable emissions for A.B. Brown, used stack heights determined in accordance with EPA's good engineering practices (GEP) policy. The state also adequately characterized A.B. Brown's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRIME was used to assist in addressing building downwash.

For sources in the study area other than A.B. Brown, Indiana did not determine building dimensions or otherwise consider building downwash. However, these other sources are at a sufficient distance from A.B. Brown that downwash is unlikely to have a significant impact on concentrations at locations near A.B. Brown with the potential to violate the SO_2 standard.

Modeling Parameter: Emissions

EPA's Modeling TAD notes that for the purposes of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. The Modeling TAD highly encourages the use of the most detailed throughput, operating schedule, and emissions information available. Variable emissions, temperature, and flow data can be modeled using AERMOD's hourly varying emissions keyword HOUREMIS or variable emission factor keyword EMISFACT. EPA believes that continuous emissions monitoring systems (CEMS) data provide valuable historical emissions information, when it is available, and that these data are available for many electric generating units. However, the TAD also provides the option to use allowable emissions reflecting the applicable, federally enforceable emission limit (referred to as PTE or the allowable emissions rate).

In certain instances, it may be advantageous or simpler to use PTE rates in designations modeling analyses. Specifically, a facility may have recently adopted a new federally enforceable emissions limit, been subject to a federally enforceable consent decree, or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS. These new limits or conditions may be used in the application of AERMOD. In these cases, the Modeling TAD notes that the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations should contain the necessary emissions information for designations-related modeling. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the state included A.B. Brown and two other emitters of SO_2 within 30 km of A.B. Brown, and modeled approximately 10 km north, south, east, and west of the facility. This distance and these facilities were selected because the state believes that this area of analysis adequately represents the area where maximum concentrations of SO_2 are expected and adequately includes the sources which might contribute to those concentrations. No other sources within or beyond 10 km were determined by the state to have the potential to cause significant concentration gradient impacts within the area of analysis. The facilities in the area

of analysis and their associated annual actual SO_2 emissions between 2012 and 2014 are summarized below. "Distance" in this table is the distance of the source from A.B. Brown.

Table 2: SO_2 Emissions Between 2012 – 2014 from Facilities in the A.B. Brown Area of Analysis

Facility Name	Distance (km)	Actual SO_2 Emissions (tons per year)			Allowable Emissions (tpy)
		2012	2013	2014	
A.B. Brown	--	7,091	6,816	8,080	9,427/ 7,646*
SABIC Innovative Plastics	19.28	--	5,407	--	--
Countrymark Refining and Logistics	17.40	--	476	--	--
Total Emissions From All Facilities in the State's Area of Analysis		12,974**	14,712	13,963**	--

*See text. The values are annual equivalents of 1-hour average limits.
**Assumes that 2012 and 2014 emissions for SABIC Innovative Plastics and Countrymark Refining and Logistics equal 2013 emissions.

For A.B. Brown, the modeling submitted initially by the state used allowable emissions of 0.164 lbs/MMBTU (1,809 tons/year) for Unit 1 and 0.69 lbs/MMBTU (7,673 tons/year) for Unit 2. However, pursuant to further discussions between Indiana and Vectren, the commissioner's order required slightly different emission limits. Both sets of modeling relied on an emission limit of 0.69 lbs/MMBTU for Unit 2, a limit that has been established through and permit issued for prevention of significant deterioration (PSD) purposes. However, the issued commissioner's order established limits on Unit 1 emissions for three scenarios. For the first scenario, in which only Unit 1 is operating, the order established limits of 2152.2 lbs/hour and 0.855 lbs/MMBTU, which allows annual emissions from this unit of 9,427 tons/year. For the second scenario, in which both units are operating, the order established limits on total emissions from the two units of 2152.2 lbs/hour and 0.426 lbs/MMBTU. For a third scenario, in which only Unit 2 is operating, the facility is already subject to a limit in a PSD permit limiting emissions to 0.69 lbs/MMBTU (1745.7 lbs/hour, corresponding to an annual maximum of 7,646 tons/year). Indiana has provided modeling of all of these scenarios under worst case operations to demonstrate that this set of limits assures attainment for all feasible operating modes. Since Unit 2 has more impact at the critical receptors than Unit 1, Indiana imposed different limits for different operating scenarios because this approach allows more flexibility in the degree of control and operation of the two units while still providing for attainment.

For SABIC Innovative Plastics and Countrymark Refining and Logistics, Indiana modeled 2013 average actual emissions for all hours.

As Indiana stated in its submittal, Indiana conducted "[initial] modeling, using A.B. Brown's hourly CEM [emission] data from 2012-2014, [which] showed that modeled 1-hour SO_2 concentrations . . . would be above the 1-hour SO_2 NAAQS." As noted above, subsequent modeling showed that the prospective limits on emissions at A.B. Brown will provide for attainment of the standard.

At present, the emission limit for A.B. Brown that is necessary to attain the standard is not federally enforceable and thus is not creditable for designations purposes. Instead, at present, EPA must express an intention to designate according to the impacts of emissions from the most recent 3 years, which is to say that EPA must express an intention to designate the A.B. Brown area as nonattainment. On the other hand, Indiana has signed a commissioner's order establishing the above emission limits, which A.B. Brown must meet by April 19, 2016, and has submitted a draft State Implementation Plan (SIP) request to EPA for approval of those limits into the Indiana SIP. EPA anticipates Indiana completing its public comment process and submitting a final SIP revision request for approval of these limits, and EPA has signed a notice of proposed rulemaking and anticipates taking final action to approve these limits well before it promulgates a designation for this area. If EPA has approved these limits adequately in advance of promulgating a designation for this area, these limits would then be federally enforceable, and under these circumstances EPA anticipates final action designating the A.B. Brown area as meeting the SO_2 standard.

Modeling Parameter: Meteorology and Surface Characteristics

The most recent three years of meteorological data (concurrent with the most recent three years of emissions data) should be used in designations efforts. As noted in the Modeling TAD, the selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data are based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include National Weather Service (NWS) stations, site-specific or onsite data, and other sources such as universities, Federal Aviation Administration (FAA), and military stations.

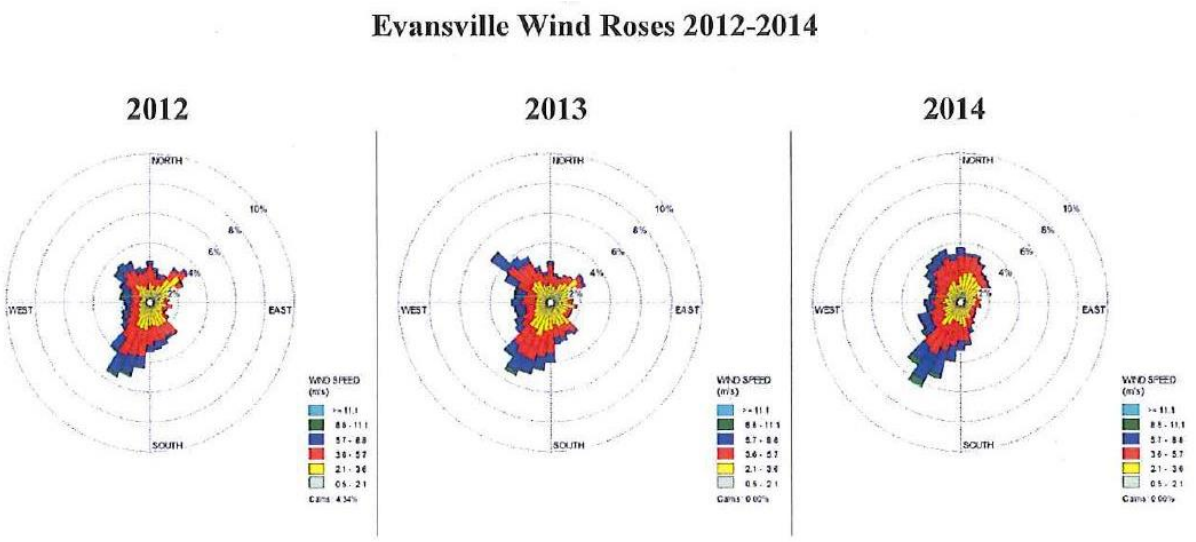
For the A.B. Brown area, Indiana selected surface meteorology from the NWS station in Evansville, Indiana, and coincident upper air observations from the NWS upper air station in Lincoln, Illinois, as best representative of meteorological conditions within the area of analysis.

The state used AERSURFACE using data from the NWS station in Evansville, Indiana (located at 38.0441° north, 87.5205° west, 23 km northeast of A.B. Brown) to estimate the surface characteristics of the area of analysis. These surface characteristics are the albedo (the fraction of solar energy reflected from the earth back into space), the Bowen ratio (representing the ratio of sensible heat flux to latent heat flux at the ground level), and the surface roughness (representing the influence of ground features such as buildings and vegetation on surface wind flow). The state estimated values for 12 wind direction sectors, examining surface roughness out to 1 km and albedo and Bowen ratio for a 10 km square area centered on the NWS station. Additionally, Indiana applied a dry or wet Bowen ratio during months when soil moisture conditions were abnormally dry or wet, and applied a surface roughness value for snow cover if more than half of the month had days with at least one inch of snow on the ground.

Figure 3 shows three years of surface wind roses for Evansville, Indiana for each of the three modeled years. In this figure, the frequency and magnitude of wind speed and direction are

defined in terms of from where the wind is blowing. This figure shows that southwesterly winds are clearly most common, especially for low wind conditions, with less frequent winds from the northwest.

Figure 3: Evansville, Indiana Annual Wind Roses for Years 2012 – 2014



Meteorological data from the above surface and upper air stations were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. The state followed the methodology and settings presented in "Regional Meteorological Data Processing Protocol EPA Region V and States" in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, since wind can be variable in nature, wind data taken at hourly intervals may not always portray wind conditions for the entire hour. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of 1-minute duration was provided from the same instrument tower, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE version 14237. These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the 1-minute wind data.

Modeling Parameter: Geography and Terrain

The terrain in the area of analysis is best described as a gently rolling river valley. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors.

Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "first tier" approach, based on monitored design values, or 2) a temporally varying approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For the A.B. Brown area, the state chose to compute variable background concentrations, determining a separate value for each season for each of the 24 hours in a day. The state made these determinations using data from the Buena Vista site in Evansville (site number 18-163-0005), excluding data from the general direction of A.B. Brown (southwest). Table 3 lists the array of background concentrations that the state used in this analysis.

Table 3. Temporally varying background concentrations for the A.B. Brown area (in ppb)

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	6.00	4.22	3.88	4.27	6.02	4.95	5.25	7.43
Spring	4.99	3.83	4.30	4.34	3.30	4.47	7.75	9.52
Summer	2.71	2.22	1.00	1.00	2.87	3.45	3.34	5.99
Fall	3.46	3.30	2.85	3.52	4.00	4.35	4.80	5.28

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	8.89	11.94	13.62	10.29	14.74	19.17	19.48	19.76
Spring	9.82	9.05	13.37	13.25	15.49	12.02	9.34	10.70
Summer	10.12	12.58	9.14	7.55	7.47	4.65	4.08	6.05
Fall	7.73	11.66	15.88	11.70	11.26	10.28	10.03	9.08

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	16.64	16.70	9.18	6.89	8.01	6.59	6.74	6.22
Spring	13.01	12.93	11.32	8.26	5.59	3.81	5.90	6.10
Summer	7.88	8.56	7.12	2.71	2.72	2.22	2.86	3.40
Fall	10.11	9.85	8.87	8.51	5.70	2.59	3.06	3.31

Summary of Modeling Results

The AERMOD parameters for modeling the A.B. Brown area are summarized below in Table 4.

Table 4: AERMOD Modeling Parameters for the A.B. Brown Area

Analysis of A.B. Brown Area	
AERMOD Version	15181
Dispersion Characteristics	Rural
Modeled Sources	3
Modeled Stacks	4
Modeled Structures	2 (2 units at A.B. Brown)
Modeled Fencelines	1 (A.B. Brown)
Total receptors	7,908
Emissions Type	A.B. Brown: Allowable SABIC and Countryside: Actual
Emissions Years	A.B. Brown: Limits to be met by 4/19/16 SABIC and Countryside: 2013 average emissions
Meteorology Years	2012-2014
Surface Meteorology Station	Evansville, Indiana
Upper Air Meteorology Station	Lincoln, Illinois
Methodology for Calculating Background SO_2 Concentration	Temporal Varying
Calculated Background SO_2 Concentration	See Table 3

The results presented below in Table 5 show the magnitude and geographic location of the highest predicted modeled concentration based on this combination of allowable and actual emissions.

Table 5: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentration in the A.B. Brown Area Based on PTE for A.B. Brown

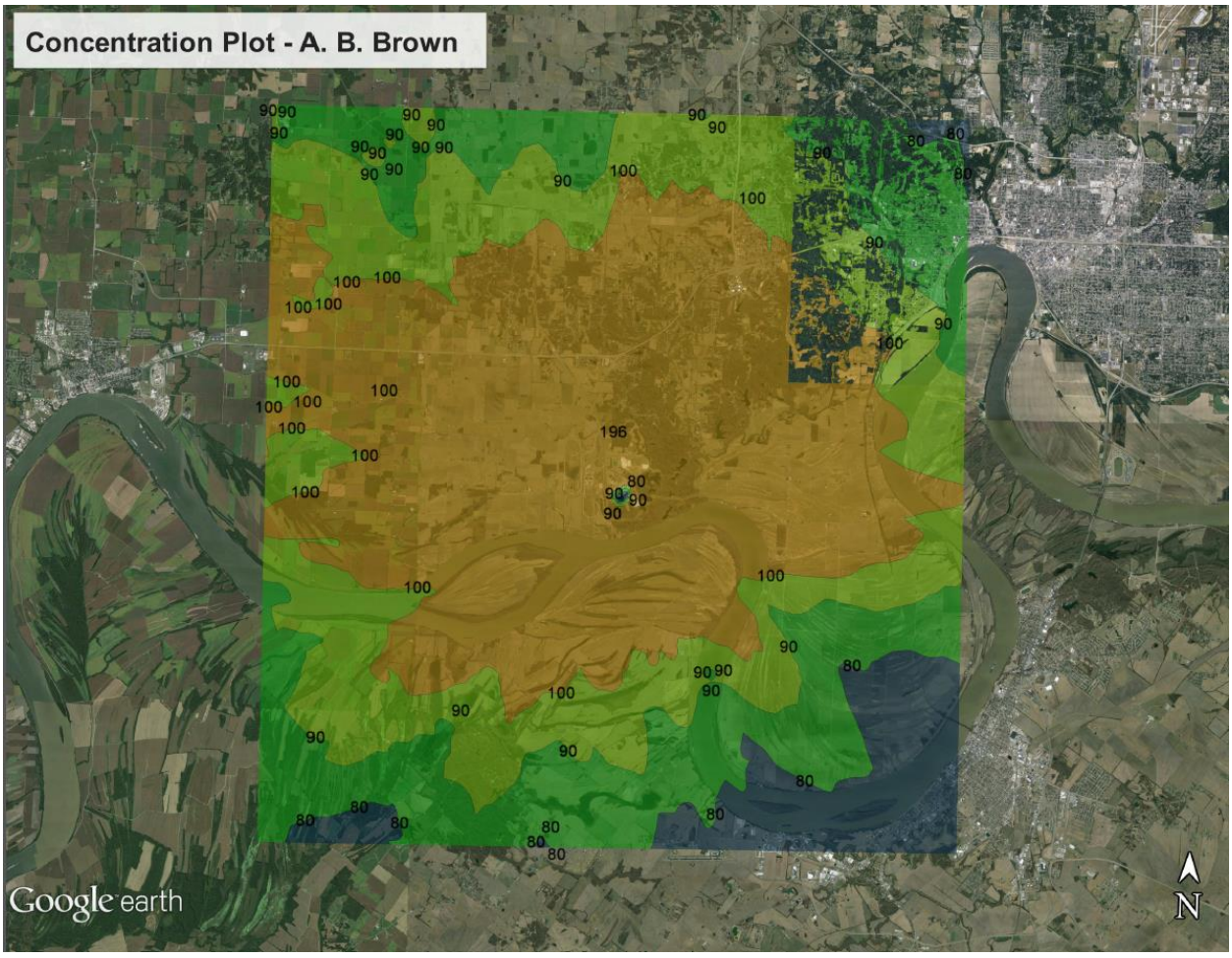
	Receptor Location		SO_2 Concentration ($\mu g/m^3$)	
Averaging Period	UTM Northing	UTM Easting	Modeled (including background)	NAAQS
99th Percentile 1-Hour Average	4197,400	436,900	195.52	196.4*

*Equivalent to the 2010 SO_2 NAAQS set at 75 ppb

The state's modeling indicates that the predicted 99th percentile 1-hour average concentration within the chosen modeling domain is 195.52 $\mu g/m^3$, or 74.7 ppb. This modeled concentration included the background concentration of SO_2, and is based on allowable emissions for A.B.

Brown and actual emissions for SABIC Innovative Plastics and Countryside Refining and Logistics. Figure 4 below was prepared from modeling files included with the state's recommendation, and indicates that the predicted value occurred about 2.8 km north of A.B. Brown (located at 4194,630 m N, 437,153 m E). The state's receptor area is also shown in the figure.

Figure 4: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations in the A.B. Brown Area Based on Prospective Allowable Emissions



Jurisdictional Boundaries:

Once the air quality in the area of analysis associated with A.B. Brown was determined, existing jurisdictional boundaries were considered for the purpose of informing our intended designated area, specifically in order to apply clearly defined legal boundaries.

The state's recommendation, that the entirety of Posey County be designated attainment, clearly applies clear, well-known, stable, and well-established boundaries. However, Indiana only modeled concentrations within approximately 10 km of A.B. Brown, and did not model concentrations elsewhere in Posey County. Significant SO_2 sources, most notably SABIC

Innovative Plastics, are located elsewhere in Posey County. EPA has insufficient information to judge the attainment status of these other locations in Posey County. EPA is obliged under court order to designate areas near power plants meeting the applicable criteria by July 2, 2016, but EPA has no obligation to designate the entirety of the counties in which these sources are located. That is, EPA is not obliged to promulgate designations for portions of Posey County where further analysis of potential violations is warranted.

As a result, EPA intends to designate only a portion of Posey County. Indiana counties are divided into townships. Townships have clear, well established boundaries that are reasonably well known, and townships are an appropriate size for differentiating areas meeting and not meeting the SO_2 standard, commensurate with the scale of spatial gradients that are common with SO_2. Therefore, EPA intends to promulgate a designation of a sub-county portion of Posey County that is defined by means of a list of townships.

Other Relevant Information

Sierra Club provided additional modeling for this area, indicating that this area is violating the SO_2 NAAQS. This modeling is based on actual emissions. While Indiana did not report concentrations estimated to result from actual emissions, Sierra Club's modeling is consistent with the state's modeling at least to the extent that both modeling analyses indicate that actual emissions are estimated to cause violations of the SO_2 NAAQS.

Nevertheless, Indiana has reviewed Sierra Club's modeling and identified numerous deficiencies in this analysis. Most significantly, Sierra Club computed a single background concentration, based on an analysis that did not exclude and therefore is prone to double count the impacts from modeled sources. Where Sierra Club used a constant background concentration of 18.0 ppb, Indiana used a temporally varying background concentration, ranging from 1 to 19.8 ppb and averaging 7.6 ppb. Sierra Club did not use the variable stack parameter information that Indiana used. Sierra Club used AERMOD version 14134, whereas Indiana used a more recent version, namely version 15181. Indiana also identified several other differences between Sierra Club's and Indiana's modeling approach. In all cases, Indiana's approach is more consistent with EPA's recommendations and prone to provide a more reliable estimation of concentrations in the area.

Despite these differences, both Sierra Club's modeling and Indiana's modeling indicates that current air quality, in absence of consideration of the emission limits for A.B. Brown that Indiana has issued but that are not presently federally enforceable, reflects violations of the SO_2 NAAQS. Thus, both sets of modeling support EPA's intended nonattainment designation for this area. However, Sierra Club has not provided modeling addressing what air quality will result from the emission limits Indiana has issued. Therefore, if the limits that Indiana has issued become federally enforceable in timely fashion, EPA expects to promulgate a designation of unclassifiable/attainment based on Indiana's modeling, irrespective of the contrary results based on current emissions provided by Sierra Club.

