Draft Technical Support Document

North Dakota
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. Unclassifiable areas are defined as those that cannot be classified on the basis of available information as meeting or not meeting the NAAQS.

North Dakota submitted updated recommendations on September 16, 2015, ahead of a July 2, 2016, deadline for the 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 the EPA to complete area designations for the 2010 SO_2 NAAQS. Table 1 below lists North Dakota's recommendations and identifies the counties or portions of counties in North Dakota that the EPA intends to designate by July 2, 2016 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.

Table 1: North Dakota's Recommended and EPA's intended designations

Area	North Dakota's Recommended Area Definition	North Dakota's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
McLean County/Eastern Mercer County, North Dakota	Unspecified (Area around source)	Attainment	McLean Co., North Dakota (full county), Within Mercer Co.: Area east of CR-37/ND 31, east/north of ND 200 ALT, west of the eastern border of Mercer County/Missouri River, south of the Knife River National Historic Site.	Unclassifiable

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Central Mercer County, North Dakota	Unspecified (Area around source)	Attainment	Within Mercer Co.: Area west of ND 49/61st Ave SW, north of – Co. Rd 15/17th St. SW, east of Co. Rd 13, south and east of the town Zap, south of 8th St. SW/ND 200	Unclassifiable/ Attainment

Background

On June 3, 2010, the 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. The 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, the 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 the 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 the 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, the EPA will promulgate the designations that it deems appropriate. If a state or tribe disagrees with the EPA's intended designations, they are given an opportunity within the 120 day period to demonstrate why any proposed modification is inappropriate.

[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. North Dakota contains no such areas.

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On August 5, 2013, the 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, the 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 the 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 effort intended to resolve the litigation in one of those cases, plaintiffs Sierra Club and the Natural Resources Defense Council and the 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 the EPA to complete the area designations according to the court-ordered schedule.

According to the court-ordered schedule, the EPA must complete the remaining designations by three specific deadlines. By no later than July 2, 2016 (16 months from the court's order), the 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 the 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. The 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 the 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 the EPA intends to evaluate in determining whether areas are in violation of the 2010 SO_2 NAAQS. The guidance also contains the factors the 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. This guidance was supplemented by two technical assistance

documents intended to assist states and other interested parties in their efforts to characterize air quality through air dispersion modeling or ambient air quality monitoring for sources that emit SO_2. Notably, the EPA released its most recent versions of documents titled, "SO_2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) and "SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document" (Monitoring TAD) in December 2013.

Based on ambient air quality data collected between 2012 and 2014, no violations of the 2010 SO_2 NAAQS have been recorded in the State.[2] It should be noted, however, that the EPA identified the Tioga area as one that was potentially subject to the initial obligation to designate by July 2, 2016, based on data collected during this time period. However, this data have been found as not comparable to the NAAQS due to certification and performance and benchmark issues. As a result, the consent decree no longer obligates us to designate the area by July 2, 2016. Instead, we will designate the Tioga area by one of the remaining deadlines, i.e., December 31, 2017, or December 31, 2020, consistent with the conditions in the consent decree. There are 3 sources in the State meeting the emissions criteria of the consent decree for which the EPA must complete designations by July 2, 2016. In this draft technical support document, the EPA discusses its review and technical analysis of North Dakota's updated recommendations for the areas that we must designate. The EPA also discusses any intended modifications from the State's recommendation 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 the 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. The 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 the EPA cannot determine based on all available information whether or not it meets the 2010 SO_2 NAAQS.

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[2] For designations based on ambient air quality monitoring data that violates the 2010 SO_2 NAAQS, the consent decree directs the EPA to evaluate data collected between 2013 and 2015. Absent complete, quality assured and certified data for 2015, the analyses of applicable areas for the 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, 2016 to the EPA for evaluation. If after our review, the ambient air quality data for the area indicates that no violation of the NAAQS occurred between 2013 and 2015, the consent decree does not obligate the EPA to complete the designation. Instead, we may 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.

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5) Designated unclassifiable/attainment area – an area which the EPA has determined to have sufficient evidence to find either is attaining or is likely to be attaining the NAAQS. The 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 the EPA designate as attainment.
8) Recommended nonattainment area – an area a state or tribe has recommended that the EPA designate as nonattainment.
9) Recommended unclassifiable area – an area a state or tribe has recommended that the EPA designate as unclassifiable.
10) Recommended unclassifiable/attainment area – an area a state or tribe has recommended that the 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.

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Technical Analysis for the McLean County/Eastern Mercer County Area

Introduction

The southern portion of McLean County contains a stationary source that according to the EPA's Air Markets Database emitted in 2012 either more than 16,000 tons of SO_2 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 Coal Creek Station emitted 16,273 tons of SO_2, and had an emissions rate of 0.34 lbs SO_2/mmBTU. Pursuant to the March 2, 2015 court-ordered schedule, the EPA must designate the area surrounding the facility by July 2, 2016.

On the eastern border of Mercer County, about 16.5 km southwest of the Coal Creek facility is a stationary source that according to the EPA's Air Markets Database emitted in 2012 more than 16,000 tons of SO_2 and 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 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 Leland Olds Station emitted 38,323 tons of SO_2, and had an emissions rate of 2.06 lbs SO_2/mmBTU. Pursuant to the March 2, 2015 court-ordered schedule, the EPA must also designate the area surrounding the facility by July 2, 2016.

In its submission, North Dakota recommended that the area surrounding both the Coal Creek and Leland Olds Stations be designated as attainment based on an assessment and characterization of air quality from the facilities and other nearby sources (specifically, the Stanton Station near Leland Olds) 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 both actual emissions (for Stanton Station) and allowable emissions (for Leland Olds Station). After careful review of the State's assessment, supporting documentation, and all available data, the EPA does not agree with the State's recommendation for the combined area because the Leland Olds allowable emissions rate was not adequately adjusted to account for the 2010 SO_2 NAAQS, and therefore intends to designate the area as unclassifiable. Specifically, the boundaries consist of McLean County, North Dakota, and within Mercer County, the area east of CR-37/ND 31, east/north of ND 200 ALT, west of the eastern border of Mercer County/Missouri River, and south of the Knife River National Historic Site.

The Coal Creek Station is located in central North Dakota in the southern portion of McLean County. As seen in Figure 1 below, the facility is located in southern McLean County, North Dakota, 10 km north of the Missouri River which acts as the border of McLean and Mercer counties.

The Leland Olds Station is located in central North Dakota near the eastern border of Mercer County. As seen in Figure 2 below, the facility is located just south of the Missouri River. Also

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included in Figure 2 are nearby emitters of SO_2 (specifically, the Stanton Station). Figure 3, below, shows the EPA's intended unclassifiable designation for the area in blue.

Figure 1. The EPA's intended designation for McLean County (full county) and a segment of eastern Mercer County, North Dakota

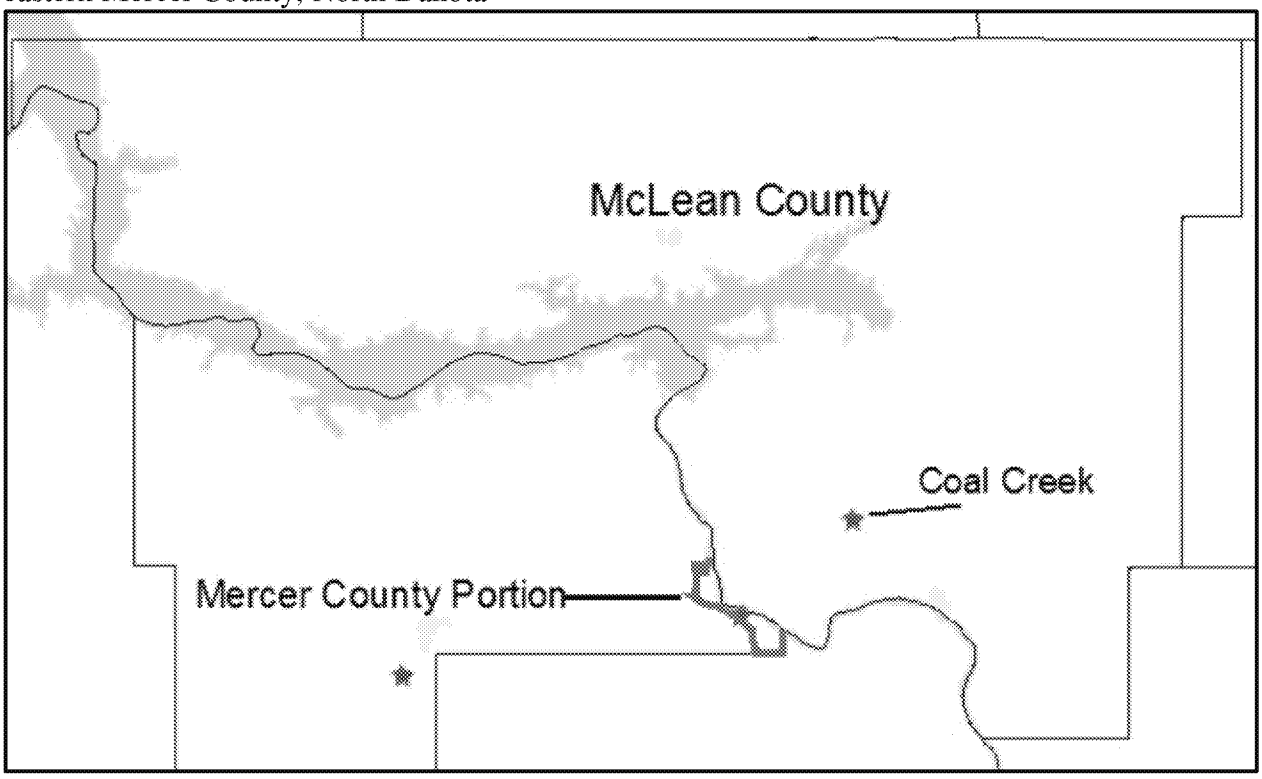

Figure 2: Close up of the Mercer County portion of EPA's intended McLean and Mercer County combined designation.

