Technical Support Document:

Chapter 31
Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for North Dakota

1. Summary

Pursuant to section 107(d) of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (the EPA, we, or us) must designate areas as either "nonattainment," "attainment," or "unclassifiable" for the 2010 1-hour sulfur dioxide (SO_2) primary national ambient air quality standard (NAAQS) (2010 SO_2 NAAQS). The CAA defines a nonattainment area as an area that does not meet the NAAQS or that contributes to a nearby area that does not meet the NAAQS. An attainment area is defined by the CAA as any area that meets the NAAQS and does not contribute to a nearby area that does not meet the NAAQS. Unclassifiable areas are defined by the CAA as those that cannot be classified on the basis of available information as meeting or not meeting the NAAQS. In this action, the EPA has defined a nonattainment area as an area that the EPA has determined violates the 2010 SO_2 NAAQS or contributes to a violation in a nearby area, based on the most recent 3 years of air quality monitoring data, appropriate dispersion modeling analysis, and any other relevant information. An unclassifiable/attainment area is defined by the EPA as an area that either: (1) based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS[1]. An unclassifiable area is defined by EPA as an area that either: (1) was required to be characterized by the state under 40 CFR 51.1203(c) or (d), has not been previously designated, and on the basis of available information cannot be classified as either: (i) meeting or not meeting the 2010 SO_2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and EPA does have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

[1] The term "designated attainment area" is not used in this document because the EPA uses that term only to refer to a previous nonattainment area that has been redesignated to attainment as a result of the EPA's approval of a state-submitted maintenance plan.

This technical support document (TSD) addresses designations for nearly all remaining undesignated areas in North Dakota for the 2010 SO_2 NAAQS. In previous final actions, the EPA has issued designations for the 2010 SO_2 NAAQS for selected areas of the country.[2] The EPA is under a December 31, 2017, deadline to designate the areas addressed in this TSD as required by the U.S. District Court for the Northern District of California.[3] We are referring to the set of designations being finalized by the December 31, 2017, deadline as "Round 3" of the designations process for the 2010 SO_2 NAAQS. After the Round 3 designations are completed, the only remaining undesignated areas will be those where a state began timely operation of a new SO_2 monitoring network meeting EPA specifications referenced in EPA's SO_2 Data Requirements Rule (DRR). (80 FR 51052). The EPA is required to designate those remaining undesignated areas by December 31, 2020.

North Dakota submitted its first recommendation regarding designations for the 2010 1-hour SO_2 NAAQS on May 25, 2011, in which the state recommended attainment for the entire state based on available ambient monitoring data. The state submitted updated air quality analysis and updated recommendations on January 12, 2017. In our intended designations, we have considered all the submissions from the state, except where a recommendation in a later submission regarding a particular area indicates that it replaces an earlier recommendation for that area we have considered the recommendation in the later submission.

For the areas in North Dakota that are part of the Round 3 designations process, Table 1 identifies EPA's intended designations and the counties or portions of counties to which they would apply. It also lists North Dakota's current recommendations. The EPA's final designation for these areas will be based on an assessment and characterization of air quality through ambient air quality data, air dispersion modeling, other evidence and supporting information, or a combination of the above.

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

Area/County	North Dakota's Recommended Area Definition	North Dakota's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Mercer County	"Area Around Source"	Attainment	Full County (apart from previously designated areas and the portion of the County containing the Fort Berthold	Unclassifiable/ Attainment

[2] A total of 94 areas throughout the U.S. were previously designated in actions published on August 5, 2013 (78 FR 47191), July 12, 2016 (81 FR 45039), and December 13, 2016 (81 FR 89870).
[3] *Sierra Club v. McCarthy*, No. 3-13-cv-3953 (SI) (N.D. Cal. Mar. 2, 2015).

Area/County	North Dakota's Recommended Area Definition	North Dakota's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
			Indian Reservation)	
Morton and Burleigh Counties	"Area Around Source"	Attainment	Full County	Unclassifiable/ Attainment
Oliver County	"Area Around Source"	Attainment	Full County	Unclassifiable/ Attainment
Remaining Undesignated Areas to Be Designated in this Action*	Rest of State	Attainment	Same as State's Recommendation	Unclassifiable/Attainment

* Except for areas that are associated with sources for which North Dakota elected to install and began timely operation of a new, approved SO2 monitoring network meeting EPA specifications referenced in EPA's SO_2 DRR (*see* Table 2), the EPA intends to designate the remaining undesignated counties (or portions of counties) in North Dakota as "unclassifiable/attainment" as these areas were not required to be characterized by the state under the DRR and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the areas may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS. These areas that we intend to designate as unclassifiable/attainment (those to which this row of this table is applicable) are identified more specifically in section 6 of this TSD.

Areas for which North Dakota elected to install and began operation of a new, approved SO_2 monitoring network are listed in Table 2. The EPA is required to designate these areas, pursuant to a court ordered schedule, by December 31, 2020. Table 2 also lists the SO_2 emissions sources around which each new, approved monitoring network has been established.

Table 2 – Undesignated Areas Which the EPA Is Not Addressing in this Round of Designations (and Associated Source)

Area	Source(s)
Williams County	Amerada Hess – Tioga Gas Plant

Areas that the EPA previously designated unclassifiable in Round 1 (*See* 78 FR 47191) and Round 2 (*See* 81 FR 45039 and 81 FR 89870) are not affected by the designations in Round 3 unless otherwise noted. Portions of Mercer County and all of McLean County were designated unclassifiable/attainment in Round 2. No areas in North Dakota were designated in Round 1.

2. General Approach and Schedule

Updated designations guidance documents were issued by the EPA through a July 22, 2016, memorandum and a March 20, 2015, memorandum from Stephen D. Page, Director, U.S. EPA, Office of Air Quality Planning and Standards, to Air Division Directors, U.S. EPA Regions I-X. These memoranda supersede earlier designation guidance for the 2010 SO_2 NAAQS, issued on March 24, 2011, and identify factors that the EPA intends to evaluate in determining whether areas are in violation of the 2010 SO_2 NAAQS. The documents also contain the factors that the EPA intends to evaluate in determining the boundaries for designated areas. These factors include: 1) air quality characterization via ambient monitoring or dispersion modeling results; 2) emissions-related data; 3) meteorology; 4) geography and topography; and 5) jurisdictional boundaries.

To assist states and other interested parties in their efforts to characterize air quality through air dispersion modeling for sources that emit SO_2, the EPA released its most recent version of a draft document titled, "SO_2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) in August 2016.[4]

Readers of this chapter of this TSD should refer to the additional general information for the EPA's Round 3 area designations in Chapter 1 (Background and History of the Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard) and Chapter 2 (Intended Round 3 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for States with Sources Not Required to be Characterized).

[4] https://www.epa.gov/sites/production/files/2016-06/documents/so2modelingtad.pdf. In addition to this TAD on modeling, the EPA also has released a technical assistance document addressing SO_2 monitoring network design, to advise states that have elected to install and begin operation of a new SO_2 monitoring network. See Draft SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, February 2016, https://www.epa.gov/sites/production/files/2016-06/documents/so2monitoringtad.pdf.

As specified by the March 2, 2015, court order, the EPA is required to designate by December 31, 2017, all "remaining undesignated areas in which, by January 1, 2017, states have not installed and begun operating a new SO_2 monitoring network meeting EPA specifications referenced in EPA's" DRR. The EPA will therefore designate by December 31, 2017, areas of the country that are not, pursuant to the DRR, timely operating EPA-approved and valid monitoring networks. The areas to be designated by December 31, 2017, include the areas associated with four sources in North Dakota meeting DRR emissions criteria that states have chosen to be characterized using air dispersion modeling, and other areas not specifically required to be characterized by the DRR.

Because many of the intended designations have been informed by available modeling analyses, this preliminary TSD is structured based on the availability of such modeling information. There is a section for each county for which modeling information is available. For some counties, multiple portions of the county have modeling information available and the section on the county is divided accordingly. The remaining to-be-designated counties are then addressed together in section 6.

The EPA does not plan to revise this TSD after consideration of state and public comment on our intended designation. A separate TSD will be prepared as necessary to document how we have addressed such comments in the final designations.

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

1) 2010 SO_2 NAAQS – The primary NAAQS for SO_2 promulgated in 2010. This NAAQS is 75 ppb, based on the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour average concentrations. See 40 CFR 50.17.
2) Design Value - a statistic computed according to the data handling procedures of the NAAQS (in 40 CFR part 50 Appendix T) that, by comparison to the level of the NAAQS, indicates whether the area is violating the NAAQS.
3) Designated nonattainment area – an area that, based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined either: (1) does not meet the 2010 SO_2 NAAQS, or (2) contributes to ambient air quality in a nearby area that does not meet the NAAQS.
4) Designated unclassifiable/attainment area – an area that either: (1) based on available information including (but not limited to) appropriate modeling analyses and/or monitoring data, the EPA has determined (i) meets the 2010 SO_2 NAAQS, and (ii) does not contribute to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.
5) Designated unclassifiable area – an area that either: (1) was required to be characterized by the state under 40 CFR 51.1203(c) or (d), has not been previously designated, and on the basis of available information cannot be classified as either: (i) meeting or not meeting the 2010 SO_2 NAAQS, or (ii) contributing or not contributing to ambient air quality in a nearby area that does not meet the NAAQS; or (2) was not required to be

characterized under 40 CFR 51.1203(c) or (d) and the EPA does have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

6) Modeled violation – a violation of the SO_2 NAAQS demonstrated by air dispersion modeling.
7) Recommended attainment area – an area that a state, territory, or tribe has recommended that the EPA designate as attainment.
8) Recommended nonattainment area – an area that a state, territory, or tribe has recommended that the EPA designate as nonattainment.
9) Recommended unclassifiable area – an area that a state, territory, or tribe has recommended that the EPA designate as unclassifiable.
10) Recommended unclassifiable/attainment area – an area that a state, territory, or tribe has recommended that the EPA designate as unclassifiable/attainment.
11) Violating monitor – an ambient air monitor meeting 40 CFR parts 50, 53, and 58 requirements whose valid design value exceeds 75 ppb, based on data analysis conducted in accordance with Appendix T of 40 CFR part 50.
12) We, our, and us – these refer to the EPA.