Conclusion

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, EPA intends to designate the area around A.B. Brown as nonattainment for the 2010 SO_2 NAAQS. Sierra Club's modeling, using current actual emissions, indicates that the area is currently violating the SO_2 NAAQS. This conclusion is also supported by Indiana's modeling, which indicates that a concentration only slightly below the standard can be expected to result from a level of emissions that is significantly lower than recent emission levels. At the same time, Sierra Club's modeling and the modeling from Indiana (reviewed in recognition of the degree of difference between the modeled emission level and recent actual emission rates) suggests that only a limited area should be considered to be violating the standard. Specifically, these results suggest that the violating area (and the contributing source) is all within Marrs Township in Posey County, which is an area that is approximately a 10-km square that largely corresponds to the area that Indiana modeled. Thus, under present circumstances, EPA intends to designate Marrs Township in Posey County as nonattainment. EPA is not obliged to designate other portions of the county, and EPA presently intends to designate no other portion of Posey County during this round of designations.

On the other hand, several steps have been taken toward making emission limits for A.B. Brown federally enforceable and creditable for designations purposes. Indiana has issued a commissioner's order that imposes emission limits on A.B. Brown, Indiana is soliciting public comment on this order, Indiana has submitted a request that EPA conduct "parallel processing" of this order as a prospective SIP revision, and Indiana has provided EPA with modeling demonstrating that these limits at A.B. Brown suffice to provide for attainment. If these limits become federally enforceable adequately in advance of EPA's final promulgation of a designation for this area, and EPA designates the A.B. Brown area as unclassifiable/attainment, it would be appropriate to define an unclassifiable/attainment area that includes other portions of Posey County that also appear likely to be attaining the standard. Although EPA does not have adequate information to judge air quality near SABIC Innovative Plastics and Countrymark Refining and Logistics, both located in Black Township, other townships north of Black and Marrs Townships are a considerable distance from any significant source, so these portions of Posey County may reasonably be judged to be attaining the standard. (Since Point Township is south of Black Township and is not contiguous with any other township in Posey County, EPA intends to designate Point Township once adequate information about air quality in and near Black Township becomes available.) Therefore, if EPA's final action is to designate the A.B. Brown area as unclassifiable/attainment, EPA anticipates applying that designation to an area that includes all townships in Posey County other than Black and Point Townships, i.e., to an area that includes Bethel, Center, Harmony, Lynn, Marrs, Robb, Robinson, and Smith Townships.

At this time, our intended designations for the state only apply to this area and the other areas addressed in this technical support document. Consistent with the conditions in the March 2, 2015 court-ordered schedule, EPA will evaluate and designate all remaining undesignated areas in Indiana by either December 31, 2017, or December 31, 2020.

Technical Analysis for the Clifty Creek Area

Introduction

Jefferson County, Indiana contains a stationary source that according to EPA's Air Markets Database emitted in 2012 either more than 16,000 tons of SO_2 in 2012 or more than 2,600 tons of SO_2 and had an annual average emission rate of at least 0.45 pounds of SO_2 per one million British thermal units (lbs SO_2/MMBTU). As of March 2, 2015, this stationary source had not met the specific requirements for being "announced for retirement." Specifically, the Clifty Creek Generating Station ("Clifty Creek") emitted 52,839 tons of SO_2 in 2012, and had an emissions rate of 1.767 lbs SO_2/MMBTU in 2012. Pursuant to the March 2, 2015 court-ordered schedule, EPA must designate the area surrounding the facility by July 2, 2016.

In its submission, Indiana recommended that the area surrounding Clifty Creek, specifically the entirety of Jefferson County, be designated as attainment based on an assessment and characterization of air quality from the facility and other nearby sources which may have a potential impact in the area of analysis where maximum concentrations of SO_2 are expected. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions.

Clifty Creek installed flue gas desulfurization in mid-2013. Indiana's submittal indicates that modeling using actual emissions from 2012 to 2014 estimated high concentrations of SO_2, but modeling using emissions for the second half of this period, after installation of emission controls, showed the area attaining the standard.

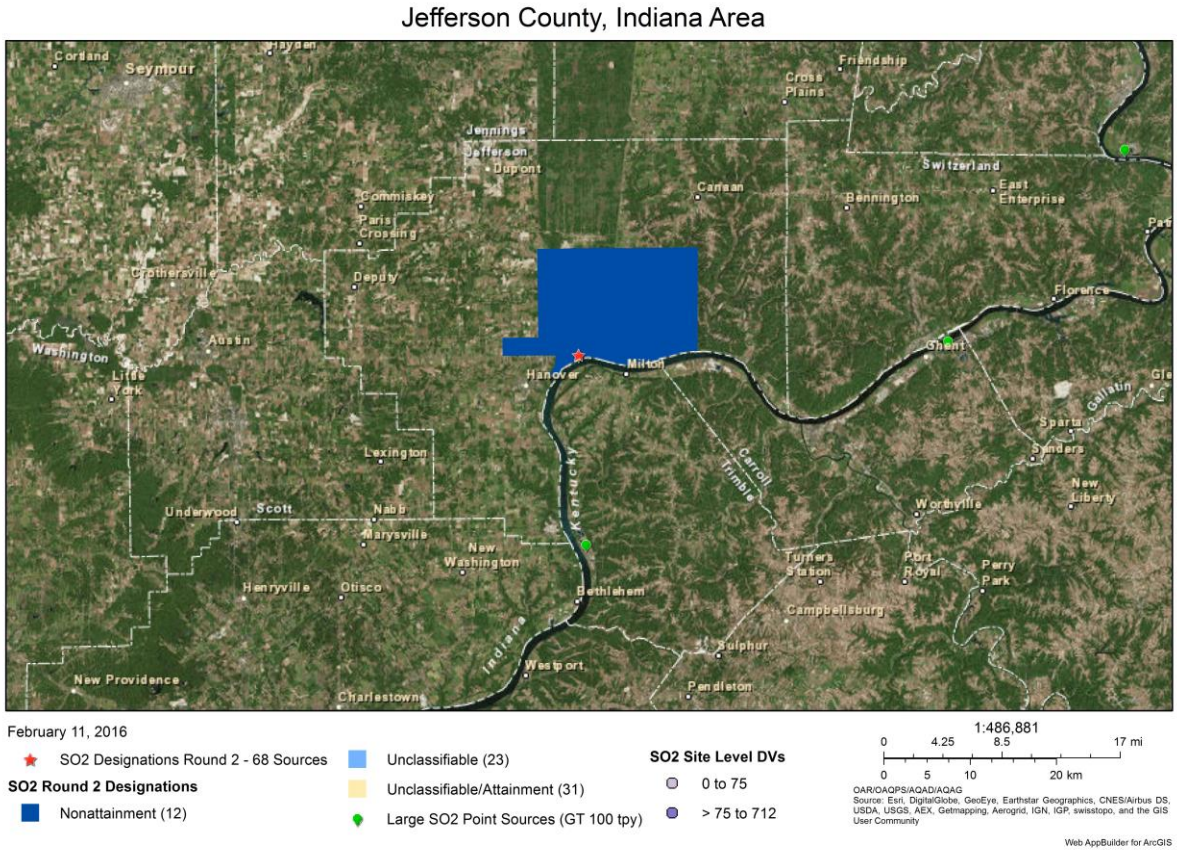
To assist states and other interested parties in their efforts to characterize air quality through air dispersion modeling for sources that emit SO_2, EPA released its most recent version of a draft document titled, "SO_2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) in December 2013. The modeling TAD recommends that areas be modeled either with three complete years of actual emissions data or with an allowable emission rate based on a federally enforceable emission limit. Therefore, modeling for only the last 1½ years of the 2012-2014 period is not an appropriate means of evaluating air quality for the most recent three years. In absence of any modeling of allowable emission levels, the evidence suggests that concentrations over the full 3-year period exceeded the NAAQS. As a result, after careful review of the state's assessment, supporting documentation, and all available data, EPA does not agree with the state's recommendation for the area and intends to designate the areas as nonattainment.

On the other hand, on February 5, 2016, Indiana submitted a draft request for a revision to its state implementation plan (SIP) to establish new emission limits for Clifty Creek. Indiana's purpose in submitting the draft SIP revision request was to begin the process of making the limits federally enforceable and thus creditable for designations purposes. Indiana has also provided EPA with modeling that EPA finds demonstrates that these limits would provide for attainment of the SO_2 NAAQS in the area of Clifty Creek. The company must begin complying with these limits by April 19, 2016, which will suffice for EPA to conclude that air quality as of the time of

final promulgation of these designations will reflect compliance with the new emission limits. In addition, EPA has signed a rulemaking notice proposing to approve these limits. EPA anticipates that Indiana will submit a final request to incorporate these limits into the SIP within about a month, and EPA anticipates completing its rulemaking on this request within the next few months. If EPA has approved these limits into the SIP before it takes final action on the designation for the Clifty Creek area, EPA anticipates designating the area unclassifiable/attainment.

Clifty Creek is located in the center of Jefferson County, which is located on the southern border of Indiana. The facility is located on the Ohio River on Clifty Creek just south of Clifty Falls State Park. Since Indiana recommended designation of the entirety of Jefferson County as attainment, Figure 5 shows the entirety of Jefferson County as well as portions of neighboring counties in Indiana and Kentucky. This figure further shows nearby emitters of SO_2, the state's recommended area for the designation, and EPA's intended designation for the area. As shown in this figure, EPA intends to designate one township in Posey County, Marrs Township, as nonattainment. As discussed below, if the pertinent limits for Clifty Creek become federally enforceable in timely fashion, EPA anticipates designating a larger portion of Jefferson County area as unclassifiable/attainment.

Figure 5. EPA's intended designation(s) for Jefferson County, Indiana



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

Detailed Assessment

Ambient Air Quality Monitoring Data

No quality assured ambient monitors are operated in or near Jefferson County.

Model Selection and Modeling Components

EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. In some instances the recommended model may be a model other than AERMOD, such as the BLP model for buoyant line sources. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRIME: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

The state used AERMOD version 15181, the most recent version. A discussion of the individual components will be referenced in the corresponding discussion that follows, as appropriate.

Modeling Parameter: Rural or Urban Dispersion

The state determined that modeling for this area would most appropriately use the model in rural mode. While Indiana did not provide Auer analyses for this or any other area, this area is distant from any urban area (e.g., approximately 60 km from Louisville) and clearly warrants being modeled with rural dispersion characteristics.

Modeling Parameter: Area of Analysis (Receptor Grid)

EPA believes that a reasonable first step towards characterization of air quality in the area surrounding Clifty Creek is to determine the extent of the area of analysis, i.e., receptor grid. Considerations presented in the Modeling TAD include, but are not limited to, the location of the SO_2 emission sources or facilities considered for modeling, the extent of significant concentration gradients of nearby sources, and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations. For Jefferson County, the state has included two other emitters of SO_2 within 30 km of Clifty Creek in any direction, and modeled approximately 10 km north, south, east, and west of the facility. The state determined that these were the appropriate distances in order to adequately characterize air quality from the facility and other nearby sources which may have a potential impact in the area

of analysis where maximum concentrations of SO_2 are expected. In addition to Clifty Creek, the other emitters of SO_2 included in the area of analysis, their location, distance from Clifty Creek, and 2013 emissions are:

- Ghent Generating Station, in Carroll County, KY, 33.34 km away, emitting 3,522 tpy
- Trimble Co. Generation Station, in Trimble County, 17.09 km away, emitting 13,424 tpy.

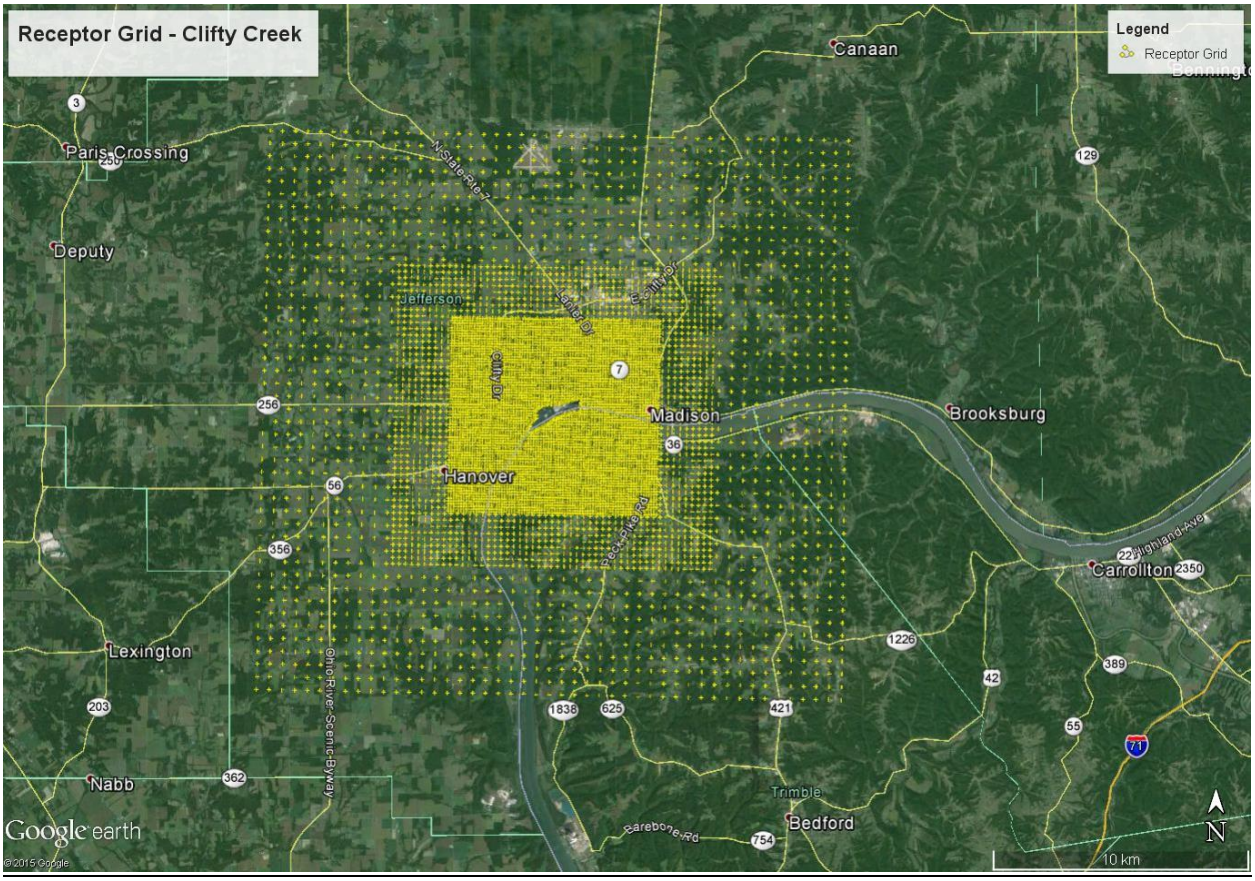
The grid receptor spacing for the area of analysis chosen by the state is as follows:

- Receptors along the fenceline every 50 meters
- Receptors every 100 meters out to a distance of 3 km from Clifty Creek
- Receptors every 250 meters from 3 km to 5 km
- Receptors every 500 meters from 5 km to 10 km

The receptor network contained 9,365 receptors, and the network covered central Jefferson County, northern Trimble County, Kentucky, and the northwestern tip of Carroll County, Kentucky, although neither Indiana nor Kentucky made no designation recommendations with respect to these portions of Kentucky.

Figure 6, prepared based on information provided by the state, shows the state's receptor grid for the area of analysis.

Figure 6: Receptor Grid for the Clifty Creek Area of Analysis



Indiana did not seek to identify areas where it might be infeasible to place a monitor, and instead conservatively placed receptors according to the above array without respect to feasibility of monitoring. The impacts of the area's geography and topography will be discussed later within this document.

Modeling Parameter: Source Characterization

In important respects, the state characterized the source within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the submitted modeling, reflecting allowable emissions for Clifty Creek, used stack heights determined in accordance with EPA's good engineering practices (GEP) policy. The state also adequately characterized Clifty Creek's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRIME was used to assist in addressing building downwash.

For sources in the study area other than Clifty Creek, Indiana did not determine building dimensions or otherwise consider building downwash. However, these other sources are at a sufficient distance from Clifty Creek that downwash is unlikely to have a significant impact on concentrations at locations near Clifty Creek with the potential to violate the SO_2 standard.

Modeling Parameter: Emissions

EPA's Modeling TAD notes that for the purposes of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also provides the option to use allowable emissions reflecting the applicable, federally enforceable emission limit (referred to as PTE or the allowable emissions rate).

EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information, when it is available, and that these data are available for many electric generating units. In the presence of CEMS data, EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, EPA believes that detailed throughput, operating schedules, and emissions information from the pertinent sources should be used.

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. Specifically, a facility may have recently adopted a new federally enforceable emissions limit, been subject to a federally enforceable consent decree, or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS. These new limits or conditions may be used in the application of AERMOD. In these cases, the Modeling TAD notes that the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations should contain the necessary emissions information for designations-related modeling. In the event that these short-term emissions are not readily available, they may

be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the state included Clifty Creek and two other significant emitters of SO_2 within 30 km in the area of analysis, and modeled approximately 10 km north, south, east, and west of the facility. This distance and these facilities were selected because the state believes that this area of analysis adequately includes the sources which might contribute to concentrations where the maximum concentrations of SO_2 near Clifty Creek are expected. No other sources were determined by the state to have the potential to cause significant concentration gradient impacts within the modeled area. The facilities in the area of analysis and their associated annual actual SO_2 emissions between 2012 and 2014 are summarized below. "Distance" in this table is the distance of the source from Clifty Creek.

Table 6: Actual SO_2 Emissions Between 2012 – 2014 from Facilities in the Clifty Creek Area of Analysis

Facility Name	Distance (km)	Actual SO_2 Emissions (tons per year)			Allowable Emissions (tpy)
		2012	2013	2014	
Clifty Creek	--	52,839	19,563	3,731	11,495.3*
Ghent Generating Station	33.34	10,772	13,422	14,851	--
Trimble County Generating Station	17.09	2,896	3,521	3,056	--
Total Emissions From All Facilities in the State's Area of Analysis		68,519	38,519	23,652	--

*Annual equivalent of 720-hour average limit.

Indiana used CEMS emissions data reported to EPA Clean Air Markets Division's data base for these three facilities. The dramatic decline in Clifty Creek emissions shown above reflects the installation of flue gas desulfurization that became operational in July 2013. Indiana performed an initial analysis using actual emissions from 2012 to 2014 for these three facilities, which "showed high modeled 1-hour SO_2 concentrations." Indiana then modeled an approximate 1½-year period from the time these controls became operation to the end of 2014. Indiana acknowledges that the modeling TAD does not recommend this approach, and instead states "sources that implement emission controls during the relevant 3-year period and that become subject to an emission limit requiring that control may wish to demonstrate that limit assures attainment, even though the 3-year average emissions level would be estimated to yield NAAQS violations." Indiana further noted discussion with EPA Region 5 indicating that "federally enforceable emission limits in place by the final SO_2 area designation date of July 2, 2016,[3] would be recognized as an appropriate assessment of an area's attainment designation." EPA in fact believes that it is an appropriate option to designate according to the impacts of the

[3] In fact, a limit that did not take effect until July 2, 2016 would not provide adequate opportunity for EPA to review the situation and confirm that a finding that the area can be considered to be attaining the standard. However, the actual commissioner's order that Indiana has submitted as a draft SIP submittal requires compliance by April 19, 2016, which EPA considers to provide for compliance enough in advance of its expected time of final action to serve as a suitable basis for determining the area's attainment status.

emissions allowed by a federally enforceable emission limit. However, the current federally enforceable emission limits are to emit no more than 7.52 lbs/MMBTU, which is substantially higher than the average of 0.12 lbs/MMBTU that Indiana modeled for 2014. That is, the modeling on which Indiana based its recommendation reflected neither the most recent three years of actual emissions data nor a federally enforceable allowable emission rate. EPA does not believe that an assessment estimating concentrations for an approximately 18-month period without a federally enforceable emission limit requiring those emission rates provides an appropriate basis for determining current actual or allowable air quality.