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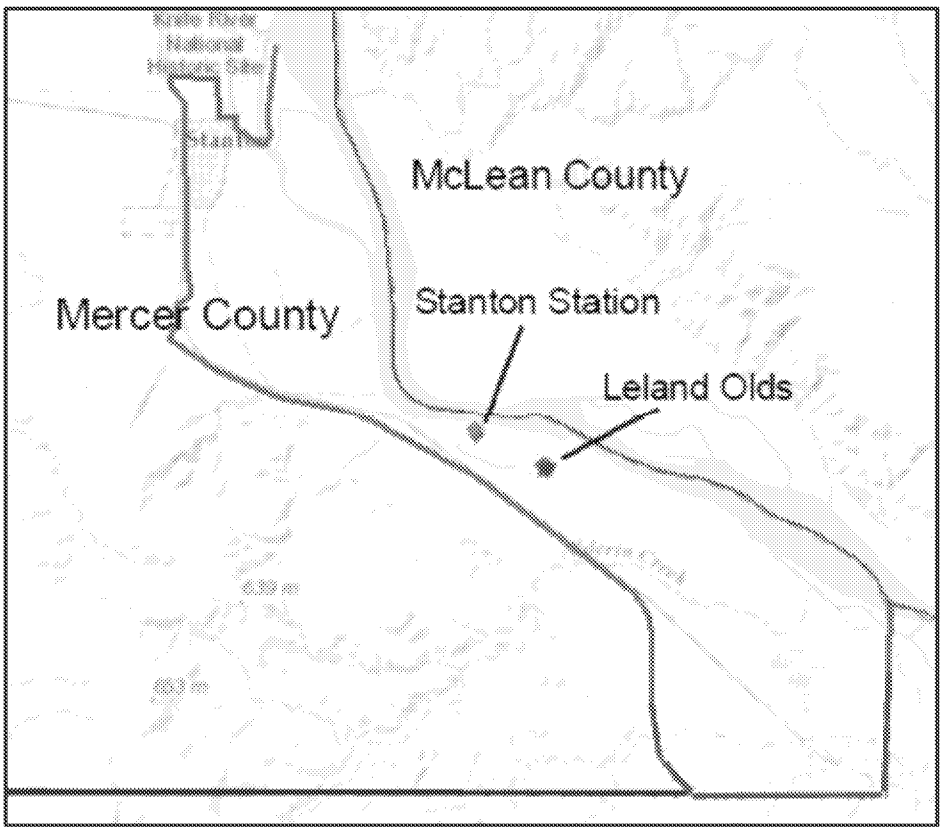
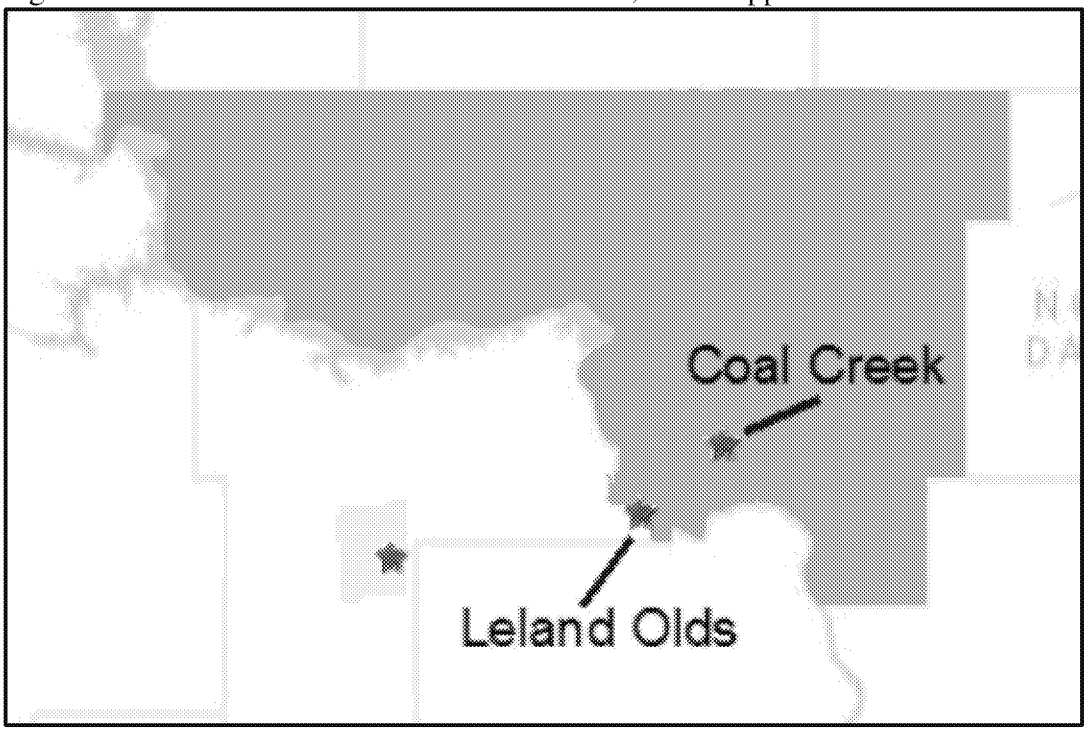


Figure 3. The EPA's intended unclassifiable area, which appears in blue.



The discussion and analysis that follows below will reference the State's use of the Modeling TAD, the EPA's assessment of the State's modeling in accordance with the Modeling TAD, and the factors for evaluation contained in the 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 of the Coal Creek and Leland Olds Stations. There are no SO_2 monitors located in McLean County. The SO_2 monitors in Mercer County are all located at least 30 kilometers (km) west of the Leland Olds facility. The nearest SO_2 monitor to both the Coal Creek and Leland Olds stations is located in Oliver County, roughly 13 km southwest of Leland Olds and 28 km southwest of Coal Creek. This and all other monitors in the State are too distant to reliably measure impacts from either of these facilities.

Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. 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 the most recent version of AERMOD, 15181, and a discussion of the individual components will be referenced in the corresponding discussion that follows, as appropriate.

Modeling Parameter: Rural or Urban Dispersion

US EPA-recommended procedure for characterizing an area by prevalent land use is based on evaluating the dispersion environment with 3 km of the facility. According to US EPA modeling guidelines, rural dispersion coefficients are to be used in the dispersion modeling analysis if more than 50% of the area within a 3-km radius of the facility is classified as rural. Conversely, if more than 50% of the area is urban, urban dispersion coefficients should be used in the modeling analysis. As shown in the Figure 4, the 3-km area surrounding each of the facilities is rural. Therefore, the State determined that is was most appropriate to run the model with rural dispersion coefficients for each of the facilities being modeled.

Modeling Parameter: Area of Analysis (Receptor Grid)

The EPA believes that a reasonable first step towards characterization of air quality in the area surrounding the Coal Creek and Leland Olds Stations 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 area near the Coal Creek and Leland Olds Stations, the State has included 1 other emitter of SO_2 within the modeling domain. The additional facility included in the modeling was Stanton Station, which lies about 1 km west of Leland Olds Station. There are no other emitters that lie within 10 km of either facility 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, citing EPA's March 1, 2011 Memorandum and the analysis presented at a 2011 EPA modeling workshop. The grid receptor spacing for the combined area of analysis chosen by the State is as follows:

- 0 km to 5 km with 100 meters spacing from Coal Creek Station
- 5 km to 10 km with 250 meter spacing from Coal Creek Station
- 0 km to 5 km with 100 meters spacing from Leland Olds Station
- 5 km to 10 km with 250 meter spacing from Leland Olds Station

The receptor network contained 30,163 receptors, and the network covered portions of Mercer, Oliver, and McLean counties in North Dakota. Figures 4 and 5, which was included in the State's recommendation, show the area surrounding the Coal Creek and Leland Olds Stations, as well as receptor grid, assumed for the modeling analysis.

Consistent with the Modeling TAD, receptors for the purposes of this designation effort were placed only in areas where it would also be feasible to place a monitor and record ambient air impacts. The impacts of the area's geography and topography will be discussed later within this document.