3. Technical Analysis for the Northern Mercer County Area

3.1. Introduction

The EPA must designate the remaining undesignated portions of Northern Mercer County, North Dakota, by December 31, 2017, because this area has not been previously designated and North Dakota has not installed and begun timely operation of a new, approved SO_2 monitoring network to characterize air quality in the vicinity of any sources in Northern Mercer County.

There are two areas in Mercer County that have already been designated for the 2010 SO_2 NAAQS (see Figure 10, below). These areas were designated as unclassifiable/attainment in Round 2, and details about those designations can be found in the final rule establishing the designations (81 FR 45039, July 12, 2016) and the docket for that action.[5] Some of the sources addressed in those designations were also modeled in this round of designations due to their proximity to sources addressed below.

3.2. Air Quality Monitoring Data for the Northern Mercer County Area

This factor considers the SO_2 air quality monitoring data in the area of Northern Mercer County. The state did not include any monitoring data in the January 12, 2017, recommendation, but did reference the attaining values from the following monitors operating in the vicinity of the DRR facilities in Northern Mercer County in its May 25, 2011, recommendation:

[5] The TSD for the North Dakota Round 2 designations can be found at EPA-HQ-OAR-2014-0464-0394.

- Air Quality System monitor 380570123. This monitor is located at 6197 Second St. SW in Mercer County, and is roughly 2.5 km northwest of Antelope Valley Station and roughly 3.5 km northwest of Great Plains Synfuels. This monitor data is valid for comparison to the NAAQS, and the monitor indicates design values well below the NAAQS (2014-2016 design value = 22 ppb). As noted, the State referenced their entire SO_2 network in the 2011 recommendation (including this monitor). However, the EPA has not received any information indicating that this monitor is adequately sited for the purposes of designating this area. Therefore, the EPA is not concluding that this attaining monitor data should be the basis of an unclassifiable/attainment designation for Northern Mercer County.
- Air Quality System monitor 380570118. This monitor is located at 6105 Third St. SW in Mercer County, and is roughly 4 km east of Antelope Valley Station and roughly 4.5 km east of Great Plains Synfuels. This monitor data is valid for comparison to the NAAQS, and this monitor indicates design values well below the NAAQS (2014-2016 design value = 22 ppb). As noted, the State referenced their entire SO_2 network in the 2011 recommendation (including this monitor). However, the EPA has not received any information indicating that this monitor is adequately sited for the purposes of designating this area. Therefore, the EPA is not concluding that this monitor data should be the basis of an attainment designation in Northern Mercer County.

3.3. Air Quality Modeling Analysis for the Northern Mercer County Area Addressing Antelope Valley Station and Great Plains Synfuels Plant

3.3.1. Introduction

This section 3.3 presents all the available air quality modeling information for a portion of Northern Mercer County that includes Antelope Valley Station and Great Plains Synfuels Plant. (This portion of Mercer County will often be referred to as "the Northern Mercer County area" within this section 3.3). This area contains the following SO_2 sources, principally the sources around which North Dakota is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tons per year:

- The Antelope Valley Station facility emits 2,000 tons or more annually. Specifically, Antelope Valley Station emitted 12,484 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and North Dakota has chosen to characterize it via modeling.
- The Great Plains Synfuels Plant facility emits 2,000 tons or more annually. Specifically, Great Plains Synfuels Plant emitted 3,818 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and North Dakota has chosen to characterize it via modeling.

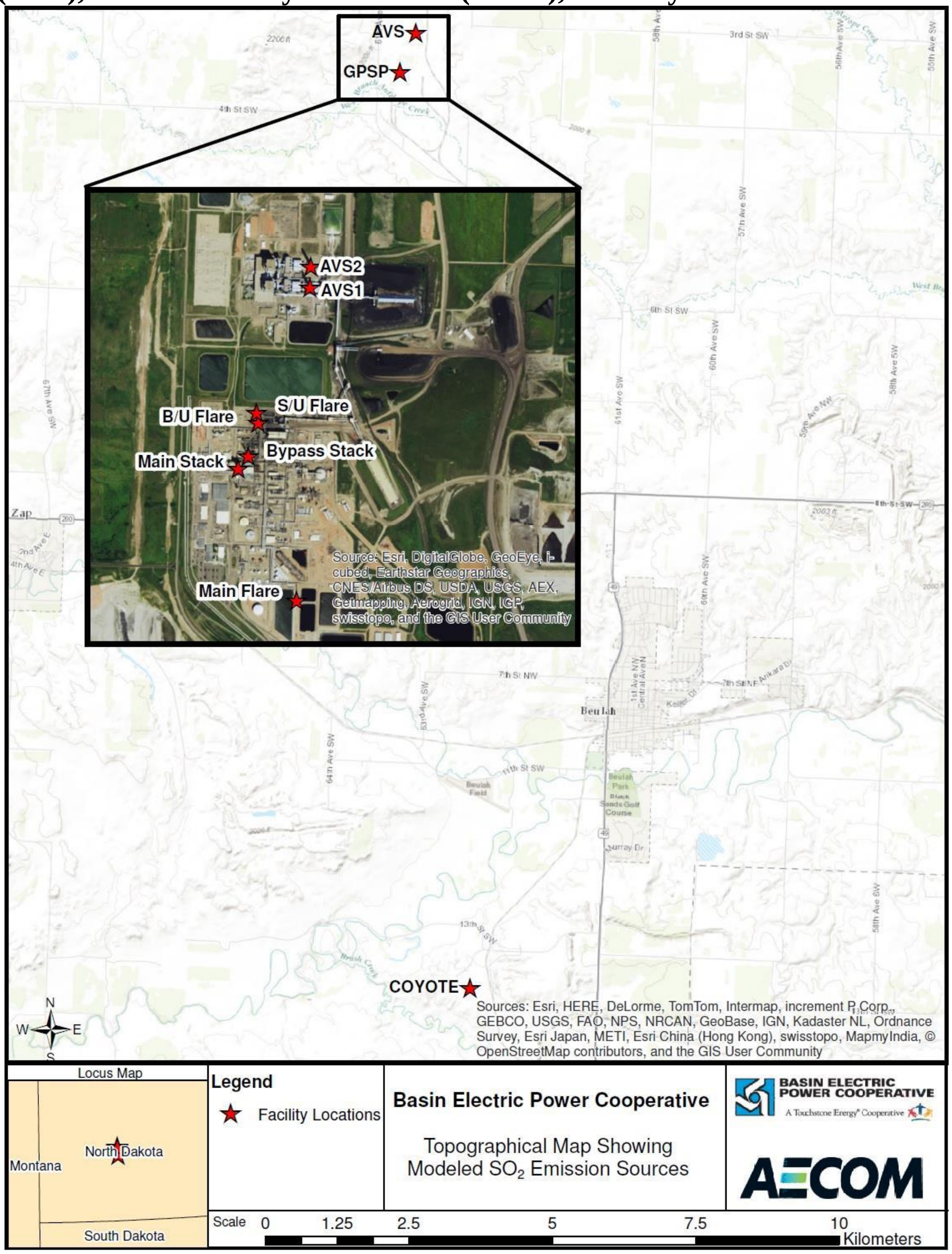
In its submission, North Dakota recommended that the area surrounding the Antelope Valley Station and Great Plains Synfuels Plant be designated as attainment based in part on an assessment and characterization of air quality impacts from these facilities as well as nearby Coyote Station. This assessment and characterization were performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the state's assessment, supporting documentation, and all available data, the EPA agrees with the state's conclusion that the area is meeting the NAAQS, and intends to designate the area as unclassifiable/attainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

The area that the state has assessed via air quality modeling is located in Northern Mercer County about 10 km north of Beulah, North Dakota. As seen in Figure 1 below, the Antelope Valley and Great Plains Synfuels facilities are located in Northern Mercer County. Also included in the figure are other nearby emitters of SO_2.[6] The Coyote Station is a coal fired power plant located 16 km south of Great Plains Synfuels Plant. The Coyote Station was modeled and the surrounding area was designated unclassifiable/attainment in Round 2 of the 2010 SO_2 designations (See Figure 10, below).

The figure does not include the state's recommended area for the attainment designation recommendation, as the state did not recommend a specific boundary but requested a designation of the area around the sources. The EPA's intended unclassifiable/attainment designation boundary for the Northern Mercer County area is not shown in this figure, but is shown in a figure in the section below that summarizes our intended designation.

[6] All other SO_2 emitters of 100 tpy or more (based on information in the 2014 NEI) are shown in Figure 1.