On the other hand, subsequent to Indiana's initial recommendations, on February 1, 2016, Indiana signed a commissioner's order limiting the SO_2 emissions from Clifty Creek to 2,624.5 lbs/hour on a 720-hour (30-day) average basis, which would correspond to annual emissions of 11,495.3 tons/year. Then, on February 5, 2016, Indiana submitted this order as part of a draft request for EPA to make this limit federally enforceable by approving the limit into the SIP. The order requires compliance with this limit by April 19, 2016. Indiana has also provided EPA with modeling to demonstrate that this limit would provide for the area to attain the SO_2 NAAQS. EPA policy is that for cases involving longer term (e.g. 30-day) average emission limits, modeling of allowable emissions should reflect an upward-adjusted value that represents the one-hour emission limit that would be at least comparably stringent. Accordingly, the value that Indiana modeled is 78 percent higher than the 720-hour average limit.

Indiana has further initiated opportunity for public comment on this commissioner's order and draft SIP revision request. EPA has signed a rulemaking notice proposing to approve this order. EPA anticipates that Indiana will submit a final SIP revision request after it completes its public comment period, after which EPA anticipates completing its rulemaking to make the limits in the order federally enforceable.

At this time, the emission limits that Indiana has imposed are not federally enforceable and thus are not currently a suitable basis for determining the attainment status of the area. On the other hand, if EPA takes final action to approve the commissioner's order adequately before promulgating a designation for this area, the limits would then be federally enforceable and would provide an appropriate basis on which to determine the attainment status of the area.

Modeling Parameter: Meteorology and Surface Characteristics

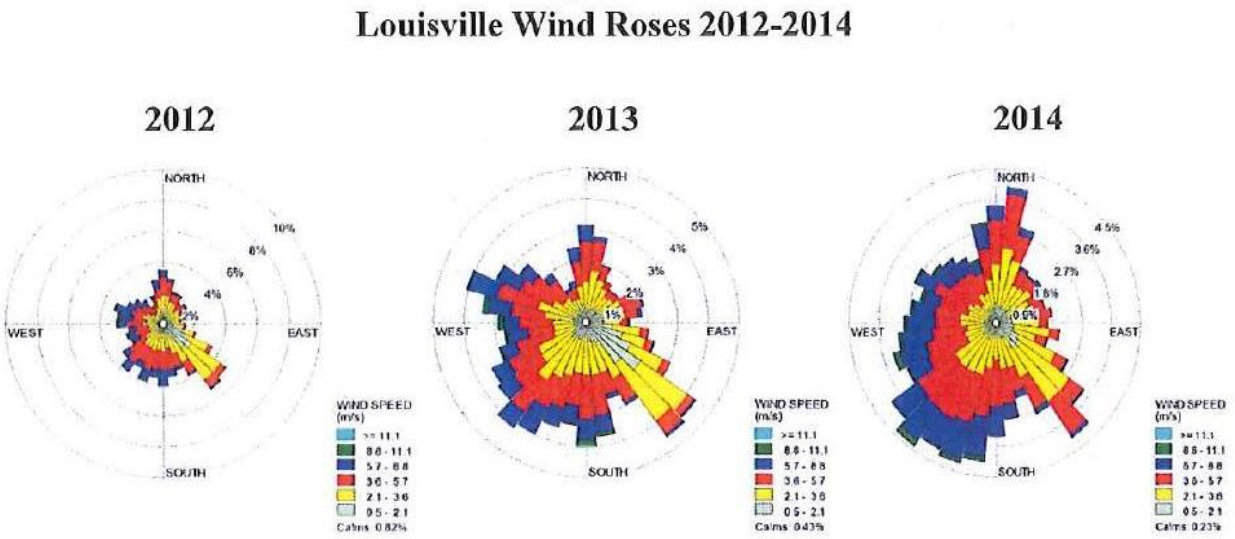
The most recent three years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. As noted in the Modeling TAD, the selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data are based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include National Weather Service (NWS) stations, site-specific or onsite data, and other sources such as universities, Federal Aviation Administration (FAA), and military stations.

For the Clifty Creek area of analysis, surface meteorology from the NWS station in Louisville, Kentucky, coincident upper air observations from the NWS station in Wilmington, Ohio were selected as best representative of meteorological conditions within the area of analysis.

The state used AERSURFACE using data from the NWS station in Louisville, Kentucky (located at 38.1811° north and 85.7391° west, 70 km northeast of Clifty Creek) to estimate the surface characteristics of the area of analysis. These surface characteristics are the albedo (the fraction of solar energy reflected from the earth back into space), the Bowen ratio (representing the ratio of sensible heat flux to latent heat flux at the ground level), and the surface roughness (representing the influence of ground features such as buildings and vegetation on surface wind flow). The state estimated values for 12 wind direction sectors, examining surface roughness out to one km and albedo and Bowen ratio for a 10-km square area. Additionally, Indiana applied a dry or wet Bowen ratio during months when soil moisture conditions were abnormally dry or wet, and applied a surface roughness value for snow cover if more than half of the month had days with at least one inch of snow on the ground.

As part of its recommendation, the state provided the surface wind rose for Louisville, Kentucky for each of the three modeled years. In Figure 7, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. As seen in this figure, winds in this area blow from all directions, but low winds are significantly more likely to blow from the southeast than from any other direction.

Figure 7: Louisville, Kentucky Annual Wind Roses for Years 2012 – 2014



Meteorological data from the above surface and upper air stations were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. The state followed the methodology and settings presented in "Regional Meteorological Data Processing Protocol EPA Region V and States" in the processing of the raw

meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, since winds can be variable in nature, wind data taken at hourly intervals may not always portray wind conditions for the entire hour. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of 1-minute duration was provided from the same instrument tower, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE. These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the one minute wind data.

Modeling Parameter: Geography and Terrain

Although Clifty Creek Generating Station is just south of Clifty Falls State Park and is in the Ohio River Valley, the terrain in the area of analysis is best described as gently rolling. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors.

Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "first tier" approach, based on monitored design values, or 2) a temporally varying approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For the Clifty Creek area of analysis, the state determined temporally varying background concentrations reflecting 99th percentile values by hour for each of the four seasons of the year. Table 7 shows the values (in ppb) that Indiana derived from data at a monitor in New Albany, Indiana (site number 18-043-1004), about 60 km to the southwest, which can be expected to provide a reasonably conservative estimate of background concentrations. The appropriate[4] value was added to the AERMOD results to obtain total concentration estimates.

[4] The conversion factor for SO_2 (at the standard conditions applied in the ambient SO_2 reference method) is 1ppb = approximately 2.62$\mu g/m^3$.

Table 7. Background Concentrations (in ppb) by hour of day by season in Clifty Creek area

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	6.61	7.81	5.50	5.57	4.25	5.09	4.89	5.95
Spring	8.10	5.36	7.03	8.25	5.64	4.85	3.51	5.39
Summer	6.84	4.05	3.99	5.35	4.14	3.10	4.40	4.62
Fall	3.34	3.50	3.69	3.64	2.80	3.36	3.39	4.62

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	6.01	6.62	8.56	12.67	14.03	10.43	12.31	10.94
Spring	9.23	8.91	9.18	10.11	16.50	13.28	11.34	9.50
Summer	6.16	18.31	11.77	11.11	14.61	12.95	9.45	9.50
Fall	5.98	6.91	9.44	9.38	11.14	11.24	8.95	8.96

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	10.38	8.80	8.90	6.90	6.15	8.28	6.28	8.04
Spring	17.56	15.06	13.38	11.96	9.41	7.69	5.08	9.02
Summer	7.80	8.64	10.04	10.26	8.10	6.14	7.44	6.50
Fall	10.81	12.77	7.85	6.35	3.90	3.30	4.70	5.55

Summary of Modeling Results

The AERMOD modeling parameters for the Clifty Creek area of analysis are summarized below in Table 8.

Table 8: AERMOD Modeling Parameters for the Clifty Creek Area of Analysis

Clifty Creek, Indiana Area of Analysis	
AERMOD Version	15181
Dispersion Characteristics	Rural
Modeled Sources	3
Modeled Stacks	8
Modeled Structures	1
Modeled Fencelines	1
Total receptors	9,365
Emissions Type	First run: Actual Second run: Allowable
Emissions Years	First run: July 2013-Dec 2014 Second run: Allowable
Meteorology Years	First run: July 2013 - Dec 2014

	Second run: 2012-2014
Surface Meteorology Station	Louisville, Kentucky
Upper Air Meteorology Station	Wilmington, OH
Methodology for Calculating Background SO_2 Concentration	Temporal Varying
Calculated Background SO_2 Concentration	See Table 7

The results presented below in Table 9 show the magnitude and geographic location of the highest predicted modeled concentration based on the limit established in Indiana's commissioner's order.

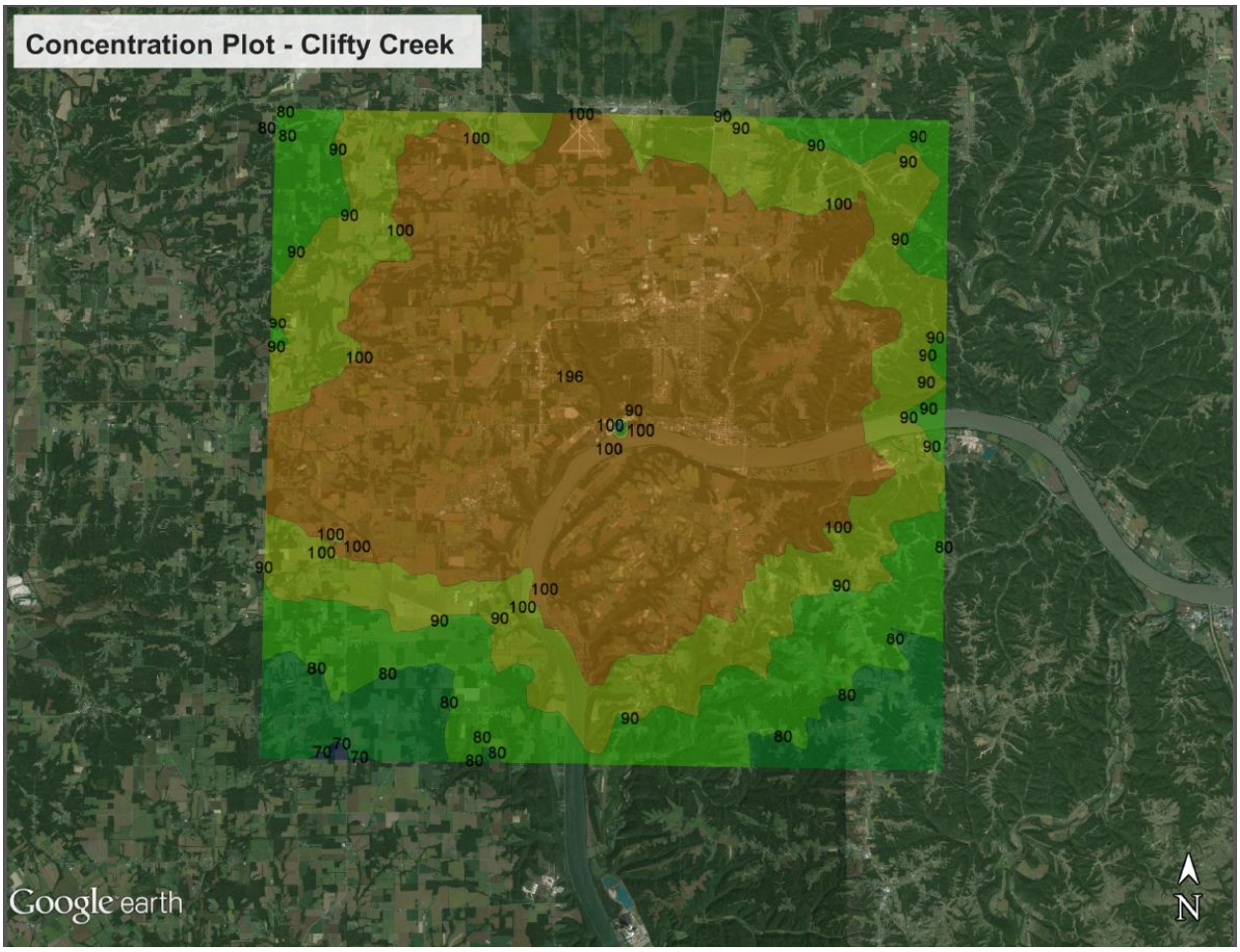
Table 9: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentration in the Clifty Creek Area Based on Allowable Emissions

	Receptor Location		SO_2 Concentration ($\mu g/m^3$)	
Averaging Period	UTM Northing	UTM Easting	Modeled (including background)	NAAQS
99th Percentile 1-Hour Average	4290,400	635,800	196.0	196.4*

*Equivalent to the 2010 SO_2 NAAQS set at 75 ppb

The state's modeling indicates that the predicted 99th percentile 1-hour average concentration within the chosen modeling domain is 196.0 $\mu g/m^3$, or 74.8 ppb. This modeled concentration included the background concentration of SO_2, and is based on the emissions allowed by the recent commissioner's order for Clifty Creek and the actual emissions from other facilities in the area. Figure 8 below was derived from modeling information provided by the state, and indicates that the predicted value occurred about 2.3 km northwest of the facility (located at 4288,832 m N, 637,432 m E). The state's receptor grid is also shown in the figure.

Figure 8. Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations in the Clifty Creek Area Based on Prospectively Allowable Emissions



Jurisdictional Boundaries:

Once the air quality in the area associated with Clifty Creek was determined, existing jurisdictional boundaries were considered for the purpose of informing our intended designated area, specifically in order to apply clearly defined legal boundaries.

The state's recommendation, that the entirety of Jefferson County be designated attainment, applies clear, well-known, stable, and well-established boundaries. However, Indiana only modeled concentrations within 10 km of Clifty Creek, and did not model concentrations elsewhere in Jefferson County. Significant SO_2 sources, most notably the Trimble County and Ghent Generating Stations, are located nearby in Trimble County and Carroll County, Kentucky, respectively. EPA has insufficient information to judge the attainment status of portions of Jefferson County that may be experiencing violations that Indiana's modeling did not evaluate. EPA is obliged under court order to designate areas near power plants meeting the applicable criteria by July 2, 2016, but EPA has no obligation to designate the entirety of the counties in

which these sources are located. That is, EPA is not obliged to promulgate designations for portions of Jefferson County where further analysis of potential violations is warranted.

As a result, EPA intends to designate a portion of Jefferson County. Indiana counties are divided into townships. Townships have clear, well-established boundaries that are reasonably well known, and townships are an appropriate size for differentiating areas meeting and not meeting the SO_2 standard, commensurate with the scale of spatial gradients that are common with SO_2. Therefore, EPA intends to promulgate a designation of a sub-county portion of Jefferson County that is defined by means of a list of townships.

As noted above, unless emission limits at Clifty Creek adequate to provide for attainment become federally enforceable in timely fashion, EPA intends to designate the area around Clifty Creek as nonattainment. The modeling that Indiana submitted suggests that only a limited area is presently violating the standard and that this area is all within Madison Township in Jefferson County. Thus, under present circumstances, EPA intends to designate Madison Township in Jefferson County as nonattainment and to designate no other portion of Jefferson County during this round of designations.

On the other hand, if limits that Indiana has issued for Clifty Creek become federally enforceable adequately in advance of EPA's final promulgation of a designation for this area, and EPA designates the Clifty Creek area as unclassifiable/attainment, it would be appropriate to define an unclassifiable/attainment area that includes other portions of Jefferson County that also appear likely to be attaining the standard. EPA does not have adequate information to judge air quality near Ghent Generating Station or Trimble County Generating Station, and thus would not designate two townships in Southwestern Jefferson County and one township in Southeastern Jefferson County (i.e., Hanover and Saluda Townships and Milton Township, respectively), which are reasonably near to significant sources in Kentucky that warrant further air quality characterization before being designated. However, EPA anticipates in this case that it would designate the remainder of Jefferson County as unclassifiable/attainment. Specifically, in this case, EPA anticipates that it would designate an unclassifiable/attainment area that includes Graham, Lancaster, Madison, Monroe, Republican, Shelby, and Smyrna Townships.

Other Relevant Information

Sierra Club provided additional modeling for this area indicating that this area is violating the SO_2 NAAQS. This modeling is based on actual emissions for 2012 to 2014. While Indiana only reported results from modeling emissions from mid-2013 to the end of 2014, after Clifty Creek installed emission control equipment, Indiana's submittal suggests that Sierra Club's modeling is consistent with their modeling at least to the extent that both modeling analyses indicate that actual emissions for the full 3-year period of 2012 to 2014 would be estimated to cause violations of the SO_2 NAAQS.

Nevertheless, Indiana has reviewed Sierra Club's modeling and identified numerous deficiencies in this analysis. Most significantly, Sierra Club computed a single background concentration, based on an analysis that did not exclude and therefore is prone to double count the impacts from modeled sources. Where Sierra Club used a constant background concentration of 18.0 ppb,

Indiana used a temporally varying background concentration, ranging from 2.8 to 18.3 ppb and averaging 8.0 ppb. Sierra Club did not use the variable stack parameter information that Indiana used. Sierra Club used AERMOD version 14134, whereas Indiana used a more recent version, namely version 15181. Indiana also identified several other differences between Sierra Club's and Indiana's modeling approach. In these respects, Indiana's approach is more consistent with EPA's recommendations and prone to provide a more reliable estimation of concentrations in the area.

Despite these differences, both Sierra Club's modeling and Indiana's modeling indicates that air quality for 2012 to 2014, in absence of consideration of the emission limits for Clifty Creek that Indiana has issued but that are not presently federally enforceable, reflects violations of the SO_2 NAAQS. Thus, both sets of modeling support EPA's intended nonattainment designation for this area. However, Sierra Club has not provided modeling addressing what air quality will result from the emission limits Indiana has issued. Therefore, if the limits that Indiana has issued become federally enforceable in timely fashion, EPA expects that it would designate the area consistent with Indiana's modeling, notwithstanding the contrary results in modeling provided by the Sierra Club.

Conclusion

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, EPA intends to designate the area around Clifty Creek as nonattainment for the 2010 SO_2 NAAQS. Specifically, the area that EPA intends to designate as nonattainment consists of Madison Township in Jefferson County. This intended designation reflects the fact that current emissions are sufficiently high to be found by modeling to cause violations of the SO_2 standard, and the fact that emission limits for Clifty Creek sufficient to provide for attainment of the standard are not federally enforceable, so that no federally enforceable limitation prevents continuation of high emission levels. EPA believes that designation of Madison Township within Jefferson County adequately encompasses the area that is violating the standard and the area that should be considered to contribute to this violation. EPA does not presently intend to designate any other portion of Jefferson County in this round of designations, and EPA intends to designate no nearby area in Kentucky.

On the other hand, several steps have been taken toward making emission limits for Clifty Creek federally enforceable and thus creditable for designations purposes. Indiana has issued a commissioner's order that imposes emission limits on Clifty Creek, Indiana is soliciting public comment on this order, and Indiana has submitted a request that EPA conduct "parallel processing" of this order as a prospective SIP revision. Indiana has also provided modeling to demonstrate that these limits would provide for attainment in the Clifty Creek area. If EPA approves these limits and the limits thereby become federally enforceable in a timely manner, EPA anticipates that it would designate the Clifty Creek area as unclassifiable/attainment. In this case, EPA anticipates that it would not designate two townships in Southwestern Jefferson County and one township in Southeastern Jefferson County (i.e., Hanover and Saluda Townships and Milton Township, respectively), which are reasonably near to significant sources in Kentucky that warrant further air quality characterization before being designated, but EPA anticipates in this case that it would designate the remainder of Jefferson County as

unclassifiable/attainment. Specifically, in this case, EPA anticipates that it would designate an unclassifiable/attainment area that includes Graham, Lancaster, Madison, Monroe, Republican, Shelby, and Smyrna Townships.