Figure 4: Area of Analysis

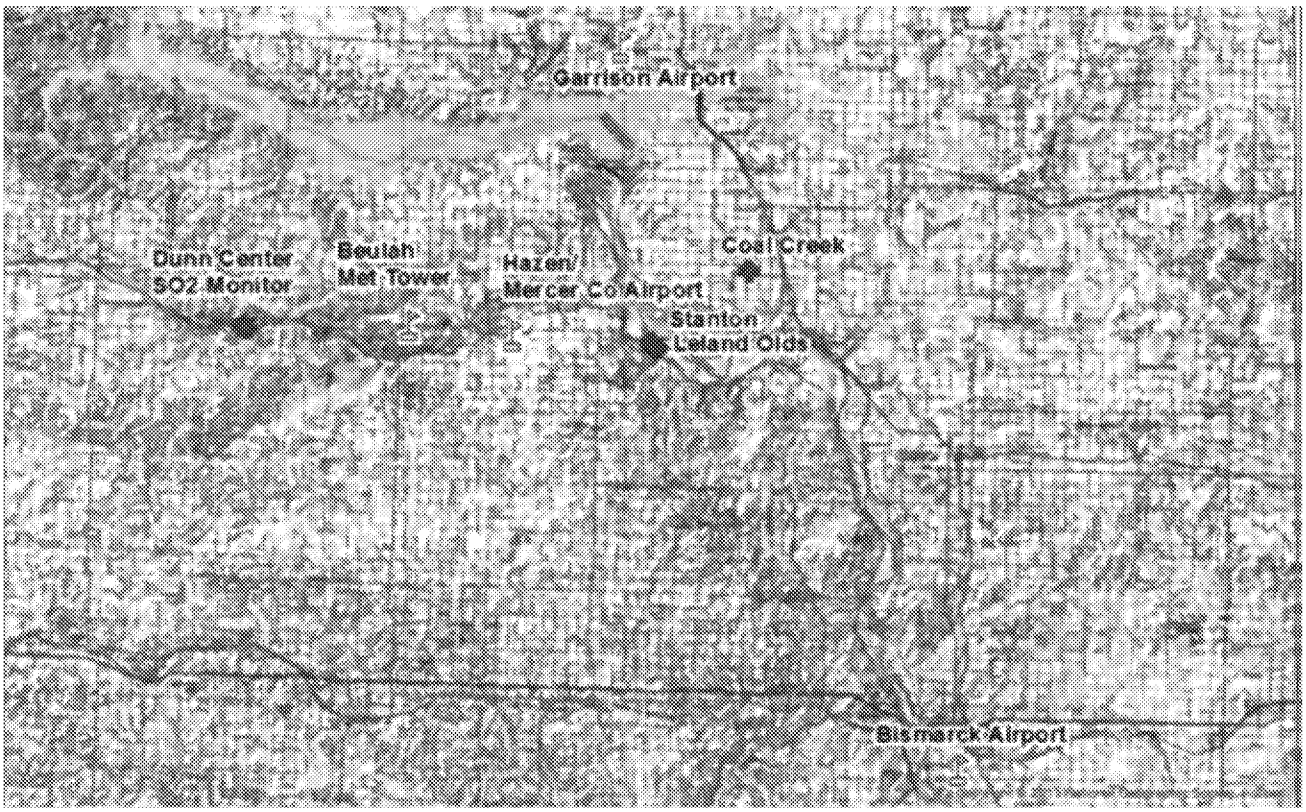
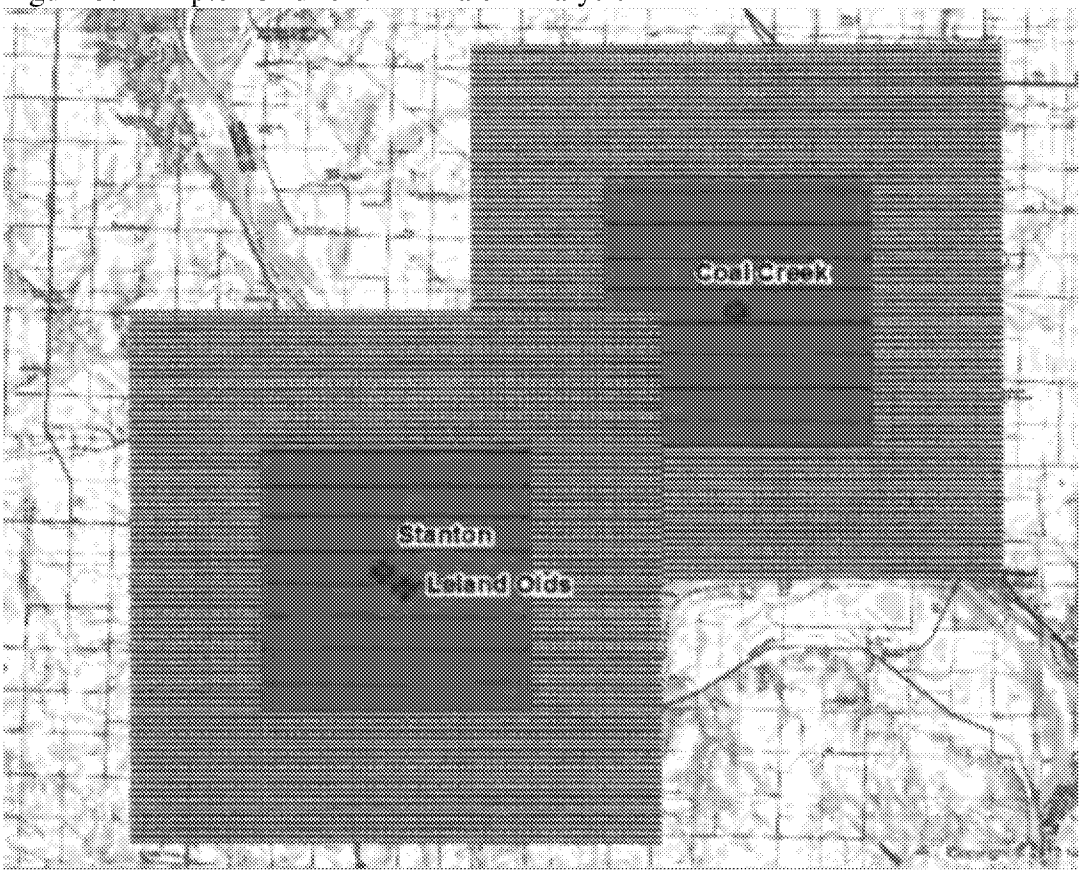

Garrison Airport
Dunn Center
SO2 Monitor
Beulah
Met Tower
Hazen/
Mercer Co Airport
Coal Creek
Stanton
Leland Olds
Bismarck Airport

Figure 5: Receptor Grid for the Area of Analysis



Modeling Parameter: Source Characterization

The State characterized the sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the State used actual stack heights in conjunction with actual emissions for the Coal Creek and Stanton stations. The State also followed EPA's good engineering practices (GEP) policy in conjunction with allowable emissions limits for the Leland Olds station. A GEP stack height analysis was performed for the sources with US EPA's Building Profile Input Program (BPIP). BPIP was used to develop the building information to simulate building downwash in the modeling analysis. The building layout and location, as well as the stack parameters (e.g., exit temperature, exit velocity, location, and diameter), were adequately characterized in the modeling analysis. Table 2 presents the assumed source characterizations for each facility provided by the State.

Table 2. Modeling Source Parameters

Parameter	**Leland Olds Station (unit 1 and unit 2 modeled as a combined source)**	**Stanton Station (unit 1 and unit 10 modeled as a combined source)**	**Coal Creek Station (unit 1 and unit 2 modeled separately)**
Stack Height	182.88 m	77.724 m	205.74 m

Exit Temperature	335 K	Actuals - hourly	Actuals - hourly
Exit Velocity	21.0 m/sec	Actuals - hourly	Actuals - hourly
Diameter	9.97 m	4.6 m	7.8 m
Base Elevation	519 m	517 m	591 m

Modeling Parameter: Emissions

The 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 does provide for the flexibility of using allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate.

The 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 absence of CEMS data, the EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, the EPA believes that detailed throughput, operating schedules, and emissions information from the impacted 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 the Coal Creek, Leland Olds, and Stanton stations in the area of analysis. North Dakota selected these facilities 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. The State determined that no other sources beyond 10 km would have the potential to cause significant concentration gradients within the area of analysis, citing EPA's March 1, 2011 Memorandum and the analysis presented at a 2011 EPA modeling workshop. For this area of analysis, the State has opted to use a hybrid approach, where emissions from certain facilities are expressed as actual emissions, and those from other facilities are expressed as allowable rates.

For the Coal Creek and Stanton stations, the State included annual actual SO_2 emissions based on CEMs data between 2012 and 2014. Coal Creek Station features two units with a total generation

capacity of more than 1100 megawatts. Each unit was modeled separately. Stanton Station has one turbine generator rated at 188 megawatts that is supplied by two boilers. Emissions from the two boilers are exhausted through a single stack.

For Leland Olds Station, the State modeled the facility using the most recent federally enforceable PTE limits for SO_2. Leland Olds Station consists of two coal-fired units; unit 1 is a 220-megawatts unit (2622 mmbtu/hr), and unit 2 is a 440-megawatt (5130 mmbtu/hr) unit. The two boilers' emissions are exhausted into a single 600-foot dual flue stack. Basin Electric installed wet scrubbers to control SO_2 emissions on both units and redirected the exhausts from two separate stacks into a common stack. Therefore, using a 3-year modeling period would not be representative of the current and future SO_2 emissions at this station. The State determined that a PTE rate of 0.15 lb/mmbtu of SO_2 (1162.8 lb/hr) would be appropriate for the analysis because there is not yet a full three-year record of actual post-wet scrubber SO_2 emissions. To be conservative, the State also assumed a constant maximum post-scrubber SO_2 emission rate of 1162.8 lb/hr for the entire model simulation, which overstates the emissions after the scrubber installation. An equivalent diameter for the two flues and the use of the 95th percentile flow rate and temperature were also assumed to represent the post-scrubber conditions for each hour of the model simulation. The EPA notes that the PTE limit for Leland Olds Station was the result of wet scrubbers being installed at the facility, whose limits have been approved into the SIP under the regional haze section (77 FR 20894, April 6, 2012). The PTE limits became effective in June 2013 for unit 1 and October 2012 for unit 2. Table 3 summarizes the SO_2 emissions assumed for each source in the modeling analysis.

Table 3: SO_2 Emissions Between 2012 – 2014 from Coal Creek, Stanton, and Leland Olds stations.

Facility Name	Units	Type of Emissions	SO_2 Emissions (tons per year)		
			2012	2013	2014
Coal Creek Station	Unit 1	Actuals	8030.85	8241.61	7713.68
	Unit 2	Actuals	8240.38	7340.04	7900.64
Stanton Station	Unit 1/Unit 10 Modeled as Single Unit	Actuals	2379.36	2061.10	2573.12
Leland Olds Station[1]	Unit 1/Unit 2 Modeled as Single Unit	PTE	5093.075	5093.075	5093.075

[1] BART Permit SO_2 Limit – 0.15 lb/mmbtu: Unit 1 rated at 2662 mmbtu/hr and Unit 2 rated at 5130 mmbtu/hr.

The emissions rate used for Leland Olds (1162.8 lb/hr) was based on continuous operation at the facility's SIP-approved maximum allowable 30-day rolling average rate of 0.15 lb/mmbtu. However, to properly account for short-term emissions spikes that can impact a one-hour rate but be smoothed out over a 30-day rate, the EPA recommends that an adjustment factor be applied to the modeled hourly emissions rate (See EPA's April 23, 2014 SO_2 Nonattainment Area Guidance at 25-37, and Appendices B, C and D). AECOM did not apply such a factor when modeling Leland Olds. Therefore, EPA finds that the AECOM modeling analysis cannot be relied upon for the purposes of designating the area of McLean County (full) and Mercer County (partial) as attainment, as the State recommended. Should the State submit an updated modeling analysis which meets EPA guidance and includes an appropriately adjusted emission rate for Leland Olds, EPA may base its final designation on that new information.

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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 determined that surface meteorological data from the state-operated Beulah 10-meter tower and upper air observations from a NWS site in Bismarck, North Dakota would best represent the meteorological conditions within the area of analysis. Missing surface data and upper air soundings were substituted with data from the Garrison airport and Glasgow station, respectively. The State selected meteorological data for the period 2012 to 2014, which is concurrent with the emissions period.

The State used AERSURFACE version 13016 using data primarily around the Beulah tower and a secondary set around the NWS Hazen airport to estimate the surface characteristics of the area of analysis. A 1-km radius circular area centered at the Beulah primary meteorological station site was assumed and divided into twelve sectors, each with its own homogeneous land use that was distinctly different from the other sectors. As recommended in the AERSURFACE User's Guide, the State determine the surface moisture condition for each season by comparing precipitation for the period of data to be processed to the 30-years of Garrison airport (Hazen airport precipitation data has poor data capture and, therefore, was not used) precipitation records, selecting "wet" conditions if precipitation is in the upper 30th percentile, "dry" conditions if precipitation is in the lower 30th percentile, and "average" conditions if precipitation is in the middle 40th percentile. The monthly designations of surface moisture input to AERSURFACE are summarized in Table 4.

Table 4. AERSURFACE Bowen Ratio Condition Designations for Beulah Site.