Figure 1. Map of the Northern Mercer County Area Addressing Antelope Valley Station (AVS), Great Plains Synfuels Plant (GPSP), and Coyote Station



The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA’s July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered one modeling assessment from the state.

3.3.2. Modeling Analysis Provided by the State

The North Dakota Department of Health (NDDH) provided an air quality modeling assessment for the Basin Electric Power Cooperative's (Basin Electric) Antelope Valley Station (AVS), Dakota Gasification Company's (DGC) Great Plains Synfuels Plant (GPSP), and Otter Tail Power's Coyote Station (Coyote) in Mercer, County, North Dakota (ND). While the area surrounding Coyote has already been designated, Coyote was included in the analysis due to its proximity to AVS and GPSP. These facilities are located in central North Dakota. Figure 1, above, shows the locations of the facilities.

3.3.2.1.Model Selection and Modeling Components

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

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

The state used AERMOD version 15181 in the regulatory default mode, which was the most recent platform that was feasible to use at the time of the initial modeling provided to EPA in January 2017. Due to an issue the EPA identified with the receptor grid used in this modeling analysis, the state provided updated modeling to EPA in July 2017 to correct the issue. The issue with the receptor grid is discussed in more detail in section 3.3.2.3. In the updated modeling, the state used the most recent version of AERMOD, which is version 16216r. A discussion of the state's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

3.3.2.2.Modeling Parameter: Rural or Urban Dispersion

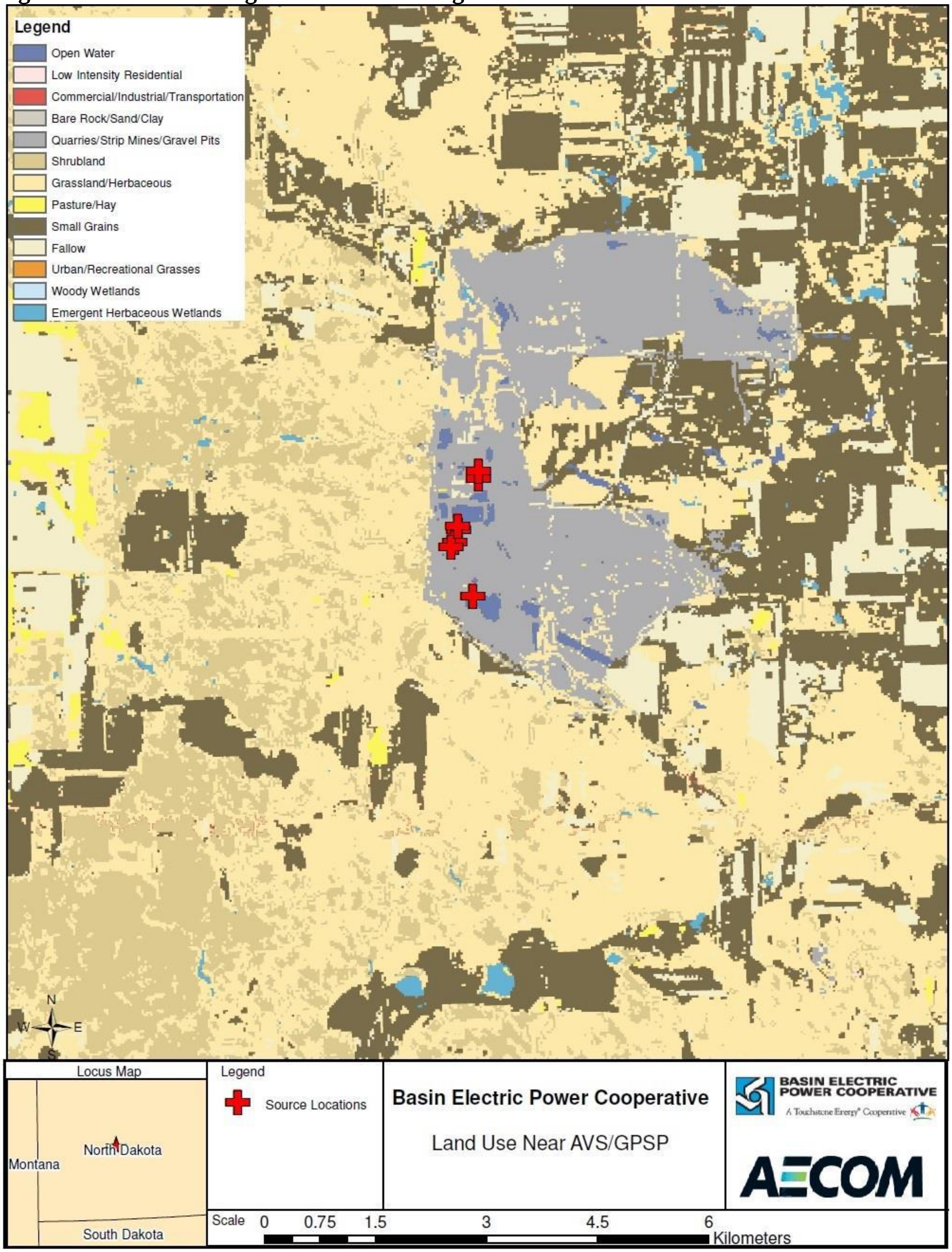
For any dispersion modeling exercise, the "urban" or "rural" determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD details the procedures used to determine if a source is urban or rural based on land use or population density.

The area surrounding AVS is considered mostly flat to gently rolling terrain, with some sharper valleys by the nearby Knife River. The station is located seven miles south of Lake Sakakawea reservoir in Mercer County and situated northwest of the community of Beulah, North Dakota.

The surrounding terrain of GPSP is the same as AVS because the facility is located to the south of and immediately adjacent to AVS. Figure 1 above shows the terrain surrounding the facilities.

For the purpose of performing the modeling for the area of analysis, the state determined that it was most appropriate to run the model in rural mode. The site location was classified as rural using the land use procedure specified in Appendix W. The National Land Cover Database (NLCD) layer was clipped to a 3-km ring around the facilities. Based on the map of land cover provided in the state's modeling assessment report, the area surrounding the facilities is rural. Figure 2 shows the land cover within a 3-km radius of the facilities. For these reasons, EPA's assessment supports the State's analysis on the land use classification.

Figure 2. Land Use categories for rural designations.



3.3.2.3.Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The sources of SO_2 emissions subject to the DRR in this area are described in the introduction to this section. For the Mercer County area, the state has included one other emitter of SO_2 within 20 km of the AVS and GPSP facilities, as there are no sources above 1 ton of SO_2 within this distance. As mentioned above, the facility included was the Coyote facility. The Coyote Station is owned by Otter Tail Power Company and is located approximately 16 km south of AVS and GPSP in Mercer County and situated southwest of the community of Beulah, North Dakota. Although the area around Coyote Station has already been designated, the plant was modeled here because of its proximity to AVS and GPSP and due to the recommendations of the NDDH in their December 2016 SO_2 Data Requirements Rule modeling protocol. Similar to AVS and GPSP, the area surrounding Coyote Station is rural with mostly flat terrain and gently rolling hills. Additional information about Coyote is included below.

The state determined that the selected modeling domain was appropriate to adequately characterize air quality through modeling, and to include the potential extent of any SO_2 NAAQS exceedances in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. No other sources beyond 20 km were determined by the state to have the potential to cause concentration gradient impacts within the area of analysis.

A Cartesian modeling receptor array was established to capture the 99th percentiles of the maximum daily one-hour average SO_2 impacts from the sources. The receptor grid is a relatively dense receptor array with the following spacing beyond the facilities' fence lines:

- 25 meters spacing along the fenceline;
- 0 km to 2.3 km with 50 meters spacing;
- 2.3 km 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 meters spacing.

The grid was centered on the area between the AVS and GPSP facilities. No areas beyond the fence line were excluded from the modeling analysis. For each facility, receptors were added on their property to model impacts from the other facility using 25-
meter spacing. The modeling was done in three parts: (1) all receptors outside of both properties, (2) receptors within AVS (for GPSP and Coyote impacts), and (3) receptors within GPSP (for AVS and Coyote impacts). During the EPA's review of the initial modeling analysis, we identified an error in the receptor grids used for the simulations that modeled AVS (i.e., the #2

modeling listed in the previous statement) and GPSP (i.e., the #3 modeling listed in the previous statement) independently. Specifically, the simulations reversed the receptor grids, where the receptor grid used in the AVS simulation was supposed to be used in the GPSP simulation, while the receptor grid used in the GPSP was supposed to be used in the AVS simulation. The state provided the EPA with updated modeling in July 2017 to correct the issue. Note that the state did not update the modeling for the #1 simulation (i.e., all receptors outside of both properties) listed previously as that modeling did not include this issue. Figure 3 shows the near-field receptor array and Figure 4 shows the far-field receptor array. The receptors using the orange color were used in the AVS modeling (i.e. #2 modeling) and the receptors using the green color were used in the GPSP modeling (i.e., #3 modeling). A total of 34,084 receptors were used for modeling AVS and GPSP (i.e., #1 modeling), a total of 5,532 receptors were used for modeling AVS (i.e., #1 modeling), and total of 2,799 receptors were used for modeling GPSP (i.e., #3 modeling).

Figure 3. Near-Field Receptor Array.