At this time, our intended designations for the state only apply to this area and the other areas addressed in this technical support document. Consistent with the conditions in the March 2, 2015 court-ordered schedule, EPA will evaluate and designate all remaining undesignated areas in Indiana by either December 31, 2017, or December 31, 2020.

Technical Analysis for the Gibson Area

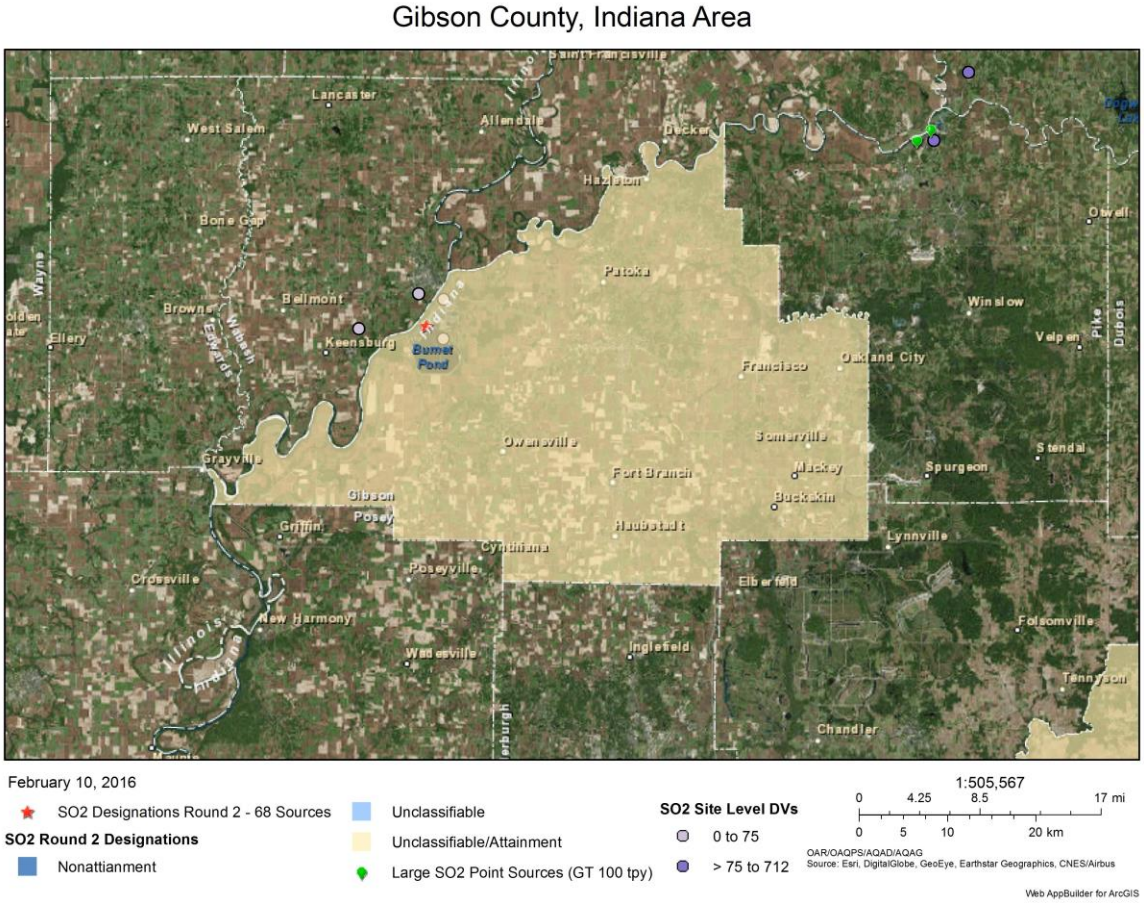
Introduction

Gibson County, Indiana contains a stationary source that according to EPA's Air Markets Database emitted in 2012 either more than 16,000 tons of SO_2 in 2012 or more than 2,600 tons of SO_2 and had an annual average emission rate of at least 0.45 pounds of SO_2 per one million British thermal units (lbs SO_2/MMBTU). As of March 2, 2015, this stationary source had not met the specific requirements for being "announced for retirement." Specifically, in 2012, the Gibson Generating Station ("Gibson") emitted 22,447 tons of SO_2 and had an emissions rate of 0.249 lbs SO_2/MMBTU. Pursuant to the March 2, 2015 court-ordered schedule, EPA must designate the area surrounding the facility by July 2, 2016.

In its submission, Indiana recommended that the area surrounding Gibson, specifically the entirety of Gibson County, be designated as attainment based on an assessment and characterization of air quality from the facility and other nearby sources which may have a potential impact in the area of analysis where maximum concentrations of SO_2 are expected. This assessment and characterization relied on air quality monitoring data from current and historic monitoring sites. After careful review of the state's assessment, supporting documentation, and all available data, EPA agrees that the area is attaining the standard, and intends to designate Gibson County as unclassifiable/attainment.

Gibson is located in southwestern Indiana, on the western portion of Gibson County, near the border between Indiana and Illinois. As seen in Figure 11, Gibson is located approximately 4.5 kilometers south of the center of Mt. Carmel, Illinois. This figure shows no nearby significant sources of SO_2, and the figure shows the Gibson County boundaries that the state recommended and EPA intends to use as boundaries of the area.

Figure 9. EPA's intended designation for Gibson County, Indiana



Gibson is the dominant source of SO_2 in its area; no other major SO_2 source (emitting at least 100 tpy) is located in Gibson County or elsewhere within 30 kilometers of this source. The area is rural and has gently rolling terrain. Emissions for 2012 to 2014 for Gibson are shown in Table 10.

Table 10. Emissions for Gibson

Facility Name	Actual SO_2 Emissions (tons per year)		
	2012	2013	2014
Gibson	22,447	20,669	22,055

The discussion and analysis that follows below will reference the state's use of the Modeling and Monitoring TADs, EPA's assessment of the state's use of these TADs, and the factors for evaluation contained in EPA's March 20, 2015 guidance, as appropriate.

Review of Monitoring Information

Air Quality Data

This factor considers the SO_2 air quality monitoring data in the area surrounding Gibson. Figure 10 shows the locations of current and former ambient monitoring sites. Figure 11 shows design concentrations from these sites starting in 2005 to 2007 through to 2012 to 2014. All four sites were operating from 2005 through 2010. (This figure also shows a fifth monitoring site, identified as "Pumphouse," for which Indiana provided limited non-quality assured data but for which no quality assured data have been reported into AQS.)

Figure 10. Location of current and historic monitors near Gibson

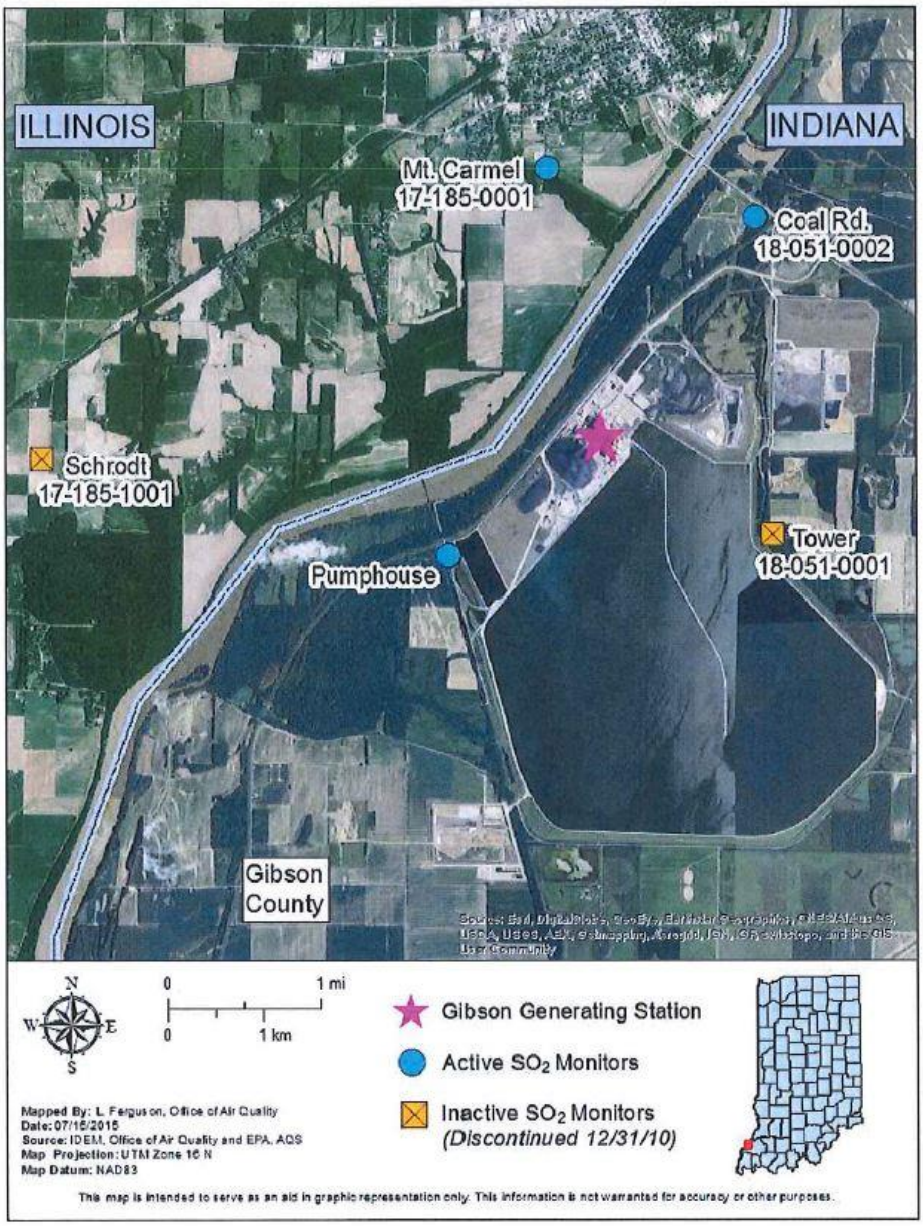
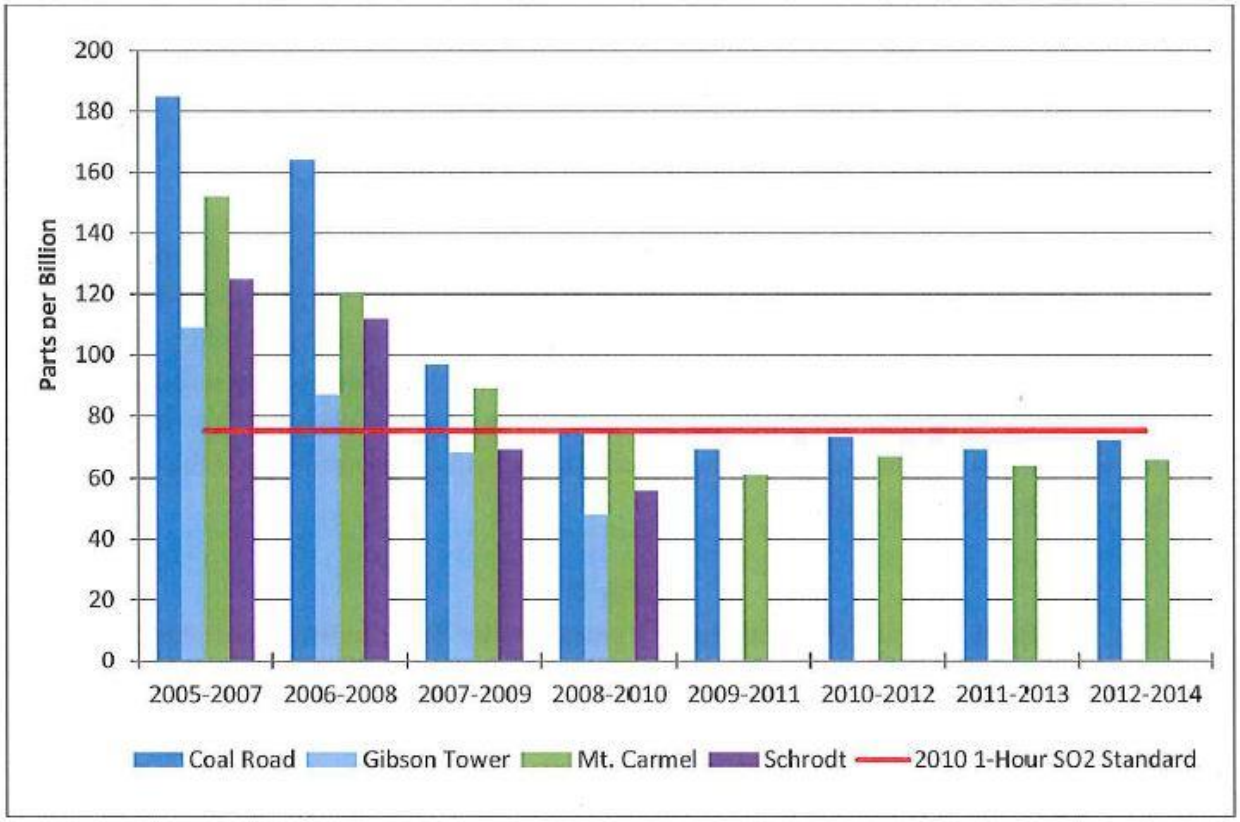


Figure 11. Bar chart of design values in the Gibson area from 2005 – 2007 to 2012 – 2014



For every three year period from 2005 – 2007 to the present, the highest design value was recorded at the Coal Road site, monitor number 18-051-0002, and the second highest design value was recorded at the Mt. Carmel site, monitor number 17-185-0001. When additional monitors were operating, the third highest design value was recorded at the Schrodt site, monitor number 17-185-1001, and the fourth highest design value was recorded at the Gibson Tower site, monitor number 18-051-0001. Therefore, the shutdown of the Schrodt and Gibson Tower sites in 2011 did not materially reduce the ability of the network to indicate whether maximum concentrations in the area are meeting or not meeting the SO_2 NAAQS.

Table 11 shows the design values for the last three three-year periods for the two sites that continued to operate during this period.

Table 11. Recent design values near Gibson

Site Name	Site ID	Design Value (ppb)		
		2010-2012	2011-2013	2012-2014
Mt. Carmel	17-185-0001	67	64	66
Coal Road	18-051-0002	73	69	72

These data indicate that the area is attaining the SO_2 NAAQS.

Adequacy of monitoring network

A key element of the review of these monitoring data is to assess the adequacy of the monitoring network for determining whether the areas of peak concentrations, where Gibson has its maximum impacts (in absence of other significant sources in the area), are sufficiently represented by monitoring to determine whether the full area may be found to be attaining the standard based on the monitored data.

The Monitoring TAD provides an extensive set of recommendations for designing monitoring networks to indicate whether areas near significant sources are meeting the SO_2 NAAQS. The TAD recommends three methods for determining appropriate monitoring site locations: 1) conduct modeling, 2) conduct exploratory monitoring, and 3) use existing emissions, monitoring, and modeling data. The TAD further includes an appendix that provides a detailed example of methods for using modeling to determine optimal candidate monitoring sites. The following sections describe how Indiana used each of these methods to evaluate the adequacy of the monitoring network in the Gibson area.

Modeling to evaluate monitoring network

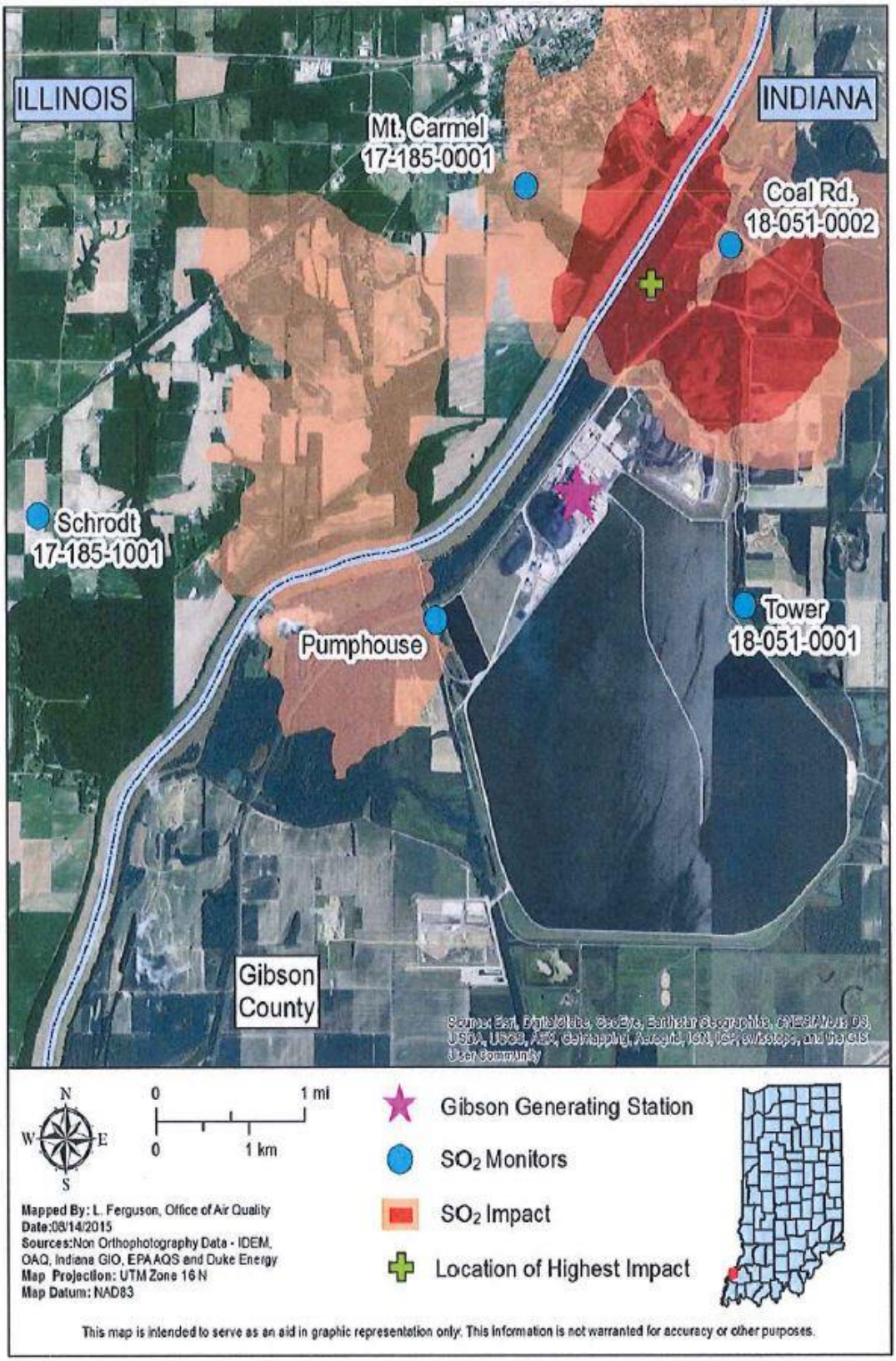
Indiana conducted modeling to evaluate the locations that are most likely to observe the highest concentrations near Gibson. A review of this modeling is provided in a subsequent section of this document.

The Monitoring TAD suggests the option of modeling normalized emission rates, i.e. modeling emission rates which reflect division of all emission rates by a common divisor. Whether the result is emission rates adding up to one gram per second or whether some other normalizing factor is used, the modeling with emission rates from various stacks that are in appropriate proportions will assure that the relative influence of various stacks (which may have peak impacts at different locations) are summed in appropriate proportions, irrespective of the absolute magnitude of the impacts.