Month	Bowen Ratio Category		
	2012	2013	2014
January	Dry	Dry	Average
February	Wet	Average	Average
March	Average	Average	Average
April	Wet	Wet	Wet
May	Average	Wet	Wet
June	Average	Wet	Average
July	Average	Average	Dry
August	Dry	Wet	Wet
September	Dry	Wet	Average
October	Wet	Wet	Average
November	Wet	Average	Wet
December	Wet	Wet	Dry

The State used AERSURFACE to develop seasonal categories by month for each modeled year and they were applied for the primary (Beulah site) and secondary (Hazen airport) site, as shown in Table 5. A month was selected as a "winter with continuous snow on the ground" if a month had at least half of the days with recorded snow on the ground. Daily snow cover records were obtained for the Garrison and Bismarck airports from the National Climatic Data Center (NCDC).

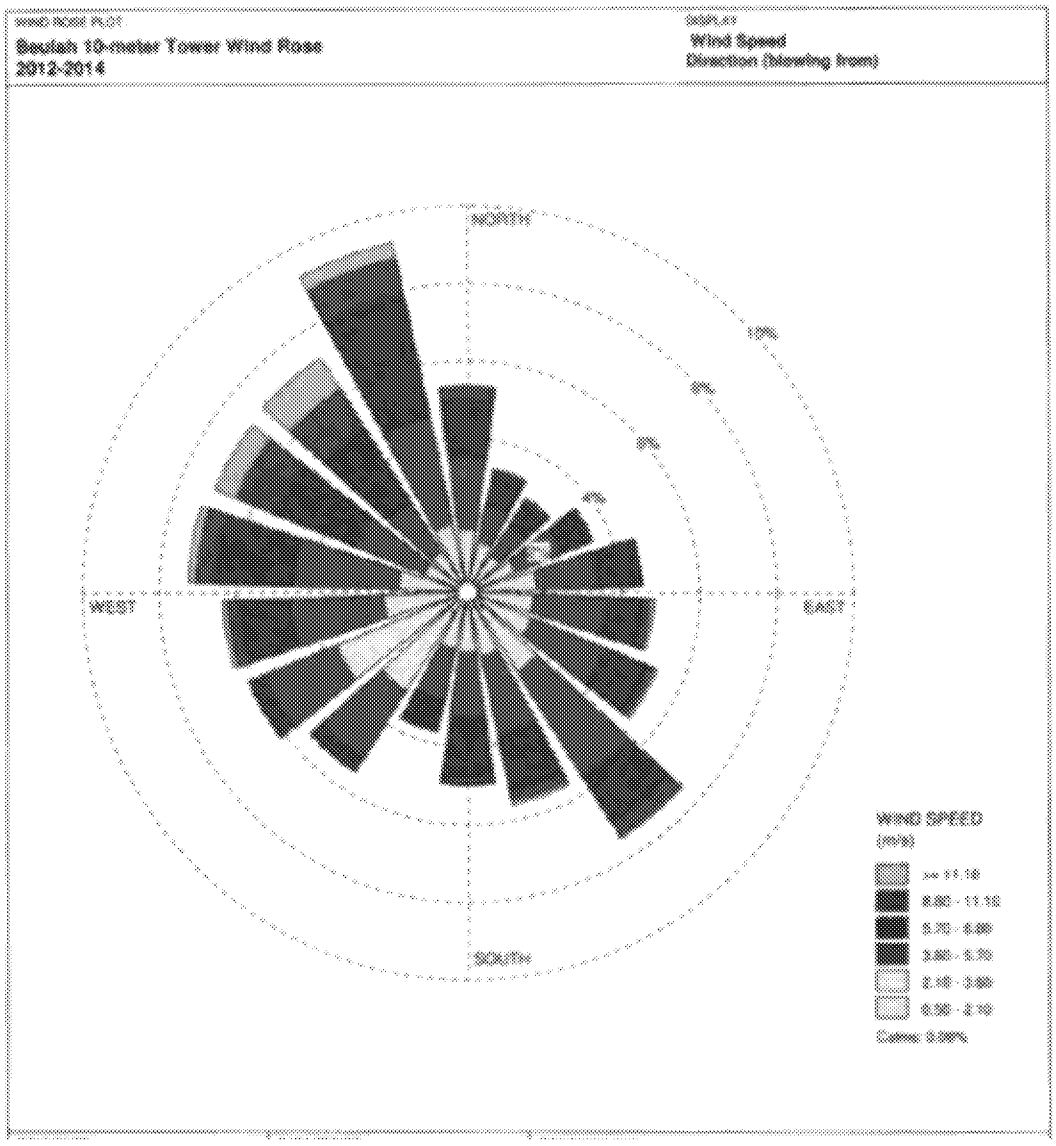
Table 5. Selected Seasonal Categories for AERSURFACE.

Season Description	2012	2013	2014
Late autumn after frost and harvest, or winter with no snow	1,2,3	3,4	3
Winter with continuous snow on the ground	11, 12	12,1,2	11, 12, 1, 2
Transitional spring	4, 5	5	4, 5
Midsummer with lush vegetation	6,7,8	6,7,8	6,7,8
Autumn with unharvested cropland	9,10	9,10,11	9,10

As part of its recommendation, the State provided the 3-year surface wind rose for Beulah, North Dakota. In Figure 6, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. Based on the wind rose, the meteorological conditions include:

- average wind speed: 5 meters per second;
- calm winds occur about six percent of the time; and
- predominant winds are from the northwest (about 8% of the time) and from the southeast (about 6% of the time).

Figure 6: Beulah, North Dakota Cumulative Annual Wind Rose 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 US EPA's SO_2 Modeling TAD, AERMOD/AERMET User Guides, and the AERMOD Implementation Guide 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, the State introduced Garrison airport data as 1-minute ASOS in Stage 2 of AERMET. The 1-minute data was processed by a separate preprocessor, AERMINUTE (version 14337). 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. This approach is consistent with a March 2013 EPA memo titled, "Use of ASOS meteorological data in AERMOD dispersion Modeling." 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 flat. To account for these terrain changes, the AERMAP (version 11103) 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 10-meter USGS National Elevation Database.

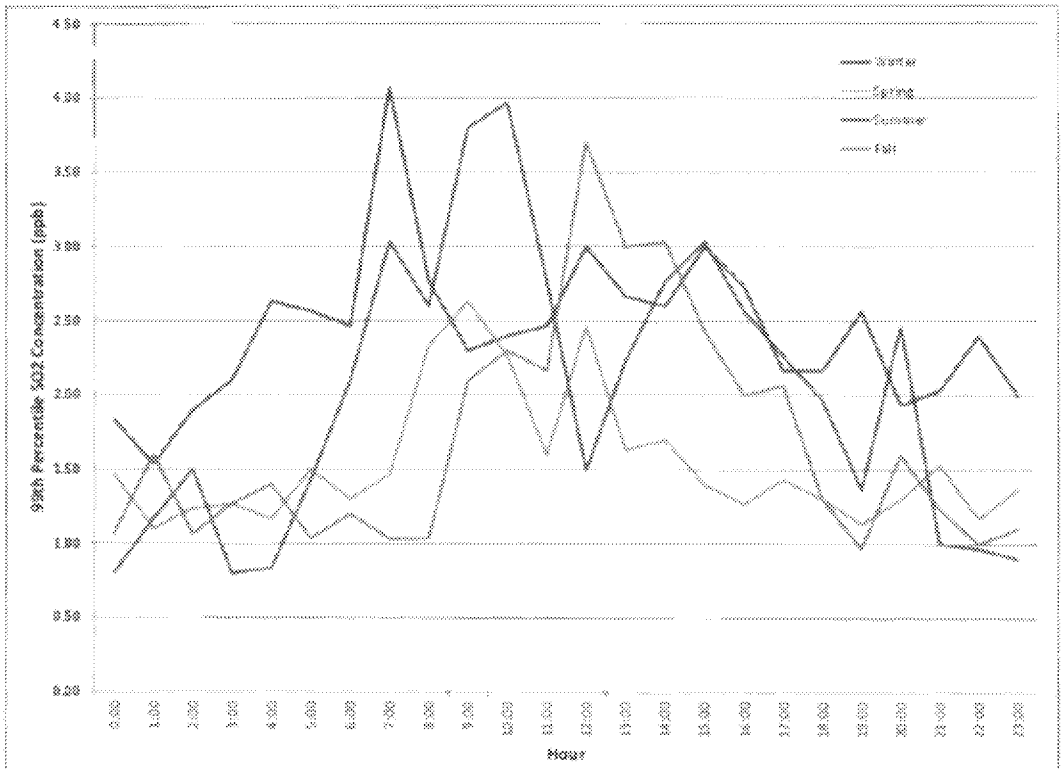
Modeling Parameter: Background Concentrations of SO_2

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.

The State determined the background concentrations of SO_2 based on information provided in the EPA March 1, 2011 Memorandum and the analysis presented at the 2011 EPA modeling workshop, specifically noting that the selection of regional background sources should be limited to 10 kilometers from the source location. The nearest large SO_2 source to Coal Creek and Leland Old stations is Stanton, which was modeled in the analysis. The next large source is more than 20 km away (Milton R. Young Station), and this source was expected to produce a uniform background influence. Therefore, this and any more distant sources were not expected to interact with the modeled sources to cause a significant concentration gradient. For this 1-hour SO_2 NAAQS analysis, the State determined that the Stanton Station was the only background source to consider in this modeling. The total concentration for 1-hour SO_2 NAAQS compliance was computed by adding the Leland Olds, Coal Creek, and Stanton stations predicted concentration to the regional background concentrations from the state-approved Dunn Center monitor. The Dunn Center monitor is appropriate for characterizing background concentrations because it is a regional site that is located away from the area of interest but can be impacted by similar natural and distant man-made sources. The background concentration was calculated as a 3-year (2012-

2014) average of the 99th percentile by season and hour-of-day and added internally in AERMOD to the AERMOD-predicted concentration for comparison with the 1-hour SO_2 NAAQS of 196.5 μg/m^3 (75 ppb[3]). The Dunn Center seasonal SO_2 concentrations are displayed in Figure 7.

Figure 7. 2012-2014 Average 99th Percentile Concentration at Dunn Center Monitor.



Summary of Modeling Results

The AERMOD modeling parameters for the Leland Olds, Coal Creek, and Stanton stations modeling analysis are summarized below in Table 6.

Table 6. AERMOD Modeling Parameters for the Leland Olds, Coal Creek, and Stanton stations modeling analysis.