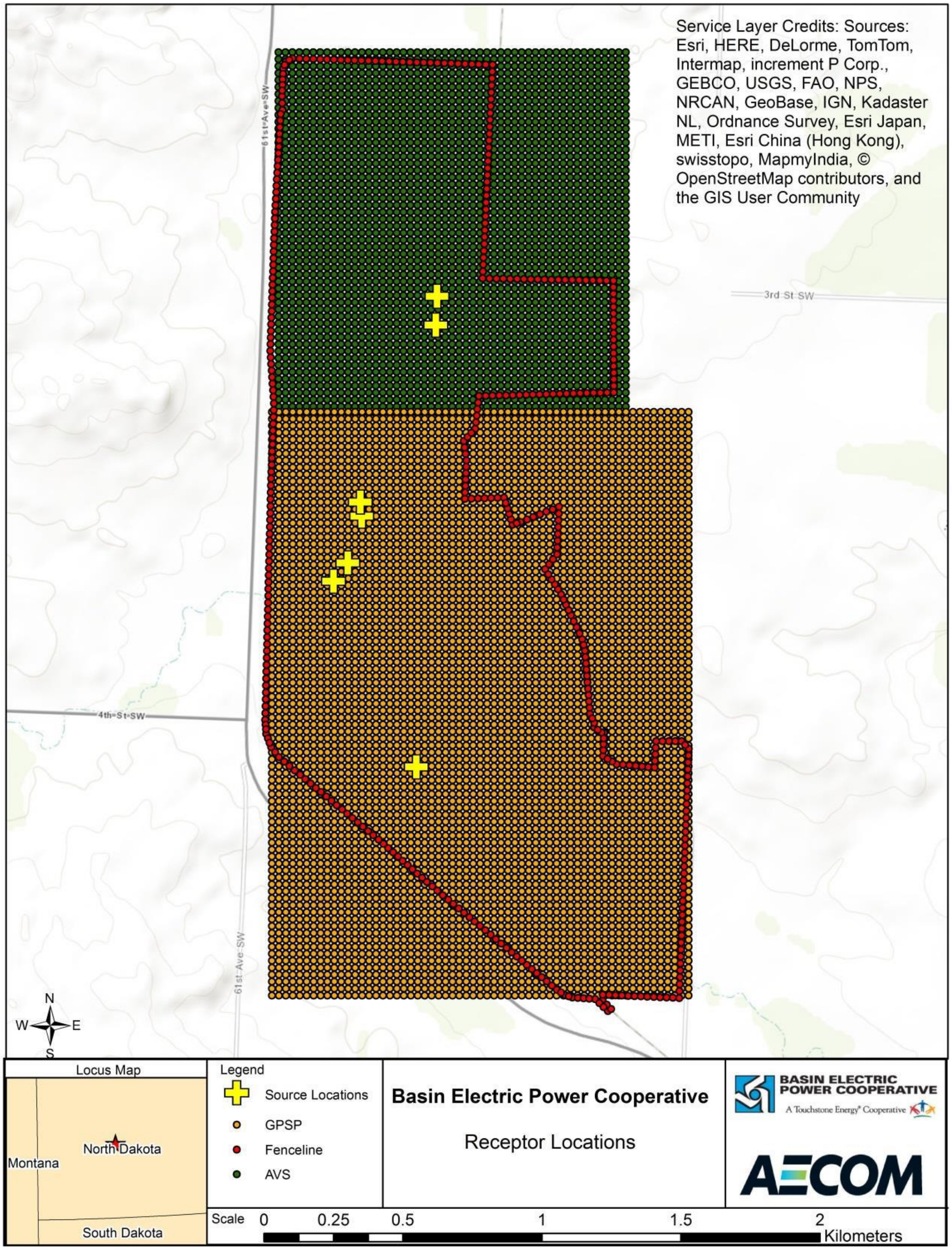
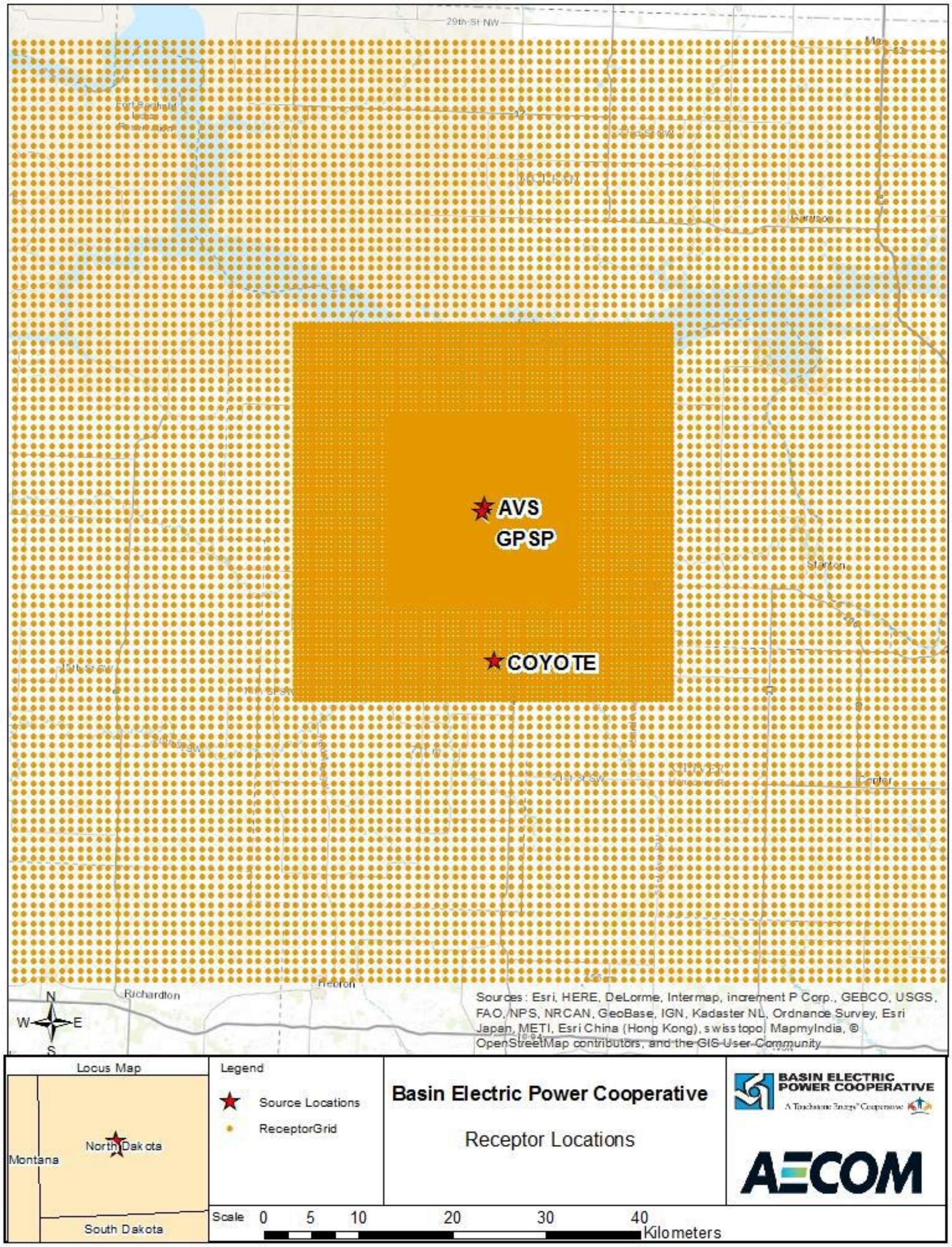


Figure 4. Far-Field Receptor Array.



Consistent with the Modeling TAD, the state placed receptors for the purposes of this designation effort in locations that would be considered ambient air relative to each modeled facility, including other facilities' property with the exceptions of locations described in Section 4.2 of the Modeling TAD. The EPA supports the locations and coverage of receptors used in the state's air quality modeling assessment based on the assumption that the fence lines surrounding both facilities preclude public access.

3.3.2.4.Modeling Parameter: Source Characterization

AVS consists of two coal-fired units: Unit 1 and Unit 2, each rated at 450 megawatts (with a heat rate input of 6,275 MMBtu/hr for each unit). The emissions from the two boilers are each exhausted into 600-foot stacks.

The SO_2 emission sources from GPSP include the main stack, bypass stack, one main flare, a startup flare and a backup flare. Hourly flare emissions provided by GPSP were calculated on a daily basis accounting for the various plant-wide streams that can be routed to each flare. Flare emissions were calculated on both 15-minute and hourly bases for each day. An hourly summary of total calculated flare emissions from each flare is routinely saved in a spreadsheet for each day of plant operations. While NO_x, CO, VOC, and PM emission rates are calculated using AP-42 factors, SO_2 emissions are calculated using mass balances based on the measured or parameterized concentrations of H_2S in the flared gases and the measured or designed flow rates of streams that could be routed to the flares. Dakota Gasification Company (DGC), which operates GPSP, conservatively assumes that all H_2S is converted to SO_2 using the ideal gas constant and the molecular weights of H_2S and SO_2.

Coyote Station has one coal-fired boiler rated at 427 megawatts. Emissions from the boiler are exhausted through a single 498-foot stack.

In accordance with the Modeling TAD, the analysis used 2013-2015 actual hourly SO_2 emissions, temperature and velocity data collected by the Continuous Emissions Monitoring (CEMs) equipment at each unit. Table 3 summarizes the stack parameters used in the AERMOD modeling.

The plant structures, buildings, and tanks were included for AERMOD downwash calculations using BPIPPRM. A total of 44 structures were included in the modeling.