Indiana's modeling analysis did not reflect normalized emission rates, and instead used actual emission rates for the 2012 to 2014 period. However, with or without normalization, modeling of emissions reflecting the actual ratios of emissions from various stacks provides a useful indication of the locations where peak concentrations are most likely to occur, and thereby provide useful information as to how well a monitoring network is likely to perform in monitoring peak concentrations. As discussed below, the modeling provides a reliable assessment of the geographical distribution of concentrations in the Gibson area, so that the modeling provides a useful assessment of the locations that most warrant ambient monitoring.

Figure 12 shows the results of Indiana's modeling, as shown in Indiana's recommendations.

Figure 12. Results of Indiana Modeling to estimate Distribution of Impacts from Gibson



These results indicate that the maximum concentrations can be expected generally northeast of Gibson, approximately 1.5 to 4 kilometers from Gibson, with a maximum concentration estimated to occur approximately 2 kilometers from the plant. The two currently operating monitors are approximately 3 km from the plant in the directions that are most likely to observe maximum impacts from the plant. Thus, this modeling suggests that the monitors are reasonably well sited to monitor maximum concentrations in the area.

Exploratory monitoring

The monitoring TAD suggests the possibility of short term monitoring efforts to evaluate the value of different potential monitoring sites in identifying maximum concentrations in the area and thereby in determining whether the area is experiencing violations of the SO_2 NAAQS. Indiana did not conduct any short term monitoring efforts, but the long-term monitoring at four sites in the area may be considered to serve a similar purpose, in demonstrating the portions of the area that are most likely to observe peak concentrations in the area.

Indiana also discussed concentrations at the Pumphouse site southwest of the plant. Although data from this site was not reported into AQS, so that these data cannot be considered to be quality assured, Indiana's recommendations letter listed the top 10 daily maximum values recorded at this site during the nearly one-year period from August 21, 2014 to July 31, 2015. These values ranged from 69 ppb down to 37 ppb; the 4th highest daily maximum value (presumably the 99th percentile during this period) was 60 ppb. While these data do not definitively indicate the attainment status of this portion of the area, these data do support a finding that the area southwest of Gibson is unlikely to be experiencing the highest concentrations in the area.

The evidence from the historic monitoring information indicates that higher concentrations are generally observed toward the north and northeast of the plant than in other directions. Conversely, the monitors toward the west and east of the plant have historically recorded lower concentrations. Thus, this long-term monitoring supports the conclusion that the two ongoing monitoring sites are well located for determining whether the area is violating the SO_2 NAAQS.

Review of Additional Information

As noted above, Gibson is the only significant SO_2 source in the area. Therefore, the appropriate means of evaluating where maximum concentrations in the area would be expected is to evaluate where the greatest impacts from Gibson would be expected.

In addition to the modeling information discussed above that Indiana provided, Indiana also provided windrose information from the Evansville NWS station (also germane to the Posey County area), as shown above in Figure 3.

In all three years shown in Figure 3 above, the predominant wind direction is from the south to southwest, with somewhat frequent winds (especially in 2013) from the northwest. This evidence suggests that the area within Gibson County that is most likely to observe maximum concentrations is northeast of Gibson.

According to the modeling information provided by Indiana, the stack heights of Gibson are approximately 180 meters. Peak modeled impacts of sources commonly occur at a distance from the source of approximately 10 stack heights away. Therefore, the maximum impacts of the plant would be expected to occur approximately 1.5 to 2.5 km from the plant. This approximation may be compared with Indiana's modeling results, which show the maximum modeled concentration occurring approximately 2 km from the plant. The monitors at Mt. Carmel and Coal Road are both approximately 3 km from the plant, in the general directions where maximum concentrations would be expected.

Review of Modeling Information

Information Submitted by Indiana

As noted above, Indiana's letter submitting recommendations for designations for the areas near Gibson and other pertinent facilities also included modeling of estimated Gibson impacts. While the purpose of this information was to evaluate the geographical distribution of impacts of this facility, and thereby to indicate the adequacy of the monitoring network for determining the attainment status of the area, the modeling also provides independent information as to whether the Gibson area is attaining the standard.

Indiana used AERMOD in its modeling analysis. Table 11 summarizes the modeling inputs used in this analysis.

Table 11: AERMOD Modeling Parameters for the Gibson Area

Gibson Area Modeling Parameters	
AERMOD Version	14134
Dispersion Characteristics	Rural
Modeled Sources	1
Modeled Stacks	5
Modeled Structures	1
Modeled Fencelines	1
Total receptors	9,365
Emissions Type	Actual
Emissions Years	2012-2014
Meteorology Years	2012-2014
Surface Meteorology Station	Evansville, Kentucky
Upper Air Meteorology Station	Lincoln, IL
Methodology for Calculating Background SO_2 Concentration	Not included
Calculated Background SO_2 Concentration	Not included

Model Selection and Modeling Components

EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. In some instances the recommended model may be a model other than AERMOD, such as the BLP model for buoyant line sources. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRIME: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

The state used AERMOD version 14134, which was the latest version when Indiana did its modeling.

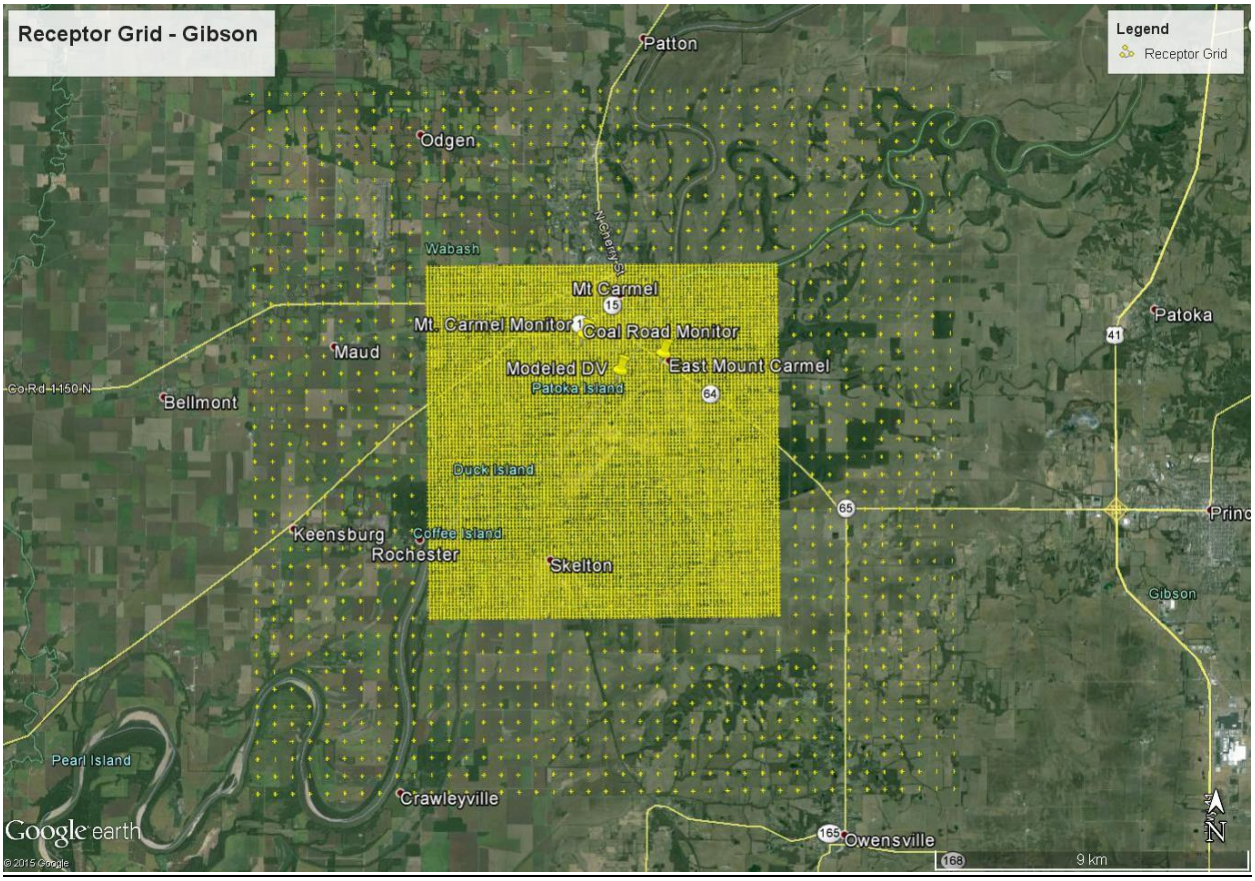
The state determined that modeling for this area would most appropriately use the model in rural mode. While Indiana did not provide Auer analyses for this or any other area, this area is distant from any urban area (e.g., 40 km from Evansville) and clearly warrants being modeled with rural dispersion characteristics.

Indiana used the following receptor grid in its analysis:

- Receptors along the fenceline every 50 meters
- Receptors every 100 meters out to a distance of 3 km from Gibson
- Receptors every 250 meters from 3 km to 5 km
- Receptors every 500 meters from 5 km to 10 km

The receptor network contained 9,365 receptors, and the network covered Gibson County, Indiana, Wabash County, Indiana, and portions of other neighboring counties. Given the absence of significant nearby sources, this analysis fully addresses the area near Gibson that is expected to experience the maximum concentrations. Figure 13 shows the receptor grid used in this analysis.

Figure 13: Receptor Grid for the Gibson Area



Indiana did not seek to identify areas where it might be infeasible to place a monitor, and instead conservatively placed receptors according to the above array without respect to feasibility of monitoring.

Modeling Parameter: Source Characterization

In important respects, the state characterized the source within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the submitted modeling reflected actual emissions for Gibson. The state also adequately characterized Gibson's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRIME was used to assist in addressing building downwash.

EPA's Modeling TAD notes that for the purposes of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also provides the option to use allowable emissions reflecting the applicable, federally enforceable emission limit (referred to as PTE or the allowable emissions rate).

EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information, when it is available, and that these data are available for many electric generating units. In the presence of CEMS data, EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, EPA believes that detailed throughput, operating schedules, and emissions information from the pertinent sources should be used.

Indiana used CEMS emissions data reported to EPA Clean Air Markets Division's data base for Gibson. As previously noted, the state identified no significant emitters of SO_2 other than Gibson within 30 km of this plant. This area of analysis adequately includes the area where significant sources might contribute to maximum concentrations of SO_2 near Gibson.

Modeling Parameter: Meteorology and Surface Characteristics

The most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. As noted in the Modeling TAD, the selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data are based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include National Weather Service (NWS) stations, site-specific or onsite data, and other sources such as universities, Federal Aviation Administration (FAA), and military stations.

For the Gibson area, surface meteorology from the NWS station in Evansville, Indiana, and coincident upper air observations from the NWS station in Lincoln, Illinois were selected as best representative of meteorological conditions within the area of analysis.

The state used AERSURFACE using data from the NWS station in Evansville, Indiana (located at 38.0441° north, 87.5205° west, 40 km southeast of Gibson) to estimate the surface characteristics of the area of analysis. These surface characteristics are the albedo (the fraction of solar energy reflected from the earth back into space), the Bowen ratio (representing the ratio of sensible heat flux to latent heat flux at the ground level), and the surface roughness (representing the influence of ground features such as buildings and vegetation on surface wind flow). The state estimated values for 12 wind direction sectors, examining surface roughness out to 1 km and albedo and Bowen ratio for a 10 km square area centered on the NWS station. Additionally, Indiana applied a dry or wet Bowen ratio during months when soil moisture conditions were abnormally dry or wet, and applied a surface roughness value for snow cover if more than half of the month had days with at least one inch of snow on the ground.

As part of its recommendation, the state provided the surface wind roses for Evansville, Indiana, for 2012, 2013, and 2014, as shown in Figure 3 above. As noted above, this wind information suggests that maximum concentrations are most likely to occur toward the north to northeast of Gibson.

Meteorological data from the above surface and upper air stations were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. The state followed the methodology and settings presented in "Regional Meteorological Data Processing Protocol EPA Region V and States" in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of one minute duration was provided from the same instrument tower, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE. These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the one minute wind data.

The terrain in the Gibson area is best described as gently rolling. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors.

Modeling Parameter: Background Concentrations of SO_2

Since the purpose of Indiana's modeling was to assess the distribution of concentrations, for purposes of determining the adequacy of the monitoring network, Indiana did not determine a background concentration for this area. Background concentrations found for A.B. Brown, based on data from an Evansville area monitor, may be a reasonable approximation of background concentrations near Gibson. These background concentrations are shown in Table 3 above, and have an average of 7.6 ppb. However, EPA has not conducted an analysis of the background concentrations that would be appropriate for the Gibson area.

Table 12: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentration in the Gibson Area Based on Actual Emissions, Without Background

	Receptor Location		SO_2 Concentration ($\mu g/m^3$)	
Averaging Period	UTM Northing	UTM Easting	Modeled (without background)	NAAQS

99th Percentile 1-Hour Average	4249,200	433,400	323	196.4*

*Equivalent to the 2010 SO_2 NAAQS set at 75 ppb

The state's modeling indicates that the predicted 99th percentile 1-hour average concentration within the chosen modeling domain is 323 $\mu g/m^3$, or 123 ppb. This modeled concentration does not include any background concentration of SO_2, and is based on actual emissions from Gibson. This evidence suggests that the area near Gibson violates the SO_2 NAAQS. As discussed above, and as shown in Figure 14 above, the maximum estimated concentrations were estimated to occur approximately 2 km northeast of the facility.

Modeling Information provided by Sierra Club

Sierra Club has also provided modeling of the Gibson area. Indiana provided a critique of Sierra Club's modeling, providing comments that are noted in pertinent sections below.

An important distinction between Indiana's modeling and Sierra Club's modeling is that Sierra Club included the Indianapolis Power and Light-Petersburg facility ("IPL-Petersburg"), located approximately 48 km from Gibson. IPL-Petersburg is within an existing nonattainment area, including portions of Daviess and Pike Counties, which is not the subject of this action. Instead, this action focuses on the attainment status near Gibson, which may reasonably be confined to a review of air quality in Gibson County, Indiana, and potentially Wabash County, Illinois (and, as necessary, a review of nearby sources contributing to any violations identified in that area). Thus, air quality at receptors near IPL-Petersburg (and any evaluation of nearby sources potentially contributing to violations near IPL-Petersburg) is not germane to this action. Given the distance between Gibson and IPL-Petersburg, Indiana reasonably concluded that the impacts of IPL-Petersburg near Gibson would be minimal and could be considered to be included as part of the background concentration.

Another distinction between Sierra Club's modeling is that while Indiana modeled only actual emissions, Sierra Club estimated concentrations both for actual emissions and for allowable emissions. These results suggest, respectively, that emissions from Gibson cause and are allowed to cause violations of the SO_2 NAAQS. However, consistent with recommendations in the modeling TAD, and given that actual emissions are lower than allowable emissions, the modeling results using actual emissions are more relevant than the modeling results using allowable emissions in determining current air quality, which is the basis on which EPA is determining these designations. Therefore, the following discussion will only address the results Sierra Club obtained using actual emissions.

Model Selection and Modeling Components

Sierra Club used AERMOD in its modeling analysis. Sierra Club used a total of 21,201 receptors, and the network covered part or all of Gibson, Daviess, Knox, and Pike Counties in Indiana and Wabash County in Illinois. Sierra Club modeled all receptors according to the above array without respect to feasibility of monitoring.

Modeling Parameter: Source Characterization

Sierra Club used fixed stack gas temperatures and flow rates. This approach differs from Indiana's approach, which was to use hourly data for stack gas temperatures and flow rates. Use of hourly stack parameters more accurately characterize plume characteristics, which will provide greater reliability both in the estimated concentration and in the geographical distribution of concentrations. In particular, use of hourly stack parameters can be expected to yield a more reliable assessment of where maximum concentrations would be expected.

Modeling Parameter: Meteorology and Surface Characteristics

For the Gibson area, Sierra Club used data from the same NWS stations as Indiana, using surface meteorology from the NWS station in Evansville, Indiana (located at 38.0441° north, 87.5205° west, 40 km southeast of Gibson), and coincident upper air observations from the NWS station in Lincoln, Illinois.

Indiana identified a number of issues with modeling parameters used by Sierra Club to characterize the meteorological and surface conditions of the Gibson area. With respect to surface characterization, Sierra Club used average seasonal moisture conditions, instead of adjusting the surface characteristics based on the number of days with snow cover on the ground during the winter months. Sierra Club also did not adjust the Bowen ratio adjustment based on soil moisture and precipitation, an adjustment recommended in "Regional Meteorological Data Processing Protocol EPA Region V and States."

Modeling Parameter: Background Concentrations of SO_2

Sierra Club used the 2011-2013 design value for the Vanderburgh County monitor as the background concentration of SO_2. A value of 47.1 $\mu g/m^3$ (18 ppb) was used by the Sierra Club as the background concentration. However, Sierra Club failed to exclude times when significant sources may be influencing concentrations, and so used a background concentration that likely overstates the concentration that would be expected in Gibson County in the absence of Gibson. Sierra Club's background concentration may be compared to the background concentration that Indiana determined for the A.B. Brown area also using Evansville monitoring data. The background concentrations that Indiana determined varied by hour-of-day and by season, with an average value of 20 $\mu g/m^3$ or 7.6 ppb. While time-varying background values likely provide the best estimation of background concentrations, this comparison provides an indication of the degree to which Sierra Club's background value likely overstates background concentrations.

Summary of Modeling Inputs and Results

Table 13 summarizes the modeling inputs used in this analysis.

Table 13: Sierra Club's AERMOD Modeling Parameters for the Gibson Area

Sierra Club's Gibson Area Modeling Parameters	
AERMOD Version	14134

Dispersion Characteristics	Rural
Modeled Sources	2
Modeled Stacks	9
Modeled Structures	0
Modeled Fencelines	N/A
Total receptors	21,201
Emissions Type	Separate results for actual and allowable emissions
Emissions Years	2012-2014 (for actual emissions)
Meteorology Years	2012-2014
Surface Meteorology Station	Evansville, Kentucky
Upper Air Meteorology Station	Lincoln, IL
Methodology for Calculating Background SO_2 Concentration	2011-2013 design value for Vanderburgh Co.
Calculated Background SO_2 Concentration	47.1 $\mu g/m^3$ (18.0 ppb)

As noted above, Sierra Club provided modeling of concentrations attributable to both Gibson and IPL-Petersburg. The highest concentrations estimated in this analysis were near IPL-Petersburg. However, as discussed above, that area has already been designated nonattainment, and air quality in that area (and the designation of that area) is not germane to this action. Since this action pertains only to air quality near Gibson, EPA is only reviewing information on concentrations near Gibson.

Table 14 shows the maximum concentrations that the Sierra Club estimated to be occurring near Gibson. The results shown in this table are from modeling actual emissions.

Table 14: Maximum Predicted 99th Percentile 1-Hour SO_2 near Gibson in Sierra Club Analysis

	Receptor Location		SO_2 Concentration ($\mu g/m^3$)	
Averaging Period	UTM Northing	UTM Easting	Modeled (including background)	NAAQS
99th Percentile 1-Hour Average	4247,386	431,452	276.8*	196.4**

*Results reflect impact only of Gibson. Since the maximum impacts from the combination of IPL-Petersburg and Gibson were near IPL-Petersburg, and Sierra Club only reported maximum concentrations, Sierra Club did not report concentrations estimated in the area near Gibson expected to result from the combination of the two sources. However, given the distance between Gibson and IPL-Petersburg, the impact of IPL-Petersburg on maximum concentrations near Gibson are likely to be small, and may be viewed as accounted for in the background concentrations.

**Equivalent to the 2010 SO_2 NAAQS set at 75 ppb

Sierra Club's modeling indicates that the predicted 99th percentile 1-hour average concentration within the chosen modeling domain, including background, is 276.8 $\mu g/m^3$, or 105.7 ppb. This

evidence suggests that the area near Gibson violates the SO_2 NAAQS. The maximum estimated concentrations were estimated to occur approximately 1.6 km west-northwest of the facility.

Evaluation of Monitoring and Modeling Evidence

In summary, the available monitoring evidence indicates that the Gibson area attains the SO_2 NAAQS, while the available modeling evidence, in the form of modeling by Indiana and by Sierra Club, indicates that the area is violating the SO_2 NAAQS. Both monitoring and modeling provide valid indications of air quality, but EPA here must promulgate a designation in the face of conflicting evidence from these two approaches. Thus, it is necessary to evaluate the relative merits of these different types of evidence as to air quality in the Gibson area.