AERMOD Version	15181
Dispersion Characteristics	Rural
Modeled Sources	3
Modeled Stacks	4
Modeled Structures	4
Modeled Fencelines	0

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

Total receptors	30,163
Emissions Type	Coal Creek: Actual Stanton: Actual Leland: PTE
Emissions Years	Actuals: 2012-2014 (Coal Creek and Stanton) PTE: Unit 1 2013/ Unit 2 2012 (Leland Olds)
Meteorology Years	2012-2014
Surface Meteorology Station	Beulah, North Dakota
Upper Air Meteorology Station	Bismarck, North Dakota
Methodology for Calculating Background SO_2 Concentration	Temporal Varying
Calculated Background SO_2 Concentration	0.80 ppb to 4.07 ppb

The State's modeling indicates that the predicted 99th percentile 1-hour average concentration within the selected modeling domain is 163.8 μg/m^3. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the Coal Creek and Stanton stations, and PTE emissions from the Leland Olds Station. The results presented below in Table 7 show the magnitude and geographic location of the highest predicted modeled concentration from the modeling analysis.

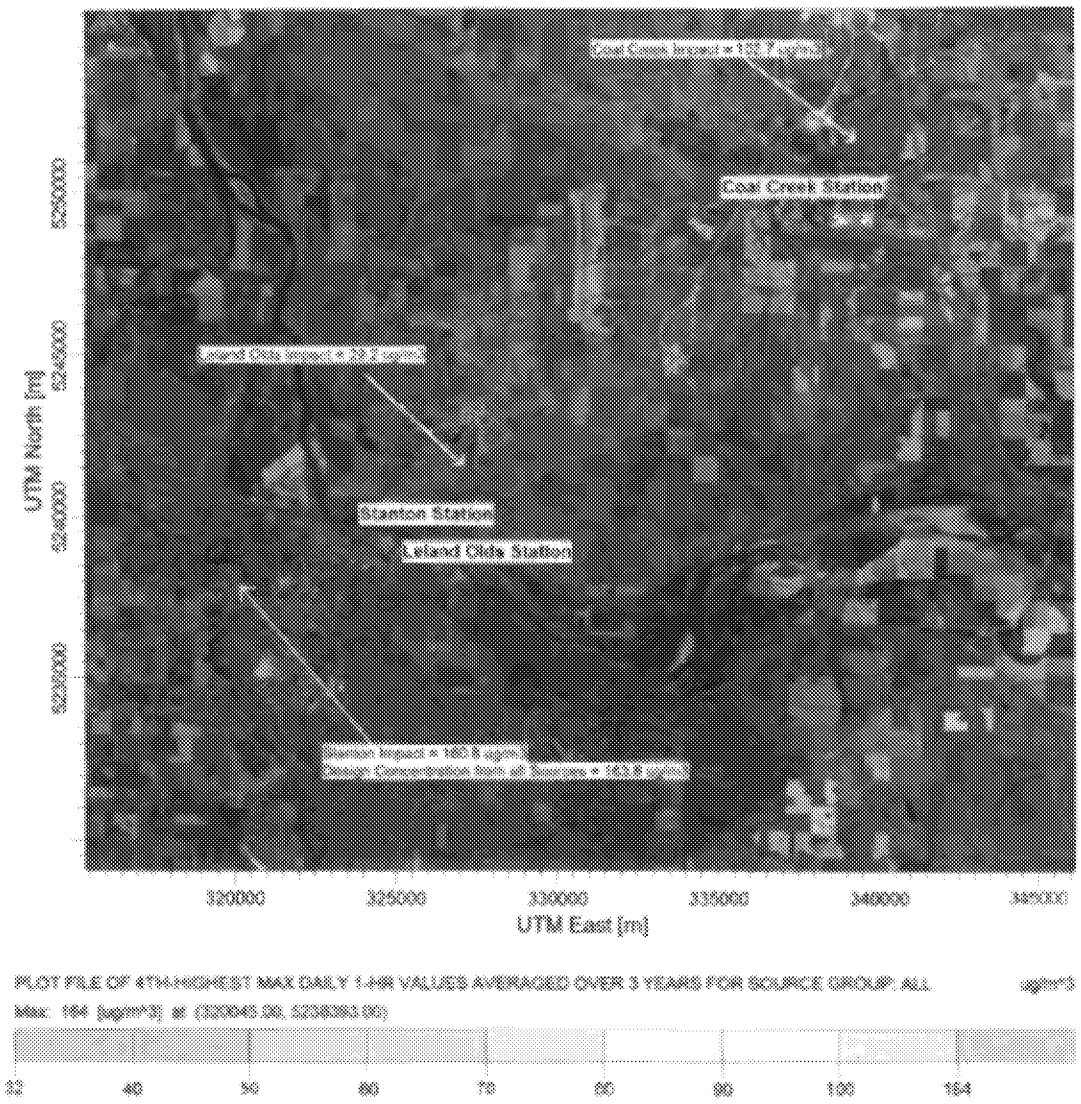
Table 7. Maximum Predicted 99th Percentile 1-Hour SO_2 Concentration

		Receptor Location		SO_2 Concentration (μg/m^3)	
Averaging Period	Data Period	UTM/Latitude	UTM/Longitude	Modeled (including background)	NAAQS
99th Percentile 1-Hour Average	2012-2014	320045	5238393	163.8	196.5*

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

Figure 8 below was included as part of the State's recommendation, and indicates that the predicted value occurred northwest of the Coal Creek station. The State also provided modeling analyses that were based on modeling that used non-default or beta configuration options for treating low-wind conditions. These non-default options include adjustments to the computation of the friction velocity (ADJ_U*) in the AERMET meteorological pre-processor and lateral wind speed standard deviation computations incorporated into AERMOD ("LOWWIND3" option). While the State provided these additional analyses, these analyses were not evaluated or approved by EPA prior to the utilization of these options in the modeling. At this time, EPA will only support the modeling analyses that used the current regulatory defaults to characterize SO_2 concentrations for the designations due July 2, 2016.

Figure 8: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations from the Modeling Analysis.



Jurisdictional Boundaries:

Once the geographic area of analysis associated with the Coal Creek, Leland Olds, Stanton stations, and background concentration is determined, existing jurisdictional boundaries are considered for the purpose of informing our intended unclassifiable/attainment area, specifically with respect to clearly defined legal boundaries.

The EPA notes that our intended unclassifiable area extends only into a portion of Mercer County. This is due to the fact that the consent decree also obligates us to designate the area around another source in Mercer County, i.e., Coyote Station. A discussion and analysis of our intended designation and associated boundaries for that area is elsewhere in this document. Except for Coal Creek Station, there are no other sources within McLean County that according

to the 2011 NEI, emit at or above 100 tpy of SO_2. As a result, the EPA believes that a county-wide designation of unclassifiable is reasonable, as sources within McLean County are unlikely to cause or contribute to a violation of the NAAQS within the county or its neighboring areas.

The EPA believes that our intended unclassifiable, consisting of the entirety of McLean County, North Dakota, and a portion of Mercer County as described in Table 1, is comprised of clearly defined legal boundaries, and we find these boundaries to be a suitably clear basis for defining our intended unclassifiable.

Other Relevant Information

EPA did not receive any additional information on this designation aside from that submitted by the State.

Conclusion

After careful evaluation of the State's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the area around the Coal Creek, Leland Olds and Stanton stations as unclassifiable for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of McLean County, and within Mercer County: the area east of CR-37/ND 31, east/north of ND 200 ALT, west of the eastern border of Mercer County/Missouri River, and south of the Knife River National Historic Site (see Figures 1-3).

As previously discussed, the emissions rate for Leland Olds was based on continuous operation at the facility's SIP-approved maximum allowable 30-day rolling average rate of 0.15 lb/mmbtu. However, no adjustment was made to this rate, consistent with the EPA's guidance, to identify a critical value of 1-hour emissions and to demonstrate that the 30-day emissions rate is of comparable stringency to that critical value. As a result, the EPA believes that the modeling performed by the State may not be a reliable indicator of attainment status, especially with respect to impacts from the Leland Olds station. Therefore, EPA is unable to determine at this time whether the area is attaining the NAAQS. It should be noted that our intended unclassifiable area that includes a portion of Mercer County does not comprise the entire county, due to the fact that the court order also directs us to designate the area around Coyote Station. Coyote Station is also located in Mercer County, and a discussion and analysis of our intended designation and associated boundaries is elsewhere in this document. At this time, our intended designations for the State only apply to this area and the other area presented in this technical support document. Consistent with the conditions in the March 2, 2015 court-ordered schedule, the EPA will evaluate and designate all remaining undesignated areas in North Dakota by either December 31, 2017, or December 31, 2020.

Technical Analysis for Central Mercer County, North Dakota (Area Surrounding Coyote Station)

Introduction

The central portion of Mercer County, North Dakota contains a stationary source that according to the EPA's Air Markets Database emitted in 2012 either more than 16,000 tons of SO_2 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 Coyote Station emitted 10,639 tons of SO_2, and had an emissions rate of 0.79 lbs SO_2/mmBTU. Pursuant to the March 2, 2015 court-ordered schedule, the EPA must designate the area surrounding the facility by July 2, 2016.

In its submission, North Dakota recommended that the area surrounding the Coyote Station 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, the EPA agrees that the area is attaining the NAAQS, and intends to designate it as unclassifiable/attainment. However, because the State did not provide specific boundaries in its recommendation, the EPA's intended boundaries consist of the area west of ND 49/61st Ave SW, north of Co. Rd 15/17th St. SW, east of Co. Rd 13, south and east of the town Zap, and south of 8th St. SW/ND 200.

The Coyote Station is located in central North Dakota in the central portion of Mercer County. As seen in Figure 9 below, the facility (indicated by a red star) is located approximately 3 km southwest of Beulah, North Dakota. Also included in the figure are nearby emitters of SO_2 (none) and the EPA's intended unclassifiable/attainment designation for the area (shown in yellow).