Table 3. Stack Parameters for AVS, GPSP, and Coyote facilities.

Stack ID Number	NAD83 Zone 14 UTM Coordinates		Stack Height	Base Elevation	Stack Diameter	Exit Velocity	Exit Temperature
	Easting [m]	Northing [m]	m	M	m	m/s	K
AVS							
Unit 1	285920.18	5250189.31	182.9	588.3	7.0	varies	varies
Unit 2	285923.89	5250293.40	182.9	588.3	7.0	varies	varies
GPSP							
Main Stack	285551.77	5249268.12	119.8	588.3	7.0	varies	varies
Bypass Stack	285603.00	5249333.40	122.5	588.3	4.9	varies	varies
Main Flare	285849.68	5248599.59	76.2	588.3	1.0	varies	varies

Stack ID Number	NAD83 Zone 14 UTM Coordinates		Stack Height	Base Elevation	Stack Diameter	Exit Velocity	Exit Temperature
	Easting [m]	Northing [m]	m	M	m	m/s	K
Backup Flare	285653.42	5249501.86	30.5	588.3	0.50	varies	varies
Startup Flare	285647.84	5249552.90	68.6	588.3	0.50	varies	varies
Coyote							
Boiler	286869.20	5233589.00	151.79	590.52	6.4	varies	varies

NAD83 = North American Datum 1983; UTM = Universal Transverse Mercator; m/s = meters per second; K = Kelvin degrees.

The state characterized these sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the state used actual stack heights in conjunction with actual emissions. The state also adequately characterized the sources' building layout and location, as well as the stack parameters (e.g., exit temperature, exit velocity, location, and diameter). Where appropriate, the AERMOD component BPIPPRM was used to assist in addressing building downwash. For these reasons, the EPA supports the state's analysis of the source characterizations.

3.3.2.5.Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective.

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

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs; for example, where a facility has recently adopted a new federally enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS, the state may choose to model PTE rates. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the state included Antelope Valley Station and Great Plains Synfuels Plant and one other emitter of SO_2 within 16 km in the area of analysis. The state has chosen to model these facilities using actual emissions. The facilities in the state's modeling analysis and their associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.

For Antelope Valley Station, Great Plains Synfuels Plant, and Coyote Station, the state provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 4. A description of how the state obtained hourly emission rates is given below this table.

Table 4. Actual SO_2 Emissions Between 2013 – 2015 from Facilities in the Northern Mercer County Area

	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Antelope Valley Station	13,629	12,768	12,991
Great Plains Synfuels Plant	2,682	3,744	3,253
Coyote Station	12,586	12,787	8,773
Total Emissions from All Modeled Facilities in the State's Area of Analysis	28,897	29,299	25,017

For all of these sources, the actual hourly emissions data were obtained from CEMs, while the emissions for the GPSP flares are calculated as described above.

3.3.2.6.Modeling Parameter: Meteorology and Surface Characteristics

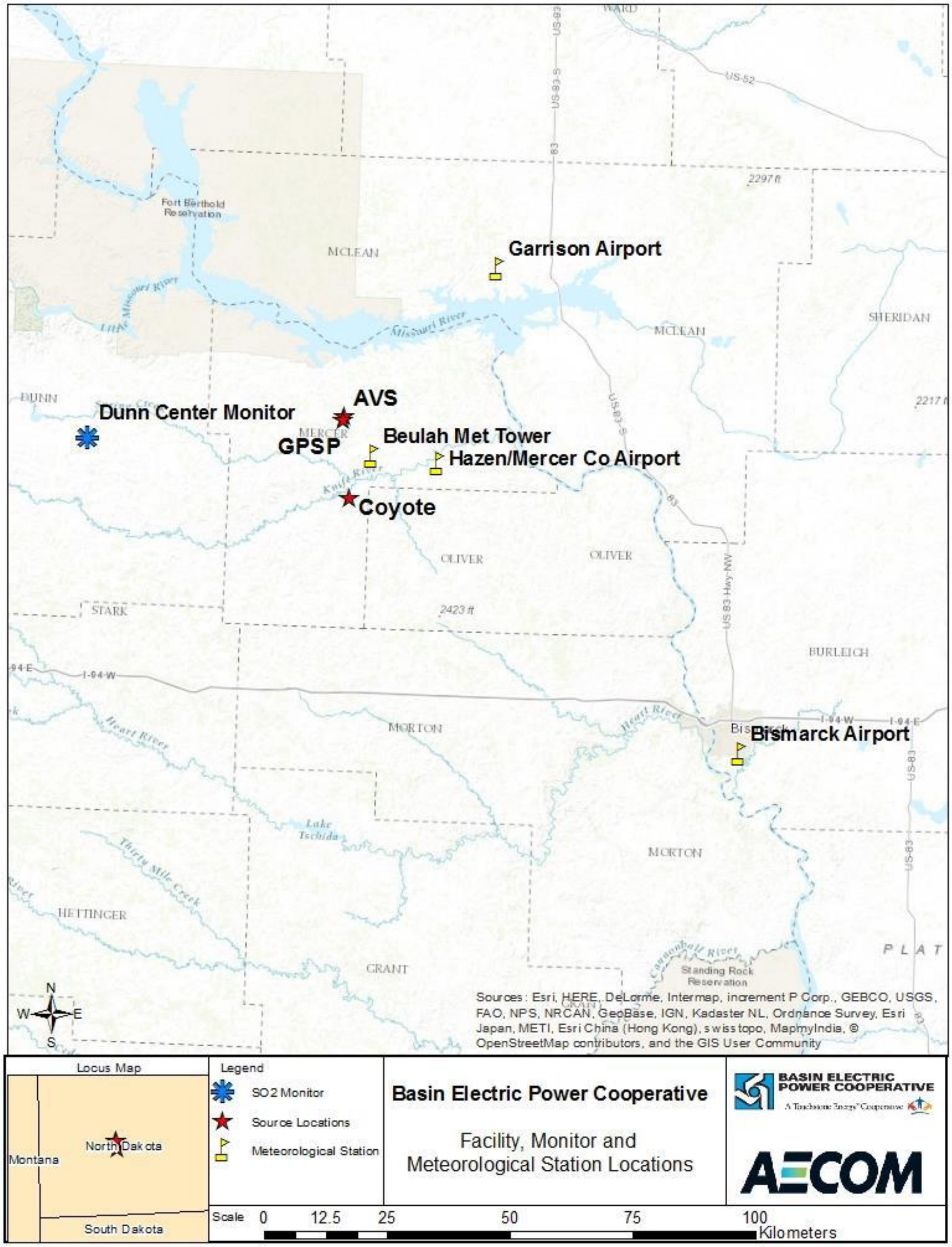
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of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

AERMET version 15181 was used to process the hourly meteorological data for the initial modeling analysis. The state used version 16216 in the updated modeling analysis provided to EPA in July 2017. Hourly averaged surface observations were processed from the state-operated meteorological station in Beulah, ND. The state has selected this data because it is the closest meteorological site to the sources (about 10 km) and has similar terrain features. Sub-hourly (1-minute) wind data (used as backup to Beulah) were processed from nearby Garrison Municipal Airport in Garrison, ND. Cloud cover observations were available from the regional observing stations at Hazen and Bismarck, ND.

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, one-minute ASOS (Automated Surface Observing System) wind data were processed using AERMINUTE (version 15272) into hourly data for input into AERMET. 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.