As a general matter, monitoring at a monitoring site provides a more reliable indication of concentrations at a single specific location. Monitoring provides a direct measurement of concentrations at the monitor site. The accuracy of monitoring in assessing whether an area is attaining the NAAQS is largely influenced by whether the monitor is (or monitors are) adequately sited to record maximum concentrations. Modeling, on the other hand, is more useful for estimating variations in concentrations over a broader geographic area. But modeling relies on a complex assortment of input data such as meteorological data and source characterization data that necessarily have more potential for errors that may introduce inaccuracies into the estimated concentrations. Thus, each monitoring site provides data only for the specific location of the monitor, while modeling provides a more direct estimate of concentrations at a range of receptor locations, commonly estimating concentrations at thousands of receptor points. Even if an area has multiple monitors, modeling will often provide more reliable information on the spatial distribution of SO_2 concentrations and on the magnitude of SO_2 concentrations at unmonitored locations.

Therefore, the most important factor in determining the relative merits of the monitoring and modeling evidence in this particular area is the degree to which the monitoring sites can be considered to be located where maximum concentrations in the area can be expected. The modeling provided by Indiana indicates that the two ongoing monitors are in appropriate locations for representing the area near Gibson where maximum concentrations would be expected. Historic monitoring in the area, as well as wind information for the area, also points to a conclusion that maximum concentrations in the area can be expected generally north of Gibson, in the area where the two ongoing monitors are located. Consequently, there is strong evidence in this case that the monitors are reliable indicators of whether the area is meeting the NAAQS, even in the face of both Indiana's and the Sierra Club's contrary modeling results.

Sierra Club's modeling, unlike Indiana's modeling, indicates that maximum concentrations may be more prone to occur to the west of the plant. However, this may be an artifact of inappropriate stack gas characteristics, which can lead to misrepresentation of the circumstances in which maximum impacts occur. This result is also contrary to evidence from historic monitoring, in which a monitor to the west of the plant (located farther to the west, but still

indicative of the likelihood of maximum concentrations occurring west of the plant) routinely recorded lower concentrations than the monitors to the north of the plant.

Given that the monitors are reasonably well located for measuring maximum concentrations in the area, EPA is choosing to treat the monitoring evidence as a more reliable indication of air quality in the Gibson area than the modeling evidence.

Consequently, EPA is designating the Gibson area as unclassifiable/attainment.

Jurisdictional Boundaries

Once air quality in the area near Gibson was determined, existing jurisdictional boundaries were considered for the purpose of informing our intended designated area, specifically in order to apply clearly defined legal boundaries.

The state's recommendation, that the entirety of Gibson County be designated attainment, applies clear, well known, stable, and well established boundaries. As noted above, IPL-Petersburg is located about 48 km from Gibson. Also, IPL-Petersburg is located about 17 km from the nearest corner of Gibson County. The nonattainment area that already includes IPL-Petersburg reflects a judgment EPA has already made as to the spatial extent of violations in that area, and so EPA has already concluded that violations associated with IPL-Petersburg do not extend to Gibson County. No other significant sources exist in or near Gibson County. Therefore, EPA concludes that designating the entirety of Gibson County as unclassifiable/attainment is warranted.

Conclusion

Based on available monitoring data, and notwithstanding contrary evidence in modeling by Indiana and Sierra Club, EPA intends to designate Gibson County as unclassifiable/attainment.

At this time, our intended designations for the state only apply to this area and the other areas addressed in this technical support document. Consistent with the conditions in the March 2, 2015 court-ordered schedule, EPA will evaluate and designate all remaining undesignated areas in Indiana by either December 31, 2017, or December 31, 2020.

Technical Analysis for the Michigan City Area

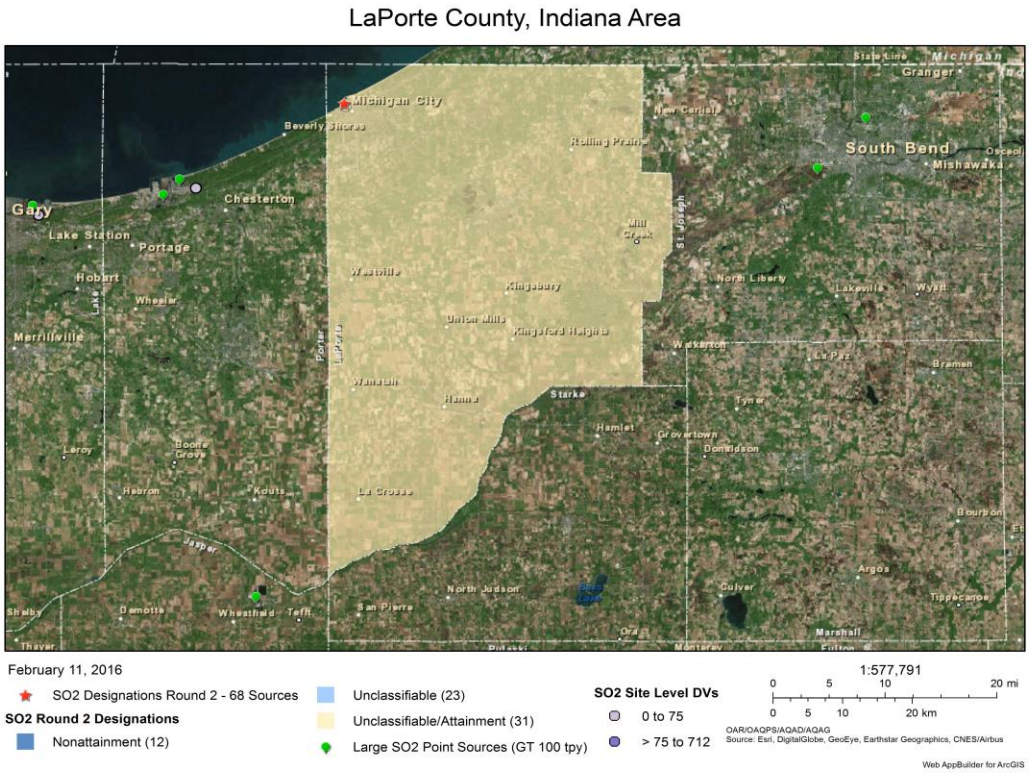
Introduction

LaPorte County, Indiana contains a stationary source that according to EPA's Air Markets Database emitted in 2012 either more than 16,000 tons of SO_2 in 2012 or more than 2,600 tons of SO_2 and had an annual average emission rate of at least 0.45 pounds of SO_2 per one million British thermal units (lbs SO_2/MMBTU). As of March 2, 2015, this stationary source had not met the specific requirements for being "announced for retirement." Specifically, the Michigan City Generating Station ("Michigan City") emitted 11,584 tons of SO_2 in 2012, and had an emissions rate of 1.006 lbs SO_2/MMBTU in 2012. Pursuant to the March 2, 2015 court-ordered schedule, EPA must designate the area surrounding the facility by July 2, 2016.

In its submission, Indiana recommended that the area surrounding Michigan City, specifically the entirety of LaPorte County, be designated as attainment based on an assessment and characterization of air quality from the facility and other nearby sources which may have a potential impact in the area of analysis where maximum concentrations of SO_2 are expected. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the state's assessment, supporting documentation, and all available data, EPA agrees that the area around Michigan City should be designated attainment/unclassifiable be so designated, and intends to designate a sub-county area as attainment/unclassifiable.

Michigan City is located in Northern Indiana in the northwestern portion of LaPorte County. As seen in Figure 17 below, the facility is located approximately on Lake Michigan adjacent to the municipality of Michigan City, Indiana. Also included in the figure are nearby emitters of SO_2, the state's recommended area for the attainment designation, and EPA's intended attainment/unclassifiable area boundaries.

Figure 14. EPA's intended designation for LaPorte County, Indiana



To assist states and other interested parties in their efforts to characterize air quality through air dispersion modeling for sources that emit SO_2, EPA released its most recent version of a draft document titled, "SO_2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) in December 2013. The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in EPA's March 20, 2015 guidance, as appropriate.

Detailed Assessment

Air Quality Data

This factor considers the SO_2 air quality monitoring data in the area surrounding Michigan City. The facility is located in LaPorte County, and among the monitors for which the state reported monitoring data is a monitor that is also located in LaPorte County. Specifically, monitor number 18-091-0005 is located at 341 West 4th Street in the municipality of Michigan City, Indiana, approximately 0.5 km southeast of the Michigan City plant. For 2012 to 2014, this monitor recorded a design value of 17 ppb. Another monitor is located in neighboring Porter County, namely monitor number 18-127-0011, recording a design value for 2012 to 2014 of 33 ppb, but this monitor is located 18 km from Michigan City, near two Porter County sources. All other monitors are located even further from Michigan City. The monitor in the municipality of Michigan City provides helpful evidence as to air quality near the Michigan City plant; other

monitoring data do not provide reliable evidence as to whether a violation is occurring in the area of Michigan City.

Model Selection and Modeling Components

EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. In some instances the recommended model may be a model other than AERMOD, such as the BLP model for buoyant line sources. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRIME: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

The state used AERMOD version 15181, the most recent version. A discussion of the individual components follows.

Modeling Parameter: Rural or Urban Dispersion

The state determined that modeling for this area would most appropriately use the model in rural mode. Michigan City is located at the far eastern end of the Chicago Metropolitan Area, substantial distance from any heavily industrialized or densely populated area. Thus, while Indiana did not conduct an Auer's land use analysis in support of the use of rural mode, the area clearly warrants being modeled in this manner.

Modeling Parameter: Area of Analysis (Receptor Grid)

EPA believes that a reasonable first step towards characterization of air quality in the area surrounding Michigan City is to determine the extent of the area of analysis, i.e., receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations. For the Michigan City area, the state has included two other emitters of SO_2 within 30 km of Michigan City in any direction, and modeled approximately 10 km north, south, east, and west of the facility. The state determined that these were the appropriate distances in order to adequately characterize air quality from the facility and other nearby sources which may have a potential impact in the area of analysis where maximum concentrations of SO_2 are expected. In addition to Michigan City, the other emitters of SO_2 included in the area of analysis were NIPSCO's Bailly Generating Station and Arcelor-Mittal's Burns Harbor facility. The grid receptor spacing for the area of analysis chosen by the state is as follows:

- Receptors along the fenceline every 50 meters

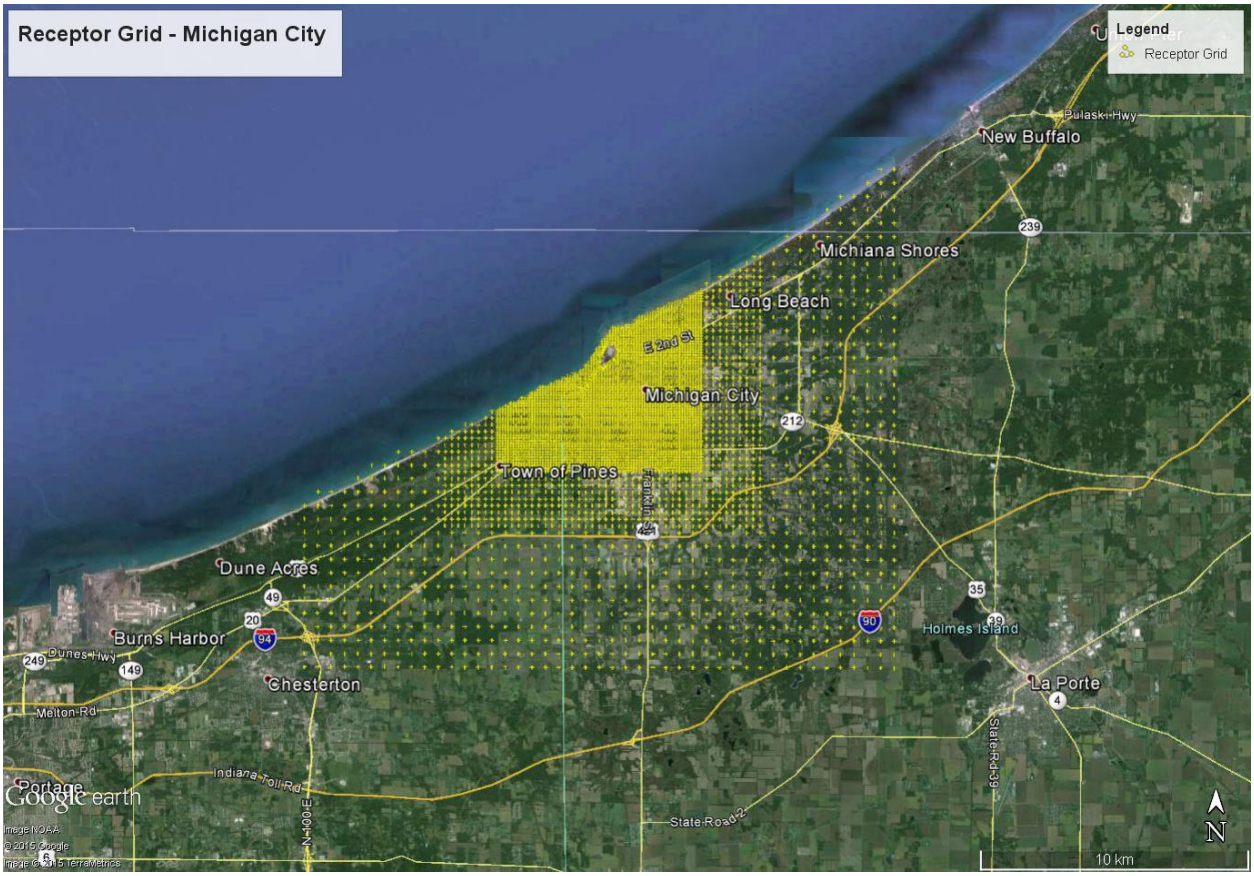
- Receptors every 100 meters out to a distance of 3 km from Michigan City
- Receptors every 250 meters from 3 km to 5 km
- Receptors every 500 meters from 5 km to 10 km

The receptor network contained 5,165 receptors, and the network covered a northwestern portion of LaPorte County and a northeastern portion of Porter County.

Indiana placed no receptors over Lake Michigan. Otherwise, Indiana did not seek to identify areas where it might be infeasible to place a monitor, and instead conservatively placed receptors according to the above array without respect to feasibility of monitoring. The impacts of the area's geography and topography will be discussed later within this document.

Figure 15, prepared based on information provided by the state, shows the receptor grid for the area of analysis.

Figure 15: Receptor Grid for the Michigan City Area



Modeling Parameter: Source Characterization

The state characterized Michigan City in accordance with the best practices outlined in the Modeling TAD. Specifically, the state used actual stack heights in conjunction with actual emissions. The state also adequately characterized Michigan City's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRIME was used to assist in addressing building downwash.

For sources in the study area other than Michigan City, Indiana did not determine building dimensions or otherwise consider building downwash. However, these other sources are at a sufficient distance from Michigan City that downwash is unlikely to have a significant impact on concentrations at locations near Michigan City with the potential to violate the SO_2 standard.

Modeling Parameter: Emissions

EPA's Modeling TAD notes that for the purposes of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. The Modeling TAD highly encourages the use of the most detailed throughput, operating schedule, and emissions information available. Variable emissions, temperature, and flow data can be modeled using AERMOD's hourly varying emissions keyword HOUREMIS or variable emission factor keyword EMISFACT. EPA believes that continuous emissions monitoring systems (CEMS) data provide valuable historical emissions information, when it is available, and that these data are available for many electric generating units. However, the TAD also provides the option to use allowable emissions reflecting the applicable, federally enforceable emission limit (referred to as PTE or the allowable emissions rate).

In certain instances, it may be advantageous or simpler to use PTE rates in designations modeling analyses. Specifically, a facility may have recently adopted a new federally enforceable emissions limit, been subject to a federally enforceable consent decree, or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS. These new limits or conditions may be used in the application of AERMOD. In these cases, the Modeling TAD notes that the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations should contain the necessary emissions information for designations-related modeling. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the state included Michigan City and two other emitters of SO_2 within 30 km in the area of analysis, and modeled approximately 10 km north, south, east, and west of the facility (except, again, to the extent that such an area is over Lake Michigan). These distances and these facilities were selected because the state believes that this area of analysis adequately represents the area where maximum concentrations of SO_2 near Michigan City are expected and adequately includes the sources which might contribute to those concentrations. No other sources within or beyond 30 km were determined by the state to have the potential to cause significant concentration gradient impacts within the area of analysis. The facilities in the area

of analysis and their associated annual actual SO_2 emissions between 2012 and 2014 are summarized below.

Table 15: Actual SO_2 Emissions Between 2012 – 2014 from Facilities in the Michigan City Area of Analysis

Facility Name	Distance (km)	Actual SO_2 Emissions (tons per year)		
		2012	2013	2014
Michigan City	--	11,584	10,429	15,991
NIPSCO Bailly	19.64	1,813	2,474	1,117
ArcelorMittal Burns Harbor	20.14	--	13,864	--
Total Emissions From All Facilities in the State's Area of Analysis		27,261	28,780	30,972

For Michigan City, the state used actual emissions from the most recent 3-year data set, i.e., 2012 – 2014. These emissions data were obtained from CEMs as reported to EPA's CAMD data base. For NIPSCO-Bailly and for Arcelor-Mittal, the state used annual average emission rates based on data reported to the state.

Modeling Parameter: Meteorology and Surface Characteristics

The most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. As noted in the Modeling TAD, the selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data are based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include National Weather Service (NWS) stations, site-specific or onsite data, and other sources such as universities, Federal Aviation Administration (FAA), and military stations.

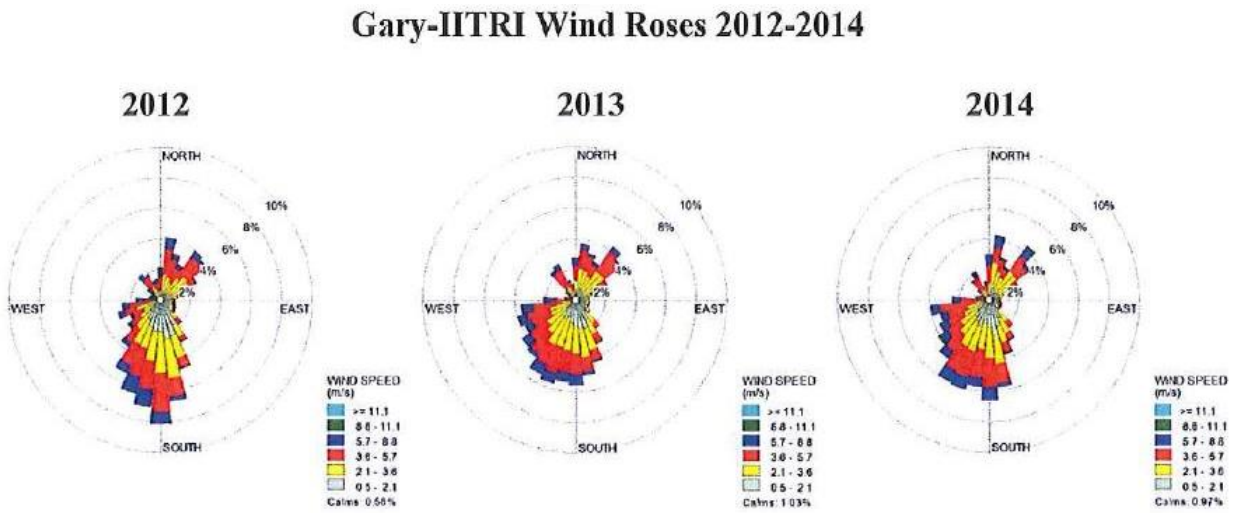
The state estimated values for albedo (the fraction of solar energy reflected from the earth back into space), the Bowen ratio (representing the ratio of sensible heat flux to latent heat flux at the ground level), and the surface roughness (representing the influence of ground features such as buildings and vegetation on surface wind flow). The state estimated values for 12 wind direction sectors, examining surface roughness out to 1 km and albedo and Bowen ratio for a 10 km square area centered on the NWS station. Additionally, Indiana applied a dry or wet Bowen ratio during months when soil moisture conditions were abnormally dry or wet, and applied a surface roughness value for snow cover if more than half of the month had days with at least one inch of snow on the ground.