Figure 9. The EPA's intended designation for Central Mercer County, North Dakota

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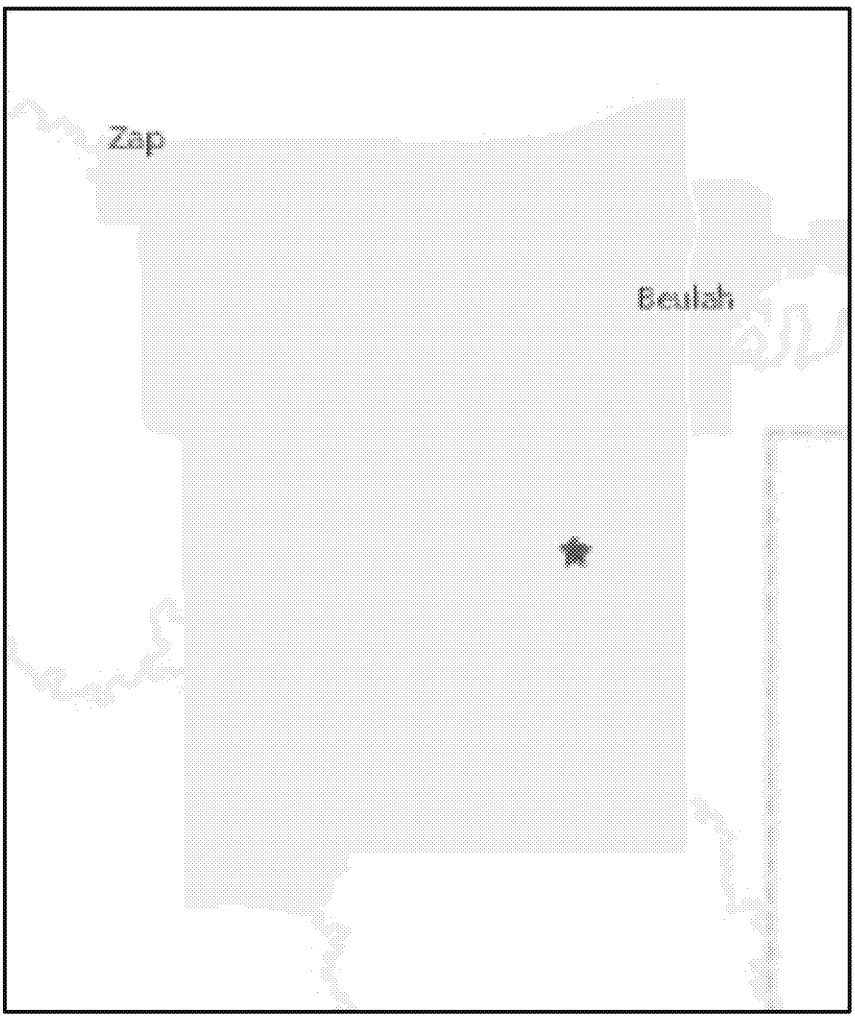


The discussion and analysis that follows below will reference the state's use of the Modeling TAD, the EPA's assessment of the State's modeling in accordance with the Modeling TAD, and the factors for evaluation contained in the EPA's March 20, 2015 guidance, as appropriate.

Detailed Assessment

Air Quality Data

This factor considers the SO_2 air quality monitoring data in the area (within 20 km) of Coyote Station. The facility is located in Mercer County, and the state included the most recent 3 years of monitoring data from the five SO_2 monitors currently operating in Mercer County. These monitors are all located north of Coyote Station. The table below shows information provided by the state related to these monitors.

Table 8: Available Air Quality Data for all SO_2 Monitors in Mercer County

County	State Recommendation	Monitor ID	Monitor Location	2012-2014 SO_2 Design Value in ppb
Mercer	Attainment	38-057-0004	6024 Highway 200	23
Mercer	Attainment	38-057-0102	Dgc #12	33
Mercer	Attainment	38-057-0118	Dgc #14	26
Mercer	Attainment	38-057-0123	Dgc # 16	21
Mercer	Attainment	38-057-0124	Dgc # 17	19

Based on available ambient air quality collected at these monitors, the county surrounding Coyote Station does not show a violation of the 2010 SO_2 NAAQS. North Dakota used this monitoring information as part of the showing, which combined with the modeling information below indicates that the area around Coyote Station should be designated as attainment for the 2010 SO_2 NAAQS. EPA does not consider these monitoring data to be conclusive as to the designation of the proposed unclassifiable/attainment area provided in Figure 9, because they are all located over 10 km from the Coyote Station.

Model Selection and Modeling Components

The EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. 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 the most recent version of AERMOD, 15181, and a discussion of the individual components will be referenced in the corresponding discussion that follows, as appropriate.

Modeling Parameter: Rural or Urban Dispersion

US EPA-recommended procedure for characterizing an area by prevalent land use is based on evaluating the dispersion environment with 3 km of the facility. According to US EPA modeling guidelines, rural dispersion coefficients are to be used in the dispersion modeling analysis if more than 50% of the area within a 3-km radius of the facility is classified as rural. Conversely, if more than 50% of the area is urban, urban dispersion coefficients should be used in the modeling analysis. As shown in Figure 10, the 3-km area surrounding each of the facilities is rural. Therefore, the State determined that is was most appropriate to run the model with rural dispersion coefficients for each of the facilities being modeled.

Modeling Parameter: Area of Analysis (Receptor Grid)

The EPA believes that a reasonable first step towards characterization of air quality in the area surrounding the Coyote Station 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 area near Coyote Station, the State has not included any other emitters of SO_2 within, as none lie within 10 km of the facility Station in any direction. The State cited EPA's March 1, 2011 Memorandum and the analysis presented at a 2011 EPA modeling workshop in support of the 10 km distance. The nearest large SO_2 sources are more than 15 km away, which would place them at a distance for which a uniform background influence would be expected. Therefore, these more distant sources would not be expected to interact with Coyote to cause a significant concentration gradient near Coyote. In addition, as the State is aware, there are 5 monitors in the vicinity of the sources to the north (Antelope Valley Station and the Great Plains Synfuels Plant) that show NAAQS compliance by a wide margin. Therefore, for this 1-hour SO_2 NAAQS analysis, no nearby background sources were considered in the modeling. Additionally, the State determined that the 10 km area was the appropriate area 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 grid receptor spacing for the area of analysis chosen by the State is as follows:

- Along the fenceline with 50-m spacing
- Fenceline to 5 km with 100 meters spacing
- 5 km to 10 km with 250 meters spacing
- 10 km to 20 km with 500 meters spacing
- 20 km to 50 km with 1,000 meter spacing

The receptor network contained 8,599 receptors, and an additional receptor to represent the source. The network mostly covers Mercer County, but portions of Dunn, Oliver, and McLean counties are also included in the analysis. Figures 10 and 11, included in the State's recommendation, show the area of analysis surrounding the Coyote Station, as well as receptor grid for the area of analysis.

Consistent with the Modeling TAD, receptors for the purposes of this designation effort were placed only in areas where it would also be feasible to place a monitor and record ambient air impacts. The impacts of the area's geography and topography will be discussed later within this document.

Figure 10. Area of Analysis

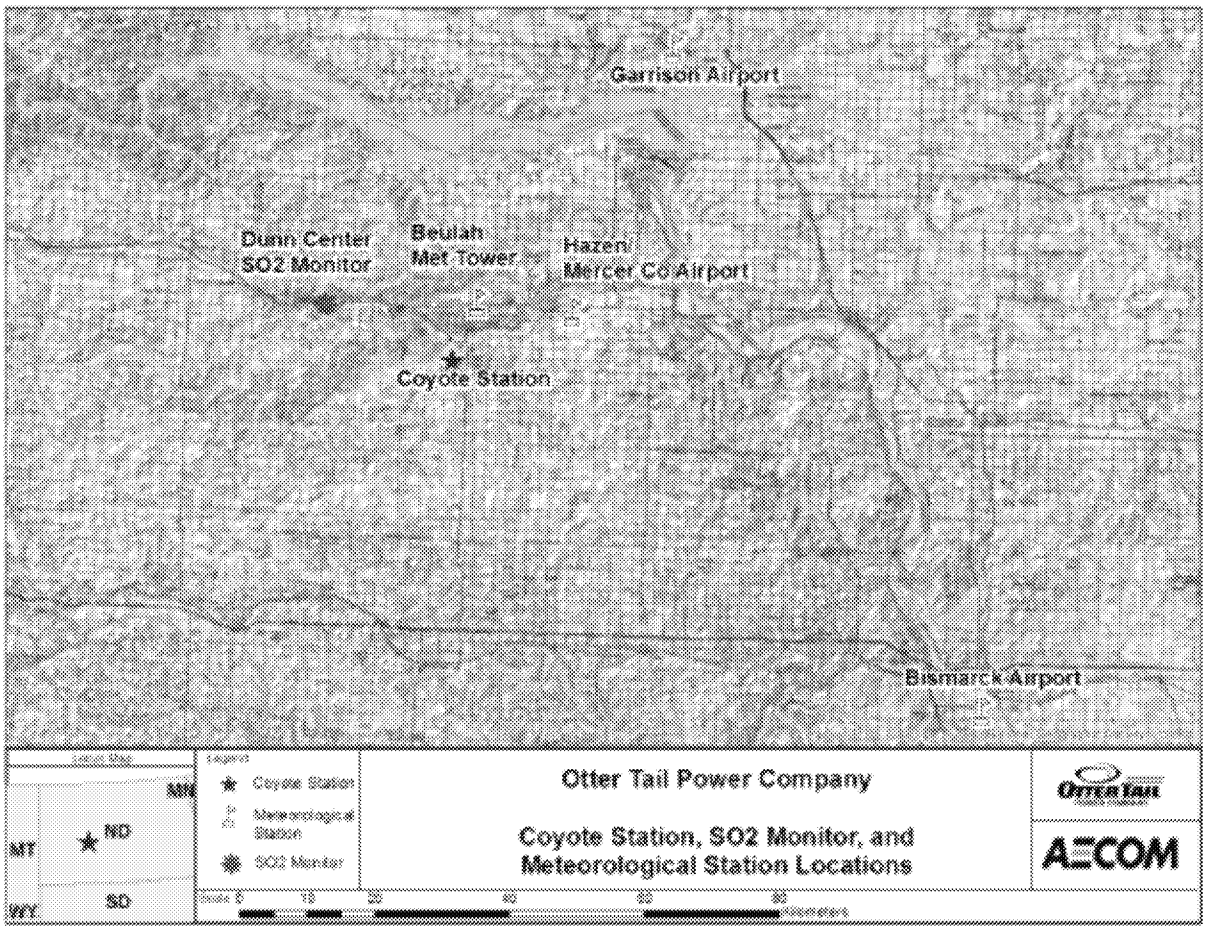
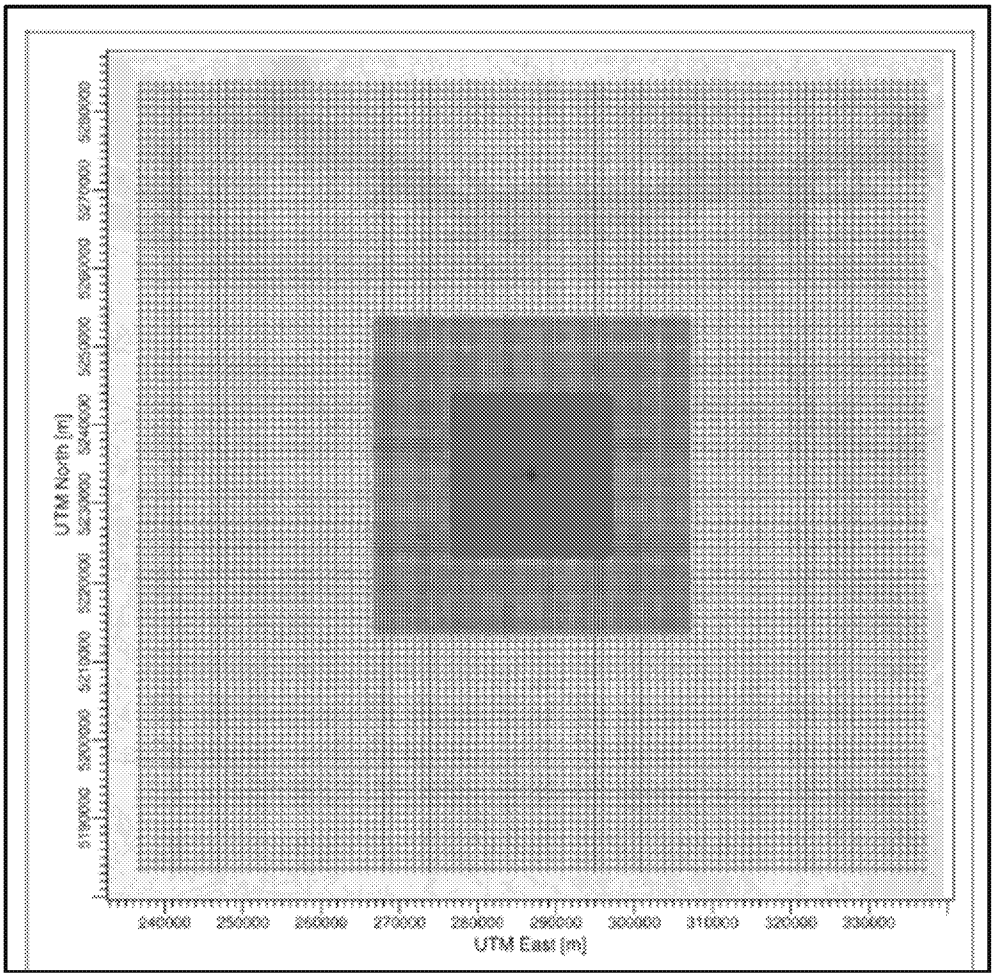