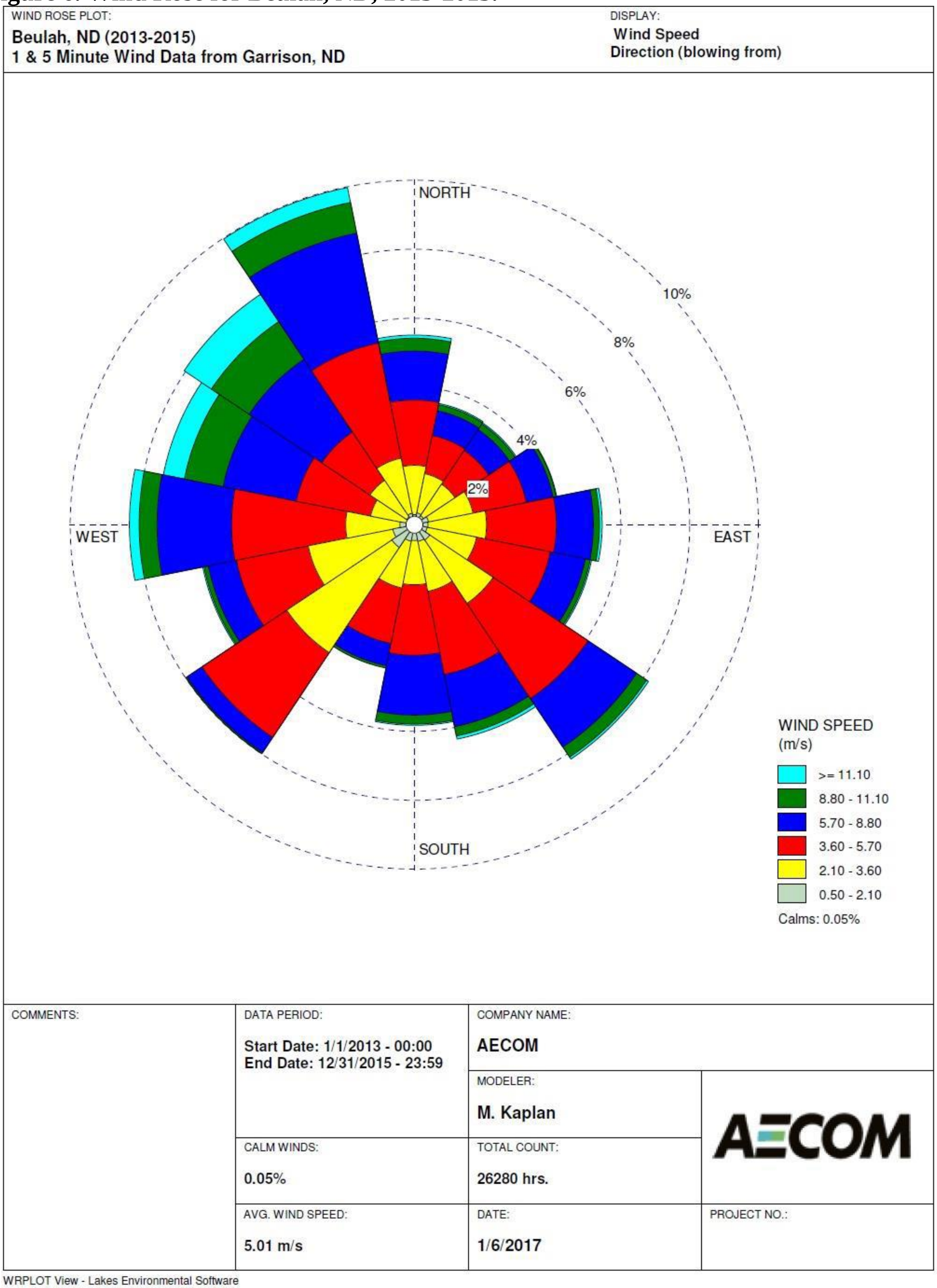
Sub-hourly observations were obtained from Garrison Municipal Airport for 2013-2015 as backup to the observations at Beulah. Since cloud cover data is not recorded from the Beulah meteorological station, cloud cover observations were taken from nearby Mercer County Airport in Hazen, ND. For periods (such as in portions of 2015) when cloud cover observations from the Mercer County Airport were missing, cloud cover data from the Bismarck Airport were substituted. This approach led to hourly observations to have at least 94 percent data capture. Missing upper air data from Bismarck, ND were substituted with data from Glasgow, MT. Figure 5 shows the locations of the meteorological stations in relation to the modeled facilities, as well as the SO_2 background station discussed below. 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 0.3 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.

Figure 5. Map of Facilities and Monitoring Locations.



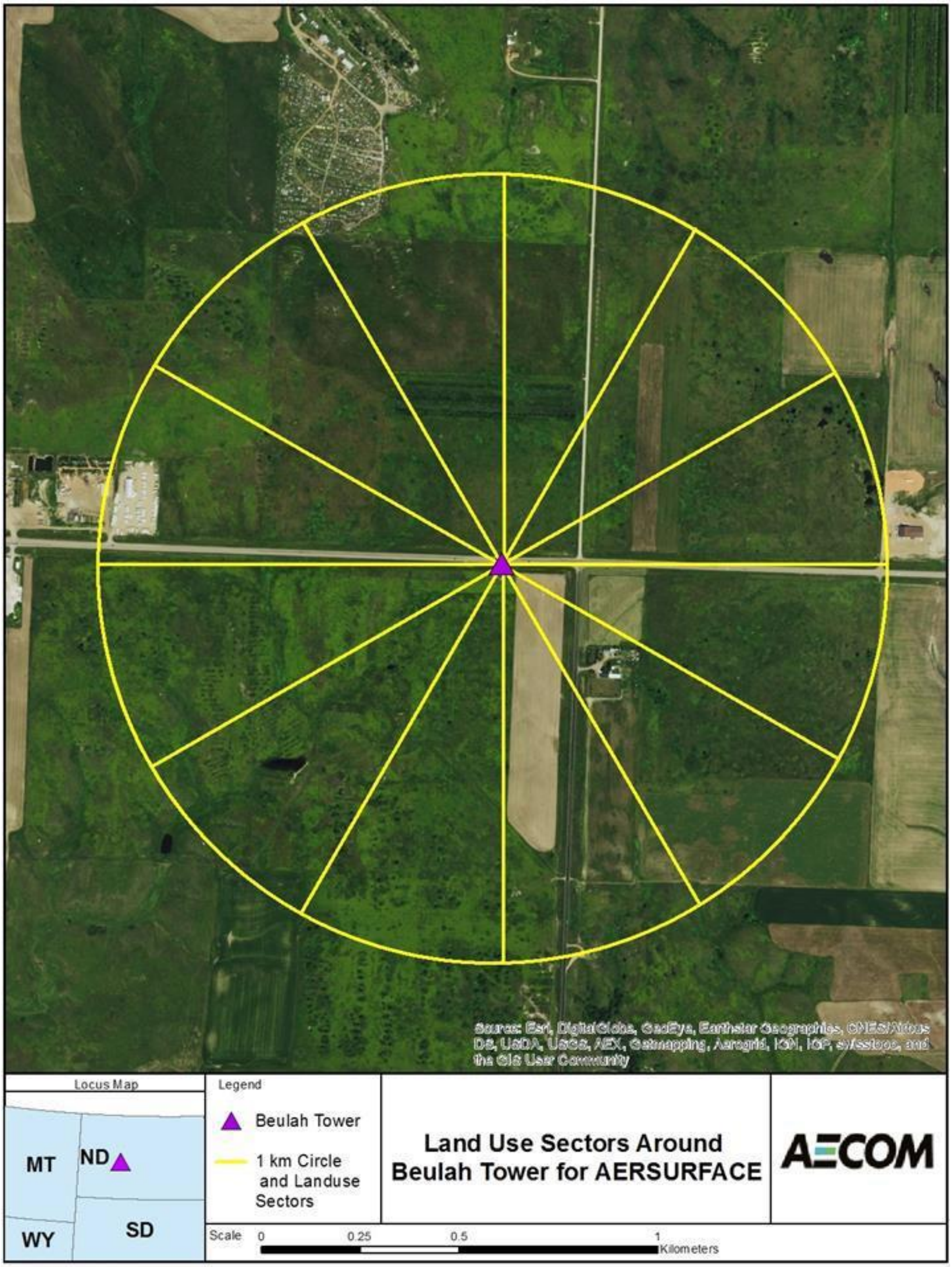
A surface wind rose for the entire 3-year period proposed for the modeling time period is shown in Figure 6. The wind rose shows that the dominate wind directions are from the northwest (about 10 percent of the time) and west, southwest, and southeast (about 8 percent of the time). The average wind speed is about 5 m/s, where calm winds are about 0.05 percent of the time.

Figure 6. Wind Rose for Beulah, ND, 2013-2015.



AERSURFACE (version 13016) was used to calculate the surface characteristics values, including albedo, Bowen ratio, and surface roughness length, at the surface meteorological observing site for input into AERMET. The 1992 National Land Cover Dataset (NLCD92) file for input into AERSURFACE was downloaded from the United States Geological Society (USGS) website. Figure 7 shows the 1992 NLCD Land Use for the monitoring site.

Figure 7. 1992 NLCD Land Use, Beulah, ND.



The state estimated values in 30 degree sectors, equating to 12 spatial sectors out to a 1 km radius around the monitoring site for surface roughness. The Bowen ratio and albedo were determined based on the average characteristics, over a 10 by 10 km square, centered on the monitoring site. The surface parameters were determined on a monthly basis using default season assignments. Since the meteorological site is at a state-operated meteorological monitor site, the AERSURFACE input was not marked as an airport. A secondary set of surface characteristics for the twelve sectors was developed around the backup NWS Hazen airport. Due to some missing cloud cover data at Hazen in 2015, a secondary backup set of surface characteristics for the twelve sectors was developed around the Bismarck airport. In AERMET Stage 3, the primary set of characteristics were applied for those hours in which the onsite data are used and the secondary set were applied for those hours in which the NWS surface file or 1-minute ASOS wind data are substituted for missing or calm onsite data.

For Bowen ratio, the land use values are linked to three categories of surface moisture corresponding to average, wet and dry conditions. The surface moisture condition for the site may vary depending on the meteorological data period for which the surface characteristics will be applied. AERSURFACE applies the surface moisture condition for the entire data period. Therefore, if the surface moisture condition varies significantly across the data period, then AERSURFACE can be applied multiple times to account for those variations. As recommended in the AERSURFACE User's Guide, the surface moisture condition for each season was determined by comparing precipitation for the period of data to be processed to a recent 30-year record at Garrison airport (for 2013-2014) and Bismarck airport (for 2015) precipitation records. This procedure selected "wet" conditions if precipitation was in the upper 30th percentile, "dry" conditions if precipitation was in the lower 30th percentile, and "average" conditions if precipitation was in the middle 40th percentile. Table 5 outlines the AERSURFACE bowen ratio condition designations.

Table 5. AERSURFACE bowen ratio condition designations.

Month	2013	2014	2015
January	Dry	Average	Wet
February	Average	Average	Average
March	Average	Average	Dry
April	Wet	Wet	Dry
May	Wet	Wet	Wet
June	Wet	Average	Wet
July	Average	Dry	Dry
August	Wet	Wet	Average
September	Wet	Average	Dry
October	Wet	Average	Average
November	Average	Wet	Average
December	Wet	Dry	Wet

The AERSURFACE seasonal categories by month were developed for each modeled year and applied for the primary (Beulah site) and secondary (Hazen airport in 2013-2014; Bismarck airport in 2015) sites. 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 6 outlines the selected seasonal categories for AERSURFACE.