For the Michigan City area of analysis, in order to obtain the best representation of meteorological conditions at Michigan City, given its relative proximity to Lake Michigan,

Indiana used a combination of data from two locations. Surface meteorological data were obtained primarily from the meteorological monitoring station operated by the Indiana Department of Environmental Management (IDEM) at Gary-IITRI (at 41.6067° north, 87.3048° west, 35 km west northwest of Michigan City). However, since snow depth and precipitation data are not readily available from the Gary-IITRI monitoring site, adjustments to the albedo and Bowen ratio surface characteristics used the precipitation, soil moisture, and snow depth data during the winter months from the South Bend NWS location. This combination of data provides a better indication of meteorological conditions at Michigan City than other available data sets. These data were used in conjunction with coincident data from the Lincoln, Illinois Upper Air Station.

As part of its recommendation, the state provided three years of surface wind roses for Gary-IITRI. In Figure 16, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. Whether one looks at all wind speeds or focuses on lighter wind speeds, winds from the south and southwest clearly predominate, with occasional winds from the northeast and very rarely from the west or east.

Figure 16: Annual Wind Roses at Gary-IITRI for Years 2012 – 2014



Meteorological data from the above surface and upper air stations were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. The state followed the methodology and settings presented in "Regional Meteorological Data Processing Protocol EPA Region V and States" in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data

may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of one minute duration was provided from the same instrument tower, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE. These data were subsequently integrated into the AERMET processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the one minute wind data.

Modeling Parameter: Geography and Terrain

The terrain in the area of analysis is best described as relatively flat. Nevertheless, to account for terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The source of the elevation data incorporated into the model is from the USGS National Elevation Database.

Michigan City is at the edge of Lake Michigan. The state used wind data from the Gary-IITRI station in order to assure that the effects of Lake Michigan are reflected in the wind data used in the analysis.

Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "first tier" approach, based on monitored design values, or 2) a temporally varying approach, based on the 99^{th} percentile monitored concentrations by hour of day and season or month. For the Michigan City area, the state used concentrations varying by hour of day and season of year. Indiana derived these background concentrations based on data from the nearby monitor in Michigan City (site number 18-091-0005), after excluding data from hours without major sources upwind. Table 16 lists the values that Indiana incorporated into the final AERMOD results.

Table 16. Temporally varying background concentrations for the Michigan City area

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	8.00	7.76	7.00	8.77	8.00	8.67	7.00	7.00
Spring	7.85	8.88	8.87	8.85	8.00	8.00	8.85	8.88
Summer	7.00	6.71	6.00	6.00	6.00	7.00	6.00	7.00
Fall	5.69	5.69	6.00	6.66	6.26	5.67	6.71	6.69

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	7.00	8.00	9.00	8.00	8.00	9.00	7.00	8.00
Spring	7.92	7.99	8.00	9.00	7.94	8.00	7.90	6.00
Summer	8.00	8.91	7.92	8.91	7.88	7.00	8.00	8.00
Fall	7.76	8.00	8.00	8.00	8.73	8.54	7.76	6.71

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	7.79	7.00	7.00	8.00	7.56	7.00	6.80	7.00
Spring	6.98	7.00	6.96	7.00	7.00	7.86	8.00	8.00
Summer	8.86	6.00	7.00	6.00	7.00	6.75	6.00	8.00
Fall	5.65	6.28	6.16	6.00	5.60	5.61	5.00	5.00

Summary of Modeling Results

The AERMOD modeling parameters for the Michigan City area are summarized below in Table 17.

Table 17: AERMOD Modeling Parameters for the Michigan City Area

Michigan City Area	
AERMOD Version	15181
Dispersion Characteristics	Rural
Modeled Sources	3
Modeled Stacks	35
Modeled Structures	1
Modeled Fencelines	1
Total receptors	5,165
Emissions Type	Actual
Emissions Years	2012-2014
Meteorology Years	2012-2014
Surface Meteorology Station	Gary-IITRI
Upper Air Meteorology Station	Lincoln, IL

Methodology for Calculating Background SO_2 Concentration	Temporal Varying
Calculated Background SO_2 Concentration	See Table 16

The results presented below in Table 18 show the magnitude and geographic location of the highest predicted modeled concentration based on actual emissions.

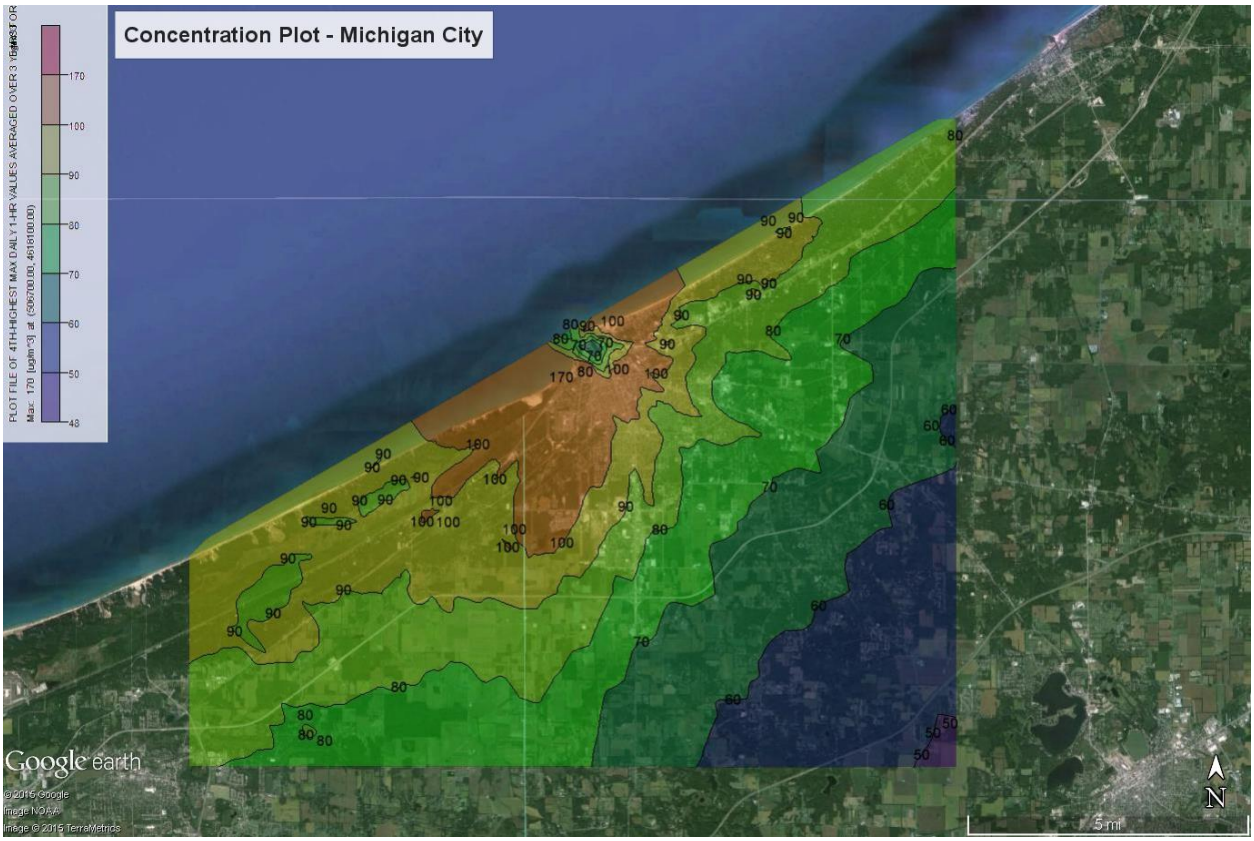
Table 18: Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentration in the Michigan City Area Based on Actual Emissions

		Receptor Location		SO_2 Concentration ($\mu g/m^3$)	
Averaging Period	Data Period	UTM Northing	UTM Easting	Modeled (including background)	NAAQS
99th Percentile 1-Hour Average	2012-2014	4618,100	506,700	169.9	196.4*

*Equivalent to the 2010 SO_2 NAAQS set at 75 ppb

The state's modeling indicates that the predicted 99th percentile 1-hour average concentration within the chosen modeling domain is 169.9 $\mu g/m^3$, or 64.9 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facilities. Figure 17 below was included as part of the state's recommendation, and indicates that the peak estimated value occurred about 1.2 km southwest of the plant (located at 4618,923 m N, 507,543 m E). The state's receptor grid is also shown in the figure.

Figure 17: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations in the Michigan City Area Based on Actual Emissions



Jurisdictional Boundaries:

Once air quality in the area near Michigan City was determined, existing jurisdictional boundaries were considered for the purpose of informing our intended unclassifiable/attainment area, specifically with respect to clearly defined legal boundaries.

The state's recommendation, that the entirety of LaPorte County be designated attainment, clearly applies clear, well known, stable, and well established boundaries. However, Indiana only modeled concentrations within 10 km of Michigan City, and did not model concentrations elsewhere in LaPorte County. Thus, review of appropriate boundaries for the Michigan City area requires a review of the potential for violations of the SO_2 standard elsewhere in LaPorte County, based on a review of whether other significant SO_2 sources are located in or near LaPorte County.

No significant SO_2 other than Michigan City are located in LaPorte County. Indiana's submittal identifies two significant, relatively nearby sources in Porter County. However, Indiana included these sources in its modeling of Michigan City, and the receptor grid for this modeling included the portion of LaPorte County nearest to and most prone to encounter violations attributable to these Porter County sources, so that Indiana has adequately demonstrated that these sources are not causing violations in LaPorte County. The other significant source located somewhat near to LaPorte County is the R.M. Schahfer Generating Station in Jasper County, about 16 km west of

the southwestern corner of LaPorte County. In 2014, this source emitted 8,412 tons of SO_2. Given that this facility has emissions that are comparable to those of Michigan City, and given that Indiana modeled attainment within 10 km of Michigan City, it appears unlikely that R.M. Schahfer would cause violations in LaPorte County 16 km away. While EPA anticipates further air quality characterization of the impacts of this source in Jasper County and Porter County (about 3 km to its north), it appears reasonable to proceed with designation of LaPorte County. Therefore, designation of the entirety of LaPorte County as unclassifiable/attainment appears warranted.

Other Relevant Information

No other parties submitted modeling or other information pertinent to the designation of LaPorte County.

Conclusion

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, EPA intends to designate the area around Michigan City, along with the remainder of LaPorte County, as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, EPA intends to designate the entirety of LaPorte County as unclassifiable/attainment.

EPA is basing this conclusion predominantly on modeling provided by Indiana, which demonstrates, even with consideration of the impacts of relatively nearby sources, that the area near Michigan City is attaining the SO_2 standard. This conclusion is also based on a finding that the modeling covers the portion of LaPorte County that has potential for violations caused by significant Porter County sources, a finding that R.M. Schahfer is unlikely to be causing violations in Southwest LaPorte County, and a finding that no other significant SO_2 sources are located in or near LaPorte County.

At this time, our intended designations for the state only apply to this area and the other areas presented in this technical support document. Consistent with the conditions in the March 2, 2015 court-ordered schedule, EPA will evaluate and designate all remaining undesignated areas in Indiana by either December 31, 2017, or December 31, 2020.

Technical Analysis for the Rockport Area

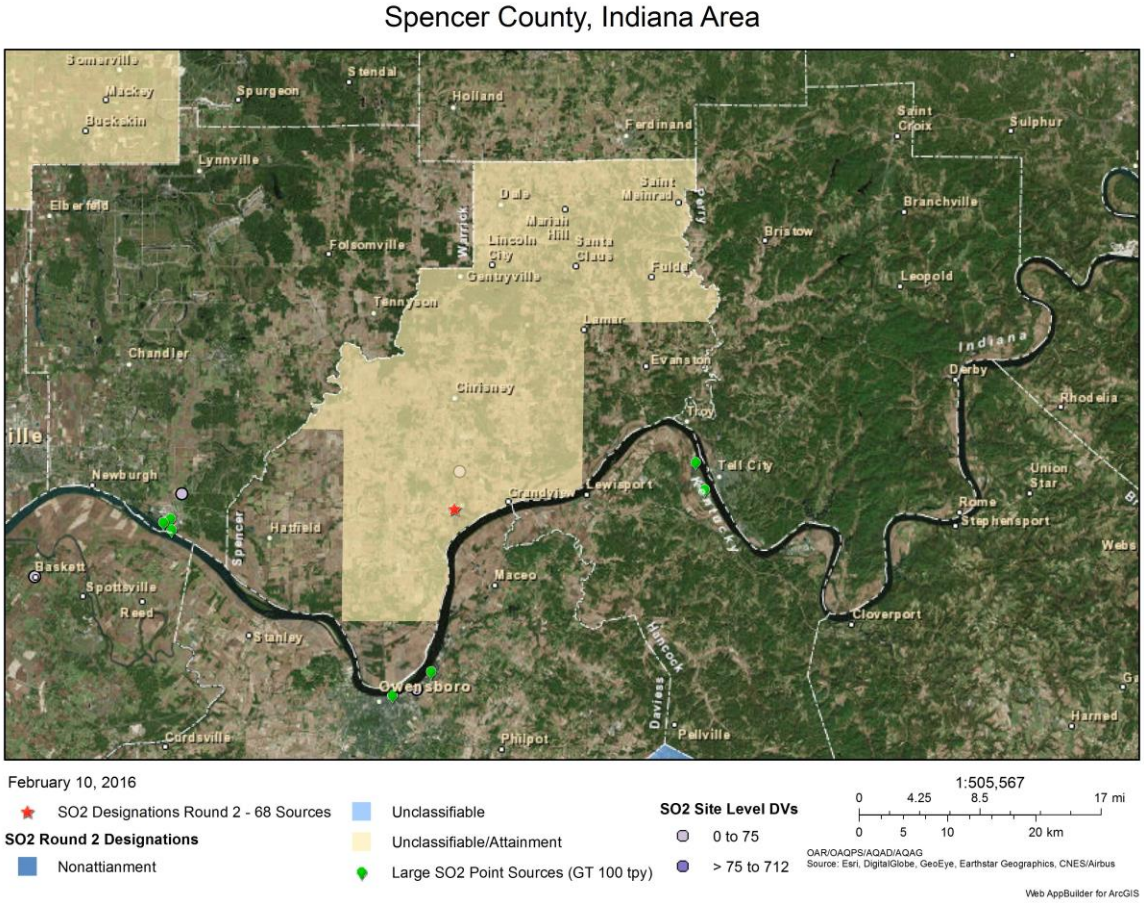
Introduction

Spencer County, Indiana contains a stationary source that according to EPA's Air Markets Database emitted in 2012 either more than 16,000 tons of SO_2 in 2012 or more than 2,600 tons of SO_2 and had an annual average emission rate of at least 0.45 pounds of SO_2 per one million British thermal units (lbs SO_2/MMBTU). As of March 2, 2015, this stationary source had not met the specific requirements for being "announced for retirement." Specifically, the Rockport Generating Station ("Rockport") emitted 54,390 tons of SO_2 in 2012, and had an emissions rate of 0.583 lbs SO_2/MMBTU in 2012. Pursuant to the March 2, 2015 court-ordered schedule, EPA must designate the area surrounding the facility by July 2, 2016.

In its submission, Indiana recommended that the area surrounding Rockport, specifically the entirety of Spencer County, be designated as attainment based on an assessment and characterization of air quality from the facility and other nearby sources which may have a potential impact in the area of analysis where maximum concentrations of SO_2 are expected. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the state's assessment, supporting documentation, and all available data, EPA agrees that the area around Rockport should be designated attainment/unclassifiable but believes that a smaller area should be so designated, and intends to designate a sub-county area as attainment/unclassifiable.

Rockport is located in southern Indiana on the border with Kentucky along the Ohio River. As seen in Figure 22 below, the facility is located approximately 5 km northeast of the center of Rockport, Indiana, close to the Ohio River. Also included in the figure are nearby emitters of SO_2, the state's recommended area for the attainment designation, and EPA's intended unclassifiable/attainment designation for the area.

Figure 18. EPA's intended designation for Spencer County, Indiana



To assist states and other interested parties in their efforts to characterize air quality through air dispersion modeling for sources that emit SO_2, EPA released its most recent version of a draft document titled, "SO_2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) in December 2013. The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in EPA's March 20, 2015 guidance, as appropriate.

Detailed Assessment

Air Quality Data

This factor considers the SO_2 air quality monitoring data in the area surrounding Rockport. No monitoring data are available in or near this facility.

Model Selection and Modeling Components

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

In some instances the recommended model may be a model other than AERMOD, such as the BLP model for buoyant line sources. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRIME: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

The state used AERMOD version 15181 (the most recent version). A discussion of the individual components will be referenced in the pertinent discussion that follows, as appropriate.

Modeling Parameter: Rural or Urban Dispersion

The state determined that modeling for this area would most appropriately use the model in rural mode. While Indiana did not provide Auer analyses for this or any other area, this area is distant from any urban area and clearly warrants being modeled with rural dispersion characteristics.

Modeling Parameter: Area of Analysis (Receptor Grid)

EPA believes that a reasonable first step towards characterization of air quality in the area surrounding Rockport is to determine the extent of the area of analysis, i.e., receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations. For the Rockport area, the state has included seven other emitters of SO_2 within 30 kilometers (km) of Rockport in any direction. The state determined that this was the appropriate distance in order to adequately characterize air quality from the facility and other nearby sources which may have a potential impact in the area of analysis where maximum concentrations of SO_2 are expected. The other emitters of SO_2 included in the area of analysis in addition to Rockport are listed in Table 19 below. The grid receptor spacing for the area of analysis chosen by the state is as follows:

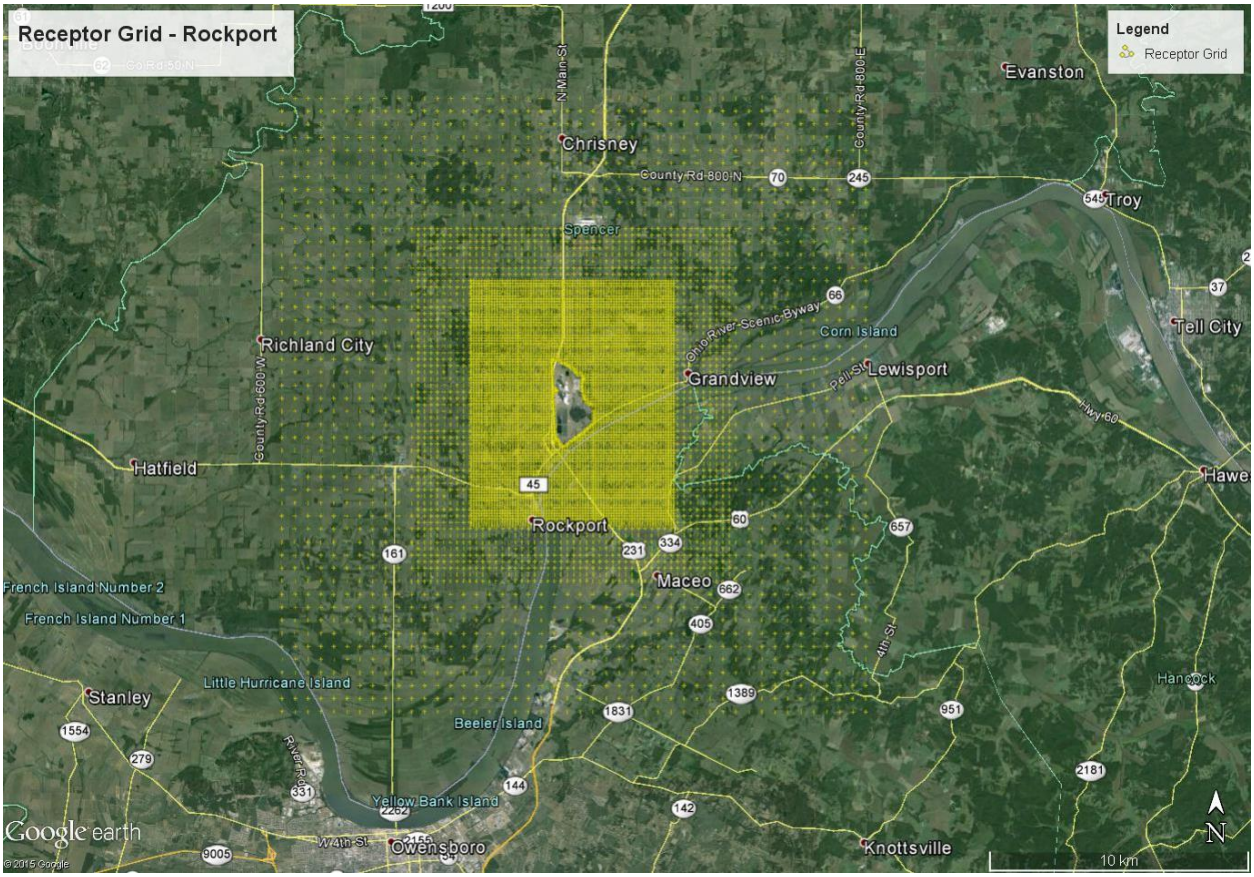
- Receptors along the fenceline every 50 meters
- Receptors every 100 meters out to a distance of 3 km from Rockport
- Receptors every 250 meters from 3 km to 5 km
- Receptors every 500 meters from 5 km to about 12 km

The receptor network contained 10,467 receptors, and the network covered the southern and central portion of Spencer County in Indiana, the northern half of Daviess County in Kentucky, and the western edge of Hancock County in Kentucky. Specifically, the receptor grid extended from 4185.5 km to 4209 km northing and from 486 km to 508.5 km easting in Zone 16.