Figure 11. Receptor Grid for the Area of Analysis



Modeling Parameter: Source Characterization

The State characterized the source within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, for the Coyote station the State used actual stack heights in conjunction with actual emissions. The State also followed the EPA's good engineering practices (GEP) policy in their GEP stack height analysis to provide input information for the building dimensions into AERMOD. A GEP stack height analysis was performed for the sources with US EPA's Building Profile Input Program (BPIP). BPIP was used to develop the building information to simulate building downwash in the modeling analysis. A total of six buildings were included into the GEP analysis: a multi-tiered boiler building structure (88 meters), the baghouse structure (24 meters), the scrubber structure (44 meters), recycle fly ash silo (32 meters), fly ash silo (43 meters), and lime silo (45 meters). The building layout and location, as well as the stack parameters (e.g., exit temperature, exit velocity, location, and diameter), were adequately characterized in the modeling analysis. Table 9 presents the assumed source characterizations for each facility provided by the State.

Table 9. Modeling Source Parameters

Parameter	Stack Height	Exit Temperature	Exit Velocity	Diameter	Base Elevation
Coyote Station	151.79 m	386.48 K	33.89 m/sec	6.40 m	590.52 m

Modeling Parameter: Emissions

The 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 does provide for the flexibility of using allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate.

The 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 absence of CEMS data, the EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, the EPA believes that detailed throughput, operating schedules, and emissions information from the impacted 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, North Dakota included only the Coyote Station in the area of analysis. The State selected only this facility because there are no other SO_2 sources within 10 km of the facility, and 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 10 km were determined by the State to have the potential to cause significant concentration gradients within the area of analysis.

For the Coyote Station, the State included annual actual SO_2 emissions based on CEMs data between 2012 and 2014. Coyote Station is a 427-megawatt (net) coal-fired power plant located in Beulah, North Dakota. The station operates a single boiler exhausting through a 151-meter tall stack.

Table 10: SO_2 Emissions Between 2012 – 2014 from Coyote Station.

Facility Name	Units	Type of Emissions	SO_2 Emissions (tons per year)		
			2012	2013	2014
Coyote Station	Unit 1	Actuals	10645.58	12584.67	12785.76

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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, the Federal Aviation Administration (FAA), and military stations.

The State determined that surface meteorological data from the state-operated Beulah 10-meter tower and upper air observations from a NWS site in Bismarck, North Dakota would best represent the meteorological conditions within the area of analysis. Missing surface data and upper air soundings were substituted with data from the Garrison airport and Glasgow station, respectively. The State select meteorological data for the period 2012 to 2014, which is concurrent with the emissions period.

The State used AERSURFACE version 13016 using data primarily around the Beulah tower and a secondary set around the NWS Hazen airport to estimate the surface characteristics of the area of analysis. A 1-km radius circular area centered at the Beulah primary meteorological station site was assumed and divided into twelve sectors, each with its own homogeneous land use that was distinctly different from the other sectors. As recommended in the AERSURFACE User's Guide, the State determine the surface moisture condition for each season by comparing precipitation for the period of data to be processed to the 30-years of Garrison airport (Hazen airport precipitation data has poor data capture and, therefore, was not used) precipitation records, selecting "wet" conditions if precipitation is in the upper 30th percentile, "dry" conditions if precipitation is in the lower 30th percentile, and "average" conditions if precipitation is in the middle 40th percentile. The monthly designations of surface moisture input to AERSURFACE are summarized in Table 11.

Table 11. AERSURFACE Bowen Ratio Condition Designations for Beulah Site.

Month	Bowen Ratio Category		
	2012	2013	2014
January	Dry	Dry	Average
February	Wet	Average	Average
March	Average	Average	Average
April	Wet	Wet	Wet
May	Average	Wet	Wet
June	Average	Wet	Average
July	Average	Average	Dry
August	Dry	Wet	Wet
September	Dry	Wet	Average
October	Wet	Wet	Average
November	Wet	Average	Wet
December	Wet	Wet	Dry

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The State used AERSURFACE to develop seasonal categories by month for each modeled year and they were applied for the primary (Beulah site) and secondary (Hazen airport) site, as shown in Table 12. A month was selected as a "winter with continuous snow on the ground" if a month had at least half of the days with recorded snow on the ground. Daily snow cover records were obtained for the Garrison and Bismarck airports from the National Climatic Data Center (NCDC).

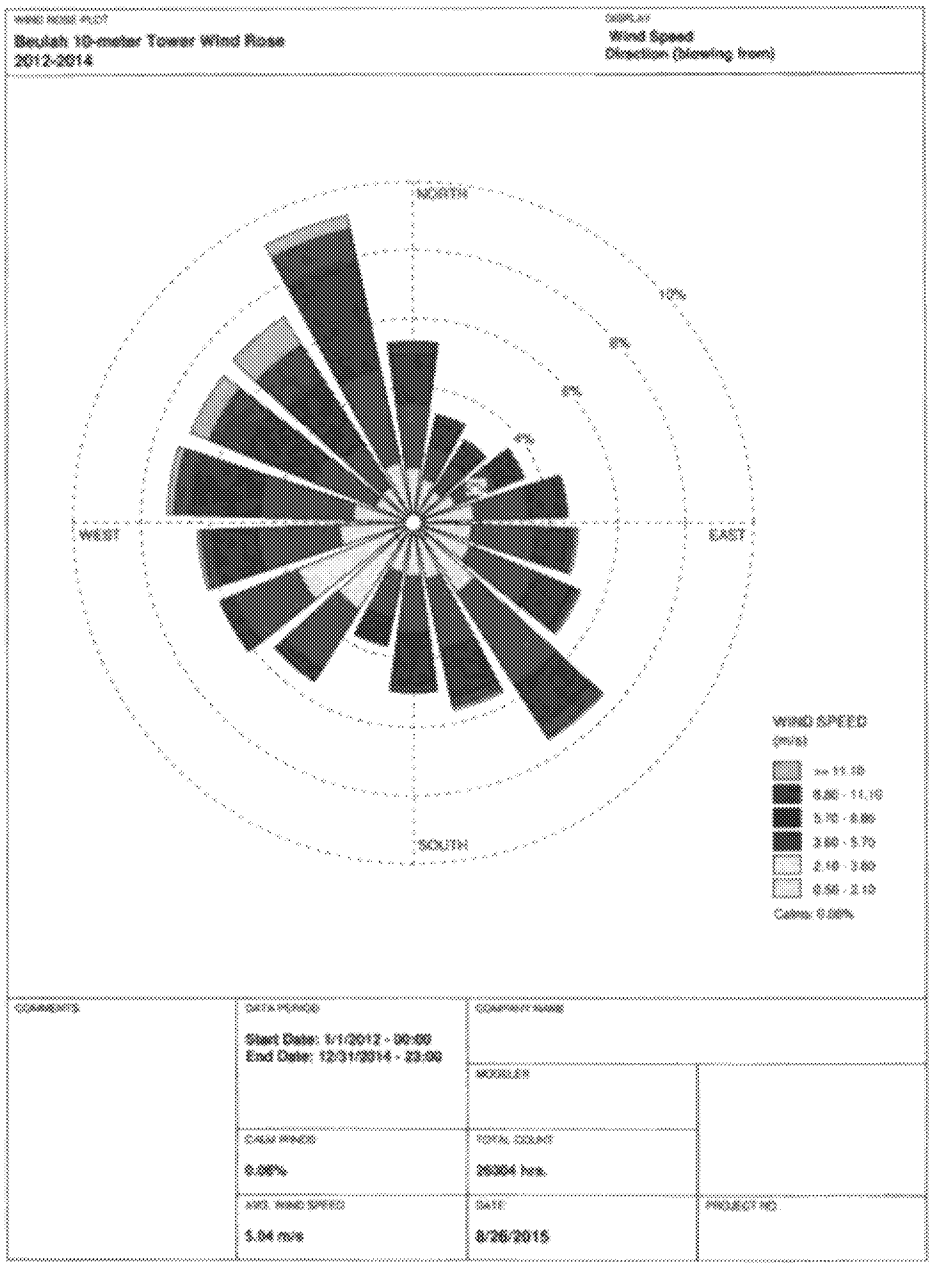
Table 12. Selected Seasonal Categories for AERSURFACE.