Table 6. Summary of Precipitation Data

Seasonal Description	2013	2014	2015
Late autumn after frost and harvest, or winter with no snow	3,4	3	11,2,3
Winter with continuous snow on the ground	12,1,2	11,12,1,2	12,1
Transitional spring	5	4,5	4,5
Midsummer with lush vegetation	6,7,8	6,7,8	6,7,8
Autumn with unharvested cropland	9,10,11	9,10	9,10

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 Appendix W and the Modeling TAD in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics. For these reasons, the EPA supports the state's analysis as most representative of meteorological conditions within the area of analysis.

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

As illustrated above, Mercer County is considered mostly flat to gently rolling terrain, with some sharper valleys nearby. To account for these terrain changes, the AERMAP terrain program (version 11103) 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. The EPA supports the state's approach for defining the terrain.

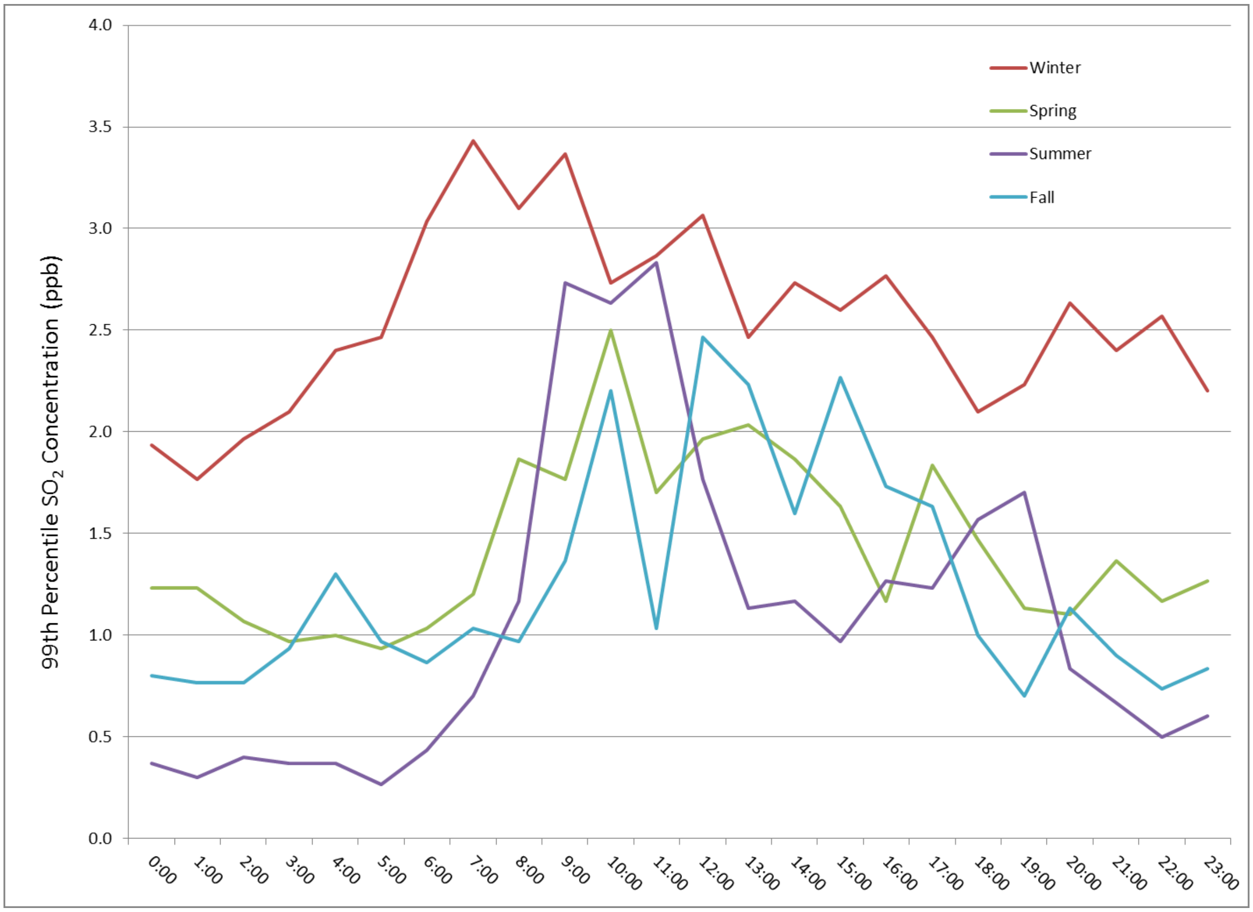
3.3.2.8.Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99^{th} percentile monitored concentrations by hour of day and season or month. For this area of analysis, the state utilized the tier 2 approach, where the background concentrations for this area of analysis were determined by the state to vary seasonally.

Sulfur dioxide background data from the NDDH-approved Dunn Center monitor was used to determine the appropriate one-hour background concentrations to add to the model predicted concentrations. The location of the Dunn Center monitor relative to the facilities is shown in Figure 5 above. The background concentrations were calculated as a 3-year (2013-2015) average of the 99th percentile by season and hour-of-day and added internally for each modeled hour in

AERMOD to the AERMOD predicted concentration for comparison with the 1-hour SO2 standard. Figure 8 shows the seasonal and hourly background values in ppb.

Figure 8. 2013-2015 Average 99th Percentile Concentration at Dunn Center SO_2 Monitor.



EPA supports the state's approach for determining the background concentration.

3.3.2.9.Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Mercer County area of analysis are summarized below in Table 7.

Table 7: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Mercer County Area

Input Parameter	Value
AERMOD Version	Initial Modeling: 15181 (regulatory options) Updated Modeling: 16216 (regulatory options)
Dispersion Characteristics	Rural
Modeled Sources	3
Modeled Stacks	8
Modeled Structures	44
Modeled Fencelines	1
Total receptors	#1 Modeling: 34,084 #2 Modeling (AVS): 5,532 #3 Modeling (GPSP): 2,799
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Beulah, ND/Garrison, ND/Hazen, ND/Bismarck, ND
NWS Station Upper Air Meteorology	Bismarck, ND/Glasgow, MT
NWS Station for Calculating Surface Characteristics	Beulah, ND/Garrison, ND/Hazen, ND/Bismarck, ND
Methodology for Calculating Background SO_2 Concentration	Tier 2 Dunn Center between 2013 and 2015.
Calculated Background SO_2 Concentration	0.27 to 3.43 ppb

The results presented below in Table 8 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

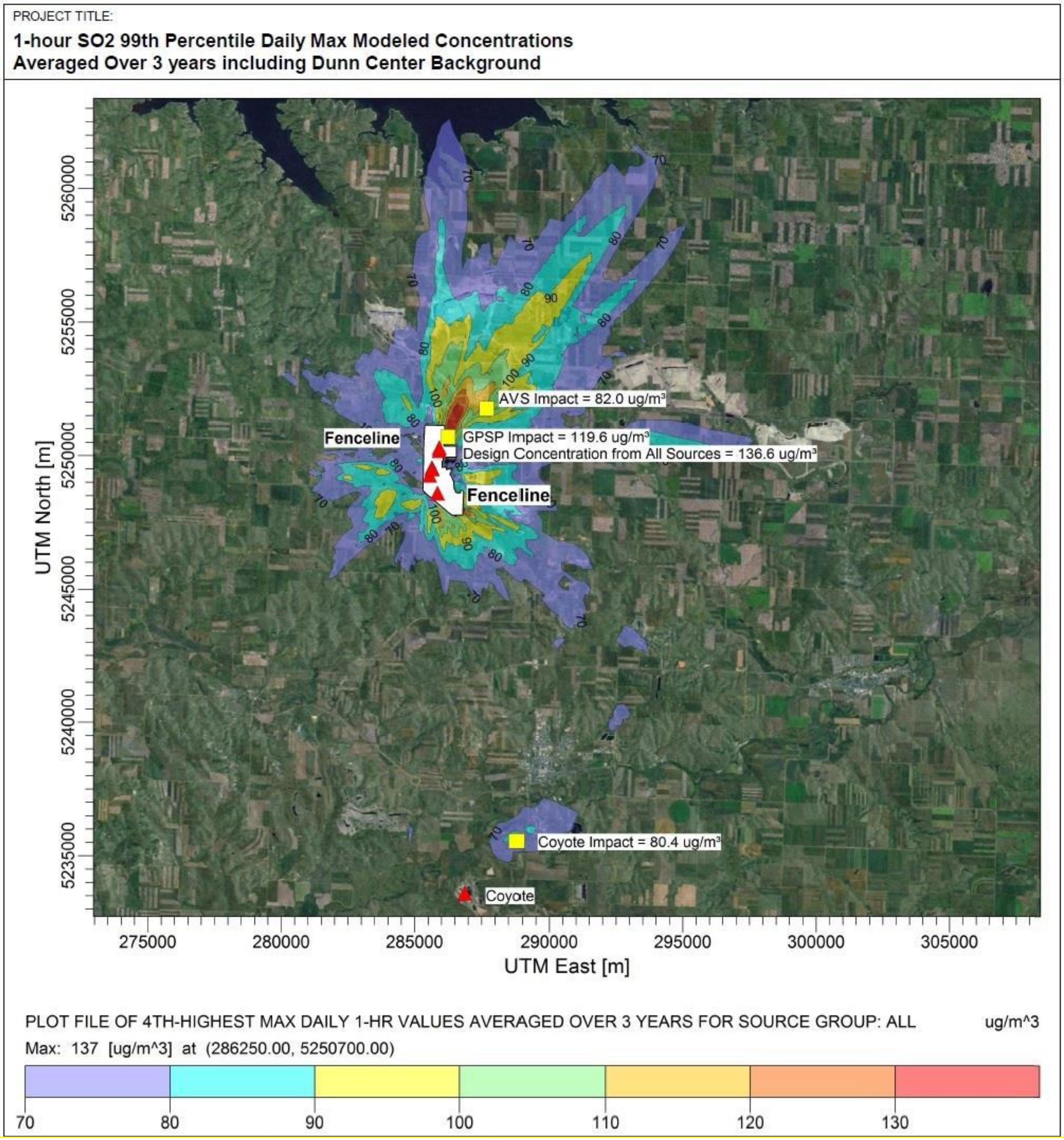
Table 8. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentration for the Area of Analysis for the Mercer County Area