Figure 19 prepared based on information provided by the state, shows the receptor grid for the area of analysis.

Indiana did not seek to identify areas where it might be infeasible to place a monitor, and instead placed receptors according to the above array without respect to feasibility of monitoring. The impacts of the area's geography and topography will be discussed later within this document.

Figure 19: Receptor Grid for the Rockport Area of Analysis



Modeling Parameter: Source Characterization

The state characterized Rockport in accordance with the best practices outlined in the Modeling TAD. Specifically, the state used actual stack heights in conjunction with actual emissions. The state also adequately characterized Rockport's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRIME was used to assist in addressing building downwash.

The state's modeling of other sources in the area of analysis besides Rockport did not consider building characteristics or downwash from these other sources. However, these other sources appear to be sufficient distance from the highest concentration areas near Rockport that this omission is unlikely to affect whether violations of the SO_2 standard are occurring near Rockport.

Modeling Parameter: Emissions

EPA's Modeling TAD notes that for the purposes of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also provides the option to use allowable emissions reflecting the applicable, federally enforceable emission limit (referred to as PTE or the allowable emissions rate).

EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information, when it is available, and that these data are available for many electric generating units. In the presence of CEMS data, EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, EPA believes that detailed throughput, operating schedules, and emissions information from the pertinent sources should be used.

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. Specifically, a facility may have recently adopted a new federally enforceable emissions limit, been subject to a federally enforceable consent decree, or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS. These new limits or conditions may be used in the application of AERMOD. In these cases, the Modeling TAD notes that the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations should contain the necessary emissions information for designations-related modeling. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the state included Rockport and seven other emitters of SO_2 within 30 km in the area of analysis, and modeled approximately 10 km north, south, east, and west of the facility. These distances and these facilities were selected because the state believes that this area of analysis adequately represents the area where maximum concentrations of SO_2 are expected and adequately includes the sources which might contribute to those concentrations. No other sources beyond 30 km were determined by the state to have the potential to cause significant concentration gradient impacts within the area of analysis. The facilities in the area of analysis and their associated annual actual SO_2 emissions between 2012 and 2014 are summarized below.

Table 19: Actual SO_2 Emissions Between 2012 – 2014 from Facilities in the Rockport Area of Analysis

Facility Name	Distance (km)	Actual SO_2 Emissions (tons per year)		
		2012	2013	2014
Rockport	--	54,389	51,636	54,979
ALCOA Warrick Power Plant	25.94	5,170	5,707	4,993

ALCOA Warrick Operations	25.29	--	3,853	--
SIGECO Culley	25.45	2,116	1,948	1,896
Big Rivers Electric Corp - Coleman	21.92	5,058	8,146	923
Owensboro Municipal - Elmer Smith	14.57	4,958	8,064	5,741
Century Aluminum of KY	22.40	--	2,262	--
Owensboro Grain	17.51	--	382	--
Total Emissions From All Facilities in the State's Area of Analysis		78,188	81,998	75,029

For Rockport, the state used actual hourly emissions from the most recent 3-year data set, i.e., 2012 – 2014. These emissions data were obtained from CEMS data reported to EPA CAMD data base. For the remaining sources in the area, the state modeled a fixed emission rate reflecting average emissions reported to the applicable state.

Modeling Parameter: Meteorology and Surface Characteristics

The most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. As noted in the Modeling TAD, the selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data are based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include National Weather Service (NWS) stations, site-specific or onsite data, and other sources such as universities, Federal Aviation Administration (FAA), and military stations.

For the Rockport area, Indiana selected surface meteorology from the NWS station in Evansville, Indiana, and coincident upper air observations from the NWS upper air station in Lincoln, Illinois, as best representative of meteorological conditions within the area of analysis.

The state used AERSURFACE using data from the NWS station in Evansville, Indiana (located at 38.0441° north, 87.5205° west, 45 km west northwest of Rockport) to estimate the surface characteristics of the area of analysis. These surface characteristics are the albedo (the fraction of solar energy reflected from the earth back into space), the Bowen ratio (representing the ratio of sensible heat flux to latent heat flux at the ground level), and the surface roughness (representing the influence of ground features such as buildings and vegetation on surface wind flow). The state estimated values for 12 wind direction sectors, examining surface roughness out to 1 km and albedo and Bowen ratio for a 10 km square area centered on the NWS station. Additionally, Indiana applied a dry or wet Bowen ratio during months when soil moisture conditions were abnormally dry or wet, and applied a surface roughness value for snow cover if more than half of the month had days with at least one inch of snow on the ground.

For the Rockport area of analysis, surface meteorology from the NWS station in Evansville, Indiana, and coincident upper air observations from the NWS station in Lincoln, Illinois, were selected as best representative of meteorological conditions within the area of analysis.

Surface wind roses for the three modeled years for Evansville, Indiana, shown above in Figure 3, are also indicative of wind patterns in Spencer County. Thus, in Spencer County, as in Gibson and Posey Counties, southwesterly winds are most common, especially for low wind conditions, with less frequent winds from the northwest.

Meteorological data from the above surface and upper air stations were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. The state followed the methodology and settings presented in "Regional Meteorological Data Processing Protocol EPA Region V and States" in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, wind data of one minute duration was provided from the same instrument tower, but in a different formatted file to be processed by a separate preprocessor, AERMINUTE version 14237. These data were subsequently integrated into the AERMET version 15181 processing to produce final hourly wind records of AERMOD-ready meteorological data that better estimate actual hourly average conditions and that are less prone to over-report calm wind conditions. This allows AERMOD to apply more hours of meteorology to modeled inputs, and therefore produce a more complete set of concentration estimates. As a guard against excessively high concentrations that could be produced by AERMOD in very light wind conditions, the state set a minimum threshold of 0.5 meters per second in processing meteorological data for use in AERMOD. In setting this threshold, no wind speeds lower than this value would be used for determining concentrations. This threshold was specifically applied to the one minute wind data.

Modeling Parameter: Geography and Terrain

The terrain in the area of analysis is best described as gently rolling within the valley of a major river. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The source of the elevation data incorporated into the model is from the USGS National Elevation Database.

Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "first tier" approach, based on monitored design values, or 2) a temporally varying approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For the Rockport area, the state chose to compute variable background concentrations, determining a separate value for each season for each of the 24 hours in a day. The state made these determinations using data from the Buena Vista site in Evansville (site number 18-163-0005), excluding data from the general direction of Rockport (southeast). Table 20 lists the array of background concentrations that the state used in this analysis.

Table 20. Background Values for the Rockport Area

	Hr 1	Hr 2	Hr 3	Hr 4	Hr 5	Hr 6	Hr 7	Hr 8
Winter	6.00	4.25	3.81	4.20	5.75	4.76	5.66	7.41
Spring	4.48	3.87	3.57	4.06	2.91	3.31	4.47	8.25
Summer	2.37	2.38	1.00	1.00	3.60	3.90	3.83	4.26
Fall	2.23	2.28	2.22	3.20	3.54	3.00	3.99	5.26

	Hr 9	Hr 10	Hr 11	Hr 12	Hr 13	Hr 14	Hr 15	Hr 16
Winter	8.86	10.80	12.58	10.87	14.64	19.51	19.33	19.31
Spring	8.36	8.89	13.01	11.98	8.85	11.87	10.46	12.29
Summer	5.55	12.12	8.41	8.80	5.72	4.40	4.81	5.27
Fall	7.56	11.32	11.34	11.68	10.07	10.39	7.16	7.79

	Hr 17	Hr 18	Hr 19	Hr 20	Hr 21	Hr 22	Hr 23	Hr 24
Winter	15.65	17.13	9.25	10.40	8.60	8.35	6.29	6.12
Spring	12.28	13.04	11.68	8.29	5.26	3.81	5.76	6.06
Summer	6.35	9.76	7.11	4.74	4.04	2.21	3.04	1.00
Fall	10.68	10.11	6.67	4.68	4.42	2.59	2.80	2.79

Summary of Modeling Results

The AERMOD modeling parameters for the Rockport area of analysis are summarized below in Table 21

Table 21: AERMOD Modeling Parameters for the Rockport Area of Analysis

Rockport Area of Analysis	
AERMOD Version	15181

Dispersion Characteristics	Rural
Modeled Sources	8
Modeled Stacks	16
Modeled Structures	1
Modeled Fencelines	1
Total receptors	10,467
Emissions Type	Actual
Emissions Years	2012-2014
Meteorology Years	2012-2014
Surface Meteorology Station	Evansville, IN
Upper Air Meteorology Station	Lincoln, IL
Methodology for Calculating Background SO_2 Concentration	Temporally Varying
Calculated Background SO_2 Concentration	See Table 20

The results presented below in Table 22 show the magnitude and geographic location of the highest predicted modeled concentration based on actual emissions.

Table 22: Maximum Predicted 99th Percentile 1-Hour SO_2

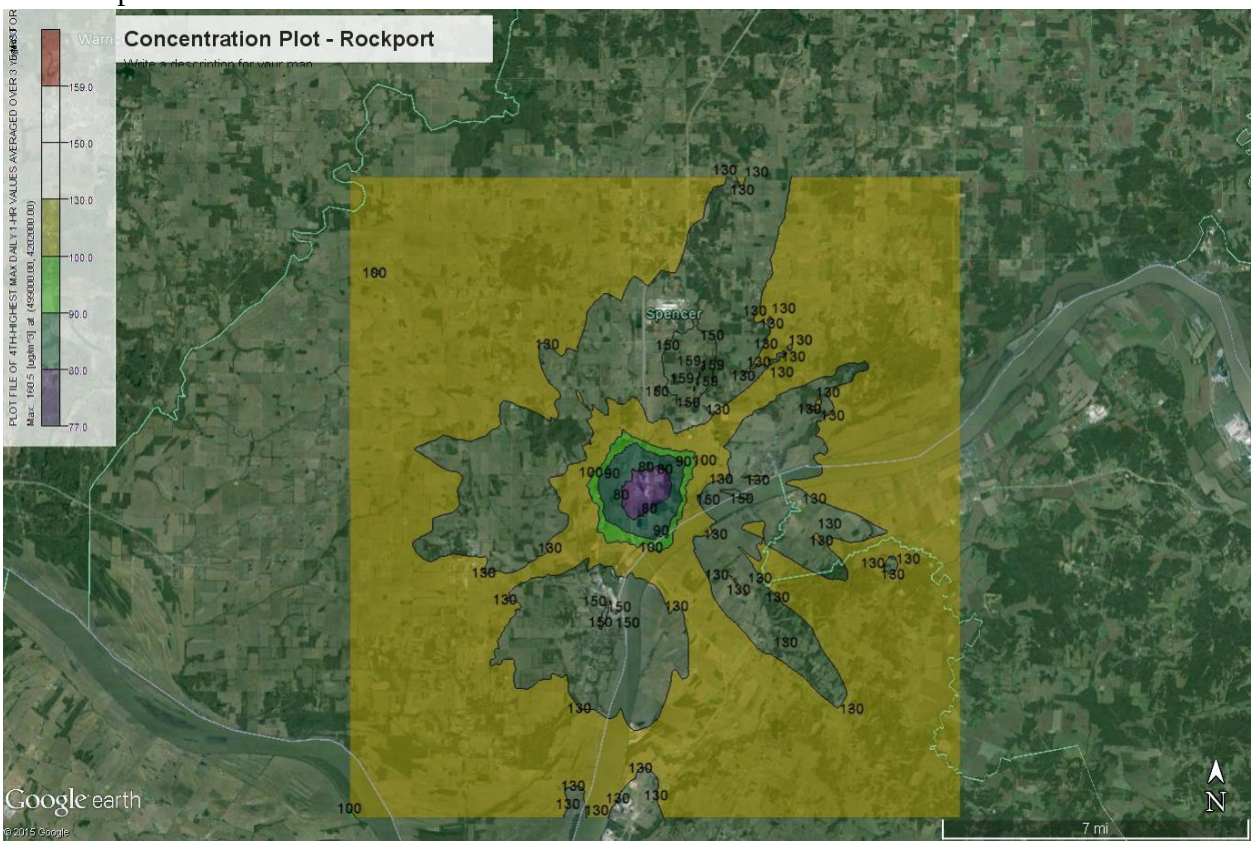
Concentration in the Rockport Area of Analysis Based on Actual Emissions

		Receptor Location		SO_2 Concentration ($\mu g/m^3$)	
Averaging Period	Data Period	UTM Northing	UTM Easting	Modeled (including background)	NAAQS
99th Percentile 1-Hour Average	2012-2014	4202,000	499,000	160.55	196.4*

*Equivalent to the 2010 SO_2 NAAQS set at 75 ppb

As shown in this table, the state's modeling indicates that the predicted 99th percentile 1-hour average concentration within the chosen modeling domain is 160.55 $\mu g/m^3$, or 61.3 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facilities. Figure 20 below is a graphical display of the results of the modeling that the state provided with its recommendations, and indicates that the predicted value occurred approximately 5 km north northeast of Rockport (located at 4197,580 m N, 496,737 m E). The state's receptor grid is also shown in the figure.

Figure 20: Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations in the Rockport Area Based on Actual Emissions



Jurisdictional Boundaries:

Once air quality in the area near Rockport was determined, existing jurisdictional boundaries were considered for the purpose of informing our intended unclassifiable/attainment area, specifically with respect to clearly defined legal boundaries.

Indiana's counties are divided into townships. These townships have long-standing, clearly defined boundaries, so that the townships provide a convenient and effective means of defining areas for designation purposes. In addition, Indiana has used townships to define areas for purposes of previous SO_2 designations and for other designation purposes. Therefore, EPA intends, to the extent practicable, to define an attainment/unclassifiable area in Spencer County according to township boundaries, to include all townships except those that are sufficiently near to significant sources to need further analysis before an appropriate designation may be determined. Since the state has indicated that these sources all emit more than 2,000 tons per year, EPA anticipates that further air quality characterization of these areas will be obtained pursuant to the SO_2 data requirements rule, and these portions of Spencer County will be designated in accordance with the information developed pursuant to that rule.

Unfortunately, Ohio Township warrants being subdivided, to designate only the northern three quarters and not to designate the southern quarter. The northern half of Ohio Township includes Rockport itself, which must be designated pursuant to court order and which Indiana has suitably

demonstrated to be attaining the standard. However, the southern quarter of Ohio Township was not included in Indiana's modeling analysis, and this area is near to significant sources with potential to cause violations.

The southern quarter of Ohio Township is a highly rural area without significant roads located for forming an appropriate boundary between the unclassifiable/attainment area and the undesignated area. For similar reasons, census boundaries, including blocks and block group boundaries, also are not located in a manner that would help define appropriate boundaries for this area. Surveyors' location indicators, namely surveyors' townships, ranges, and sections, provide boundaries that can more readily define the area that Indiana did and did not model. Finally, the coordinate system known as the Universal Transverse Mercator (UTM) system, which Indiana used as the coordinate system for its modeling, provides another means of identifying precise boundaries of the designated area. Indiana's receptor grid extended as far south as 4185.5 km northing, and this line provides a suitable definition of the boundary between portions of Ohio Township that Indiana did and did not provide sufficient information to determine an appropriate designation. Therefore, EPA intends to define an unclassifiable/attainment area that for most of Spencer County includes full townships and for Ohio Township includes that portion of the township north of 4185.5 km northing.

Other Relevant Information

Sierra Club provided additional modeling for this area, indicating that this area is violating the SO_2 NAAQS. Indiana has reviewed Sierra Club's modeling and identified numerous deficiencies in this analysis. Most significantly, Sierra Club computed a single background concentration, based on an analysis that did not exclude and therefore is prone to double count the impacts from modeled sources. Where Sierra Club used a constant background concentration of 18.0 ppb, Indiana used a temporally varying background concentration, ranging from 1.0 to 19.5 ppb and averaging 7.2 ppb. Sierra Club did not use the variable stack parameter information that Indiana used. Sierra Club used AERMOD version 14134, whereas Indiana used a more recent version, namely version 15181. Indiana also identified several other differences between Sierra Club's and Indiana's modeling approach. In all cases, Indiana's approach is more consistent with EPA's recommendations and prone to provide a more reliable estimation of concentrations in the area. Therefore, EPA finds Indiana's modeling to provide a better indication of air quality in the Rockport area.

Conclusion

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, EPA intends to modify Indiana's recommendation. EPA agrees that the area near Rockport is attaining the SO_2 standard, and EPA intends accordingly to designate this area as attainment/unclassifiable. On the other hand, EPA intends to designate a smaller area than Indiana recommended.

Indiana recommended that the entirety of Spencer County be designated as attainment. As discussed above, no other significant SO_2 sources other than Rockport are located in Spencer County, but several significant SO_2 sources are located in neighboring Warrick County, Indiana,

and Daviess and Hancock Counties, Kentucky. Since Indiana only analyzed concentrations within about 12 kilometers of Rockport, and did not analyze concentrations at other locations in Spencer County that might have greater impacts from these other facilities, EPA has insufficient information to judge the attainment status of these other locations in Spencer County. EPA is obliged under court order to designate areas near power plants meeting the applicable criteria by July 2, 2016, but EPA has no obligation to designate the entirety of the counties in which these sources are located. That is, EPA is not obliged to promulgate portions of Spencer County where further analysis of potential violations is warranted.

Conversely, the northern portion of Spencer County is a considerable distance from any significant source, so this portion of the county may reasonably be judged to be attaining the standard. Therefore, EPA is defining an area to be designated attainment/unclassifiable that includes the portions of Spencer County near Rockport and the northern portions of Spencer County and excludes only those portions of Spencer that are relatively near to significant sources in neighboring counties.

Specifically, EPA intends to designate most of Spencer County as unclassifiable/attainment but does not intend to designate Huff Township, Luce Township, or the southern quarter of Ohio Township. That is, EPA intends to designate as unclassifiable/attainment an area within Spencer County that includes the portion of Ohio Township north of 4185.5 km northing, along with Carter, Clay, Grass, Hammond, Harrison, and Jackson Townships.

At this time, our intended designations for the state only apply to this area and the other areas presented in this technical support document. Consistent with the conditions in the March 2, 2015 court-ordered schedule, EPA will evaluate and designate all remaining undesignated areas in Indiana by either December 31, 2017, or December 31, 2020.