Season Description	2012	2013	2014
Late autumn after frost and harvest, or winter with no snow	1,2,3	3,4	3
Winter with continuous snow on the ground	11, 12	12,1,2	11, 12, 1, 2
Transitional spring	4, 5	5	4, 5
Midsummer with lush vegetation	6,7,8	6,7,8	6,7,8
Autumn with unharvested cropland	9,10	9,10,11	9,10

As part of its recommendation, the State provided the 3-year surface wind rose for Beulah, North Dakota. In Figure 12, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. Based on the wind rose, the meteorological conditions include:

- average wind speed: 5 meters per second;
- calm winds occur about six percent of the time; and
- predominant winds are from the northwest (about 8% of the time) and from the southeast (about 6% of the time).

Figure 12. Beulah, North Dakota Cumulative Annual Wind Rose for Years 2012 – 2014.



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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, the State introduced Garrison airport data as 1-minute ASOS in Stage 2 of AERMET. The 1-minute data was processed by a separate preprocessor, AERMINUTE (version 14337). 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. This approach is consistent with a March 2013 EPA memo titled, "Use of ASOS meteorological data in AERMOD dispersion Modeling." 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 flat. To account for these terrain changes, the AERMAP (version 11103) 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 10-meter 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 area near Coyote, the State chose the temporally varying approach. The background concentration for this area of analysis was determined by the State to be from 2.09 to 10.66 micrograms per cubic meter ($\mu g/m^3$), or 0.80 ppb to 4.07 ppb,[4] and that value was incorporated into the final AERMOD results.

The State determined the background concentrations of SO_2 based on information provided in the EPA March 1, 2011 Memorandum and the analysis presented at the 2011 EPA modeling workshop, specifically noting that the selection of regional background sources should be limited to 10 kilometers from the source location. The nearest large SO_2 sources are more than 15 km away, which would place them at a distance for which a uniform background influence would be expected. Therefore, these more distant sources would not be expected to interact with Coyote to

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

cause a significant concentration gradient near Coyote. In addition, there are 5 monitors in the vicinity of the sources to the north (Antelope Valley Station and the Great Plains Synfuels Plant) that show NAAQS compliance by a wide margin. The total concentration for 1-hour SO_2 NAAQS compliance was computed by adding the Coyote Station predicted concentration to the regional background concentrations from the state-approved Dunn Center monitor. The Dunn Center monitor is appropriate for characterizing background concentrations because it is a regional site that is located away from the area of interest but can be impacted by similar natural and distant man-made sources. The background concentration was calculated as a 3-year (2012-2014) average of the 99th percentile by season and hour-of-day and added internally in AERMOD to the AERMOD-predicted concentration for comparison with the 1-hour SO_2 NAAQS of 196.5 $\mu g/m^3$ (75 ppb[5]). The Dunn Center seasonal SO_2 concentrations are displayed in Figure 13.

Figure 13. 2012-2014 Average 99th Percentile Concentration at Dunn Center Monitor.

Summary of Modeling Results

The AERMOD modeling parameters for the Coyote Station modeling analysis are summarized below in Table 13.

Table 13. AERMOD Modeling Parameters for the Coyote station modeling analysis.

AERMOD Version	15181

[5] Id.

Dispersion Characteristics	Rural
Modeled Sources	1
Modeled Stacks	1
Modeled Structures	1
Modeled Fencelines	1
Total receptors	8600
Emissions Type	Actuals
Emissions Years	2012-2014
Meteorology Years	2012-2014
Surface Meteorology Station	Beulah, North Dakota
Upper Air Meteorology Station	Bismarck, North Dakota
Methodology for Calculating Background SO_2 Concentration	Temporal Varying
Calculated Background SO_2 Concentration	0.80 ppb to 4.07 ppb

The State's modeling indicates that the predicted 99th percentile 1-hour average concentration within the selected modeling domain is 115.88 $\mu g/m^3$. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the Coyote Station. The results presented below in Table 14 show the magnitude and geographic location of the highest predicted modeled concentration from the modeling analysis.

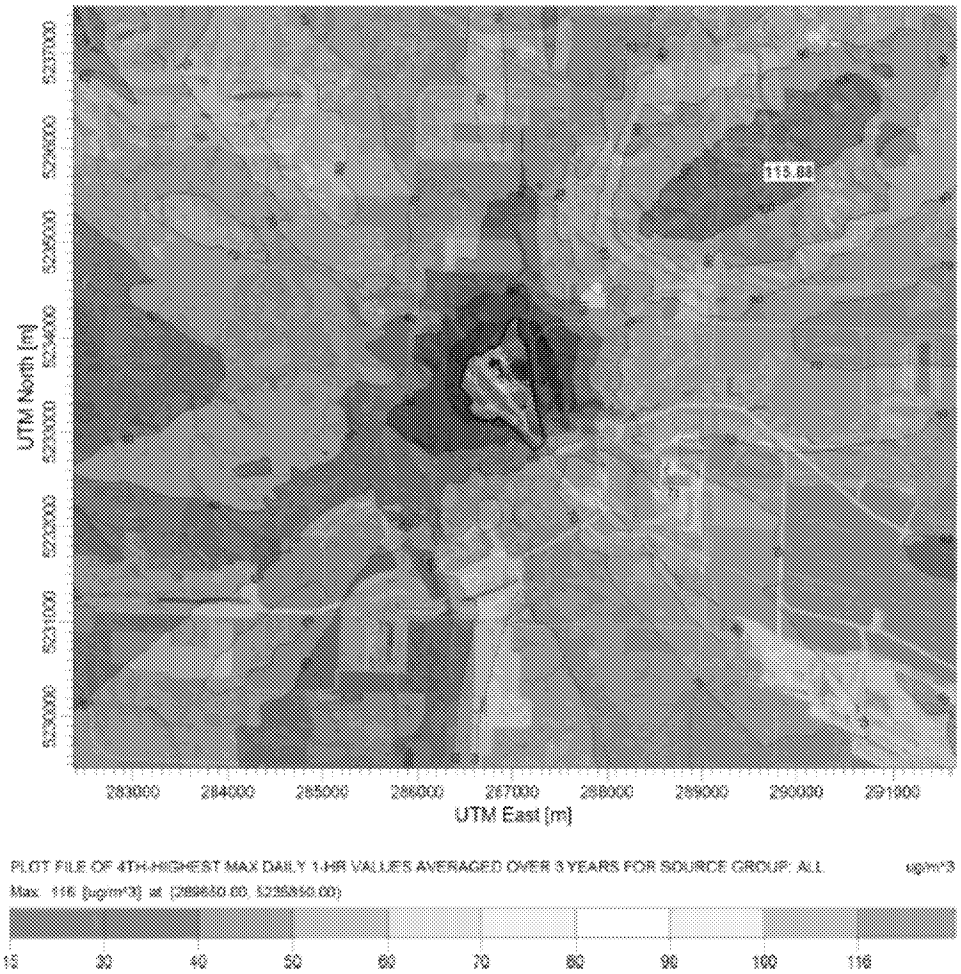
Table 14: Maximum Predicted 99th Percentile 1-Hour SO_2 Concentration

		Receptor Location		SO_2 Concentration ($\mu g/m^3$)	
Averaging Period	Data Period	UTM/Latitude	UTM/Longitude	Modeled (including background)	NAAQS
99th Percentile 1-Hour Average	2012-2014	289650	5235850	115.88	196.5*

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

Figure 14 below was included as part of the State's recommendation, and indicates that the predicted value occurred northeast of the Coyote station. The State also provided modeling analyses that were based on modeling that used non-default or beta configuration options for treating low-wind conditions. These non-default options include adjustments to the computation of the friction velocity (ADJ_U*) in the AERMET meteorological pre-processor and lateral wind speed standard deviation computations incorporated into AERMOD ("LOWWIND3" option). While the State provided these additional analyses, these analyses were not evaluated or approved by EPA prior to the utilization of these options in the modeling. At this time, EPA will only support the modeling analyses that used the current regulatory defaults to characterize SO_2 concentrations for the designations required by July 2, 2016.

Figure 14. Maximum Predicted 99th Percentile 1-Hour SO_2 Concentrations from the Modeling Analysis.



Jurisdictional Boundaries:

Once the geographic area of analysis associated with the Coyote Station and background concentration is determined, existing jurisdictional boundaries are considered for the purpose of informing our intended unclassifiable/attainment area, specifically with respect to clearly defined legal boundaries.

The EPA has determined that there are no other significant sources of SO_2 in the intended unclassifiable/attainment area emitting at or above 20 tpy but for Coyote Station. As previously mentioned, there are 2 facilities, i.e., Antelope Valley Station and Great Plains Synfuels, located approximately 8 km north of the EPA's intended unclassifiable/attainment area. The design values at ambient air quality monitors near these facilities, and summarized in Table 8 above, indicate that at distances of approximately 2.5 km downwind of these facilities, the concentration of SO_2 is approximately half of the NAAQS. As a result, the EPA does not believe that

emissions from either Antelope Valley Station or Great Plains Synfuels are likely to cause or contribute to a violation of the NAAQS within the intended unclassifiable/attainment area.

The EPA believes that our intended unclassifiable/attainment area, consisting of County Road 13, and the outer border of Zap, ND as the western border, 8th St. SW/ND 200 as the northern border, 61st Ave SW/ND 49 as the eastern border, and 17th St. SW/County Road 15 as the southern border, are comprised of clearly defined legal boundaries, and we find these boundaries to be a suitably clear basis for defining our intended unclassifiable/attainment area.

Other Relevant Information

EPA did not receive any additional information on this designation aside from that submitted by the State.

Conclusion

After careful evaluation of the State's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate the area around the Coyote Station as attainment/unclassifiable for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of; County Road 13, and the outer border of Zap, ND as the western border, 8th St. SW/ND 200 as the northern border, 61st Ave SW/ND 49 as the eastern border, and 17th St. SW/County Road 15 as the southern border (see Figure 9).

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