Averaging Period	Data Period	Receptor Location [UTM zone 14]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM/Latitude	**UTM/Longitude**	**Modeled concentration (including background)**	**NAAQS Level**
99th Percentile 1-Hour Average	2013 - 2015	#1 Modeling: 286250.00 #2 Modeling: 286729.69 #3 Modeling: 286253.68	#1 Modeling: 5250700.00 #2: Modeling: 5248777.03 #3 Modeling: 5250670.81	#1 Modeling: 136.6 #2 Modeling (AVS): 71.1 #3 Modeling (GPSP): 134.6	196.4*

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

The state's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 136.6 $\mu g/m^3$, equivalent to 52.2 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the facilities. Figure 9 below was included as part of the state's recommendation, and indicates that the predicted value occurred about 10 km northeast of the center point among the facilities.

Figure 9: Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations for the Area of Analysis for the Mercer County Area



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

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

The state's approach to conducting the dispersion modeling for EPA's 1-hour SO_2 designations appears to align with the TAD. The state has also provided sufficient information to the EPA to determine that the modeling assessment is sufficient for supporting designation decisions.

3.3.3. Modeling Analysis Provided by Other Organizations

As of July 2017, the EPA has not received any modeling assessments from a 3rd party.

3.4. Jurisdictional Boundaries in the Northern Mercer County Area

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for county. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable. As noted, the state did not recommend a specific boundary but requested a designation of the area around the sources.

As part of our review of the relevant jurisdictional boundaries, the EPA considered the boundaries of the Fort Berthold Indian Reservation, a portion of which is located in northern Mercer County (see Figure 10, below). Specifically, the EPA intends to exclude the Fort Berthold Indian Reservation portion of Mercer County from the intended designation described in this section. The EPA is also noting that the portions of Mercer County that have already been designated as unclassifiable/attainment (see Figure 10) will not be included as part of this designation.

3.5. The EPA's Assessment of the Available Information for the Mercer County Area

Based on our review of the modeling data provided by the state, the EPA has determined that Mercer County meets the 2010 SO_2 NAAQS and does not contribute to any nearby area that does not meet the NAAQS as there are no nonattainment areas near these facilities. For this reason, we intend to designate the remaining undesignated portions of Mercer County (with one exception as explained below) as unclassifiable/attainment. The ambient monitoring data in the area reported values well below the NAAQS. These data were available to the EPA for consideration in the designations process; however, since it is unclear if these monitors are located in areas of maximum concentration, it is unclear if the data are representative of the area's actual air quality.

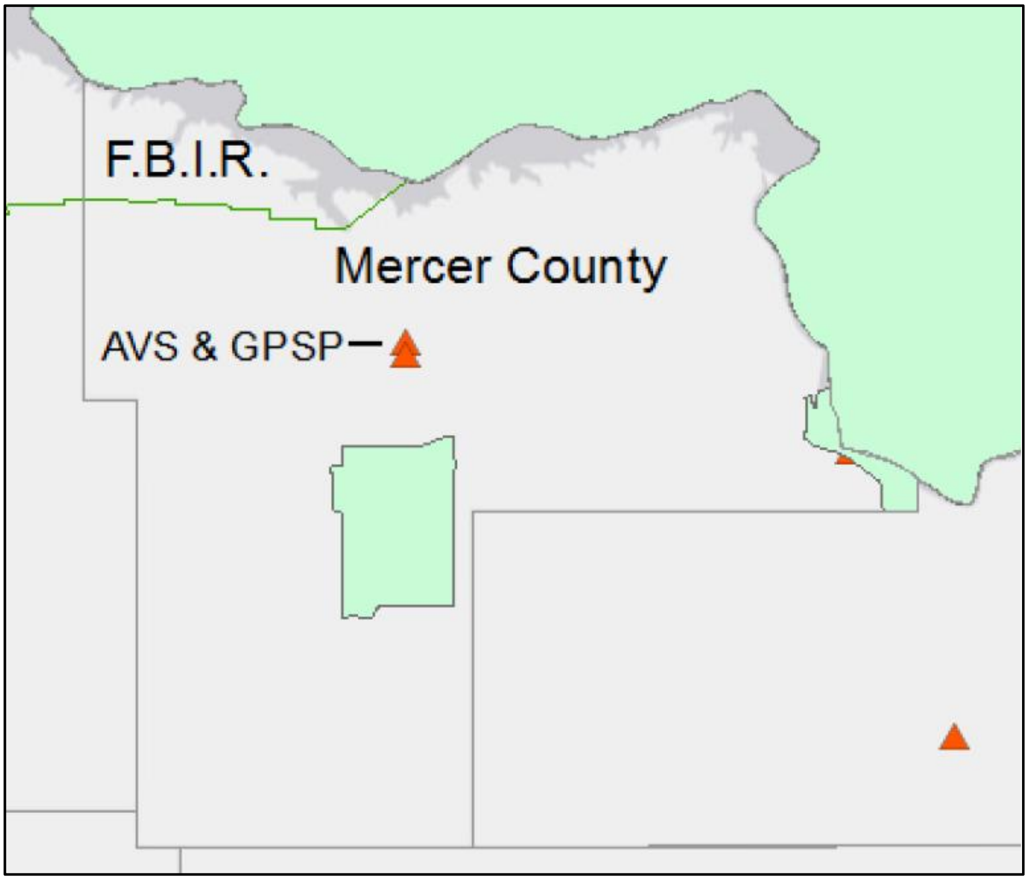
The EPA believes that our intended unclassifiable/attainment area, bounded by the boundaries of all non-designated portions of Mercer County apart from the portion of the County containing the Fort Berthold Indian Reservation, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area. With the state's modeling analysis of AVS and GPSP, the state has now modeled each source of SO_2 in the county above 1 ton per year of SO_2 and shown that emissions from all of these sources in this area do not violate the 2010 SO_2 NAAQS. The EPA does not intend to include the portion of the Fort Berthold Indian Reservation that is located in Mercer County, which is shown below in Figure 10, as part of this intended unclassifiable/attainment area.

3.6. Summary of Our Intended Designation for the Mercer County, North Dakota Area

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate Mercer County (with noted exceptions) as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of all non-designated portions of Mercer county (areas previously designated are shown in green in Figure 10) apart from the northern portion containing the Fort Berthold Indian Reservation. In Figure 10, the green line indicates the portion of the Fort Berthold Reservation (labeled as F.B.I.R.) located in Mercer County that the EPA intends to designate separately as specified in Section 6 of this document.

Figure 10 shows the boundary of this intended designated area.

Figure 10. Boundary of the Intended Mercer County, North Dakota Unclassifiable/Attainment Area



At this time, our intended designations for the state only apply to this area and the other areas presented in this technical support document. The EPA intends in a separate action to evaluate and designate all remaining undesignated area in North Dakota by December 31, 2020.

4. Technical Analysis for the Oliver County Area

4.1. Introduction

The EPA must designate the Oliver County, North Dakota, area by December 31, 2017, because the area has not been previously designated and North Dakota has not installed and begun timely operation of a new, approved SO_2 monitoring network to characterize air quality in the vicinity of any sources in Oliver County.

4.2. Air Quality Monitoring Data for the Oliver County Area

This factor considers the SO_2 air quality monitoring data in the area of Oliver County. The state included monitoring data from the following monitor:

- Air Quality System monitor 380650002. This monitor is located at 1575 Highway 31 in Oliver County, and is located 20 km northwest of the MR Young facility. Data collected at this monitor indicates that SO_2 levels at the monitor are well below the NAAQS, as the 2014-2016 design value was 10 ppb. As noted, the state referenced their entire SO_2 network in the 2011 recommendation (including this monitor). However, the EPA has not received any information indicating that this monitor is adequately sited for the purposes of designating this area. Therefore, the EPA is not concluding that this monitor data should be the basis of an attainment designation in Northern Mercer County.

4.3. Air Quality Modeling Analysis for the Oliver County Area Addressing Milton R Young Station

4.3.1. Introduction

This section 4.3 presents all the available air quality modeling information for a portion of Oliver County that includes Milton R Young. (This portion of Oliver County will often be referred to as “the Oliver County area” within this section 4.3). This area contains the following SO_2 source, principally the source around which North Dakota is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tons per year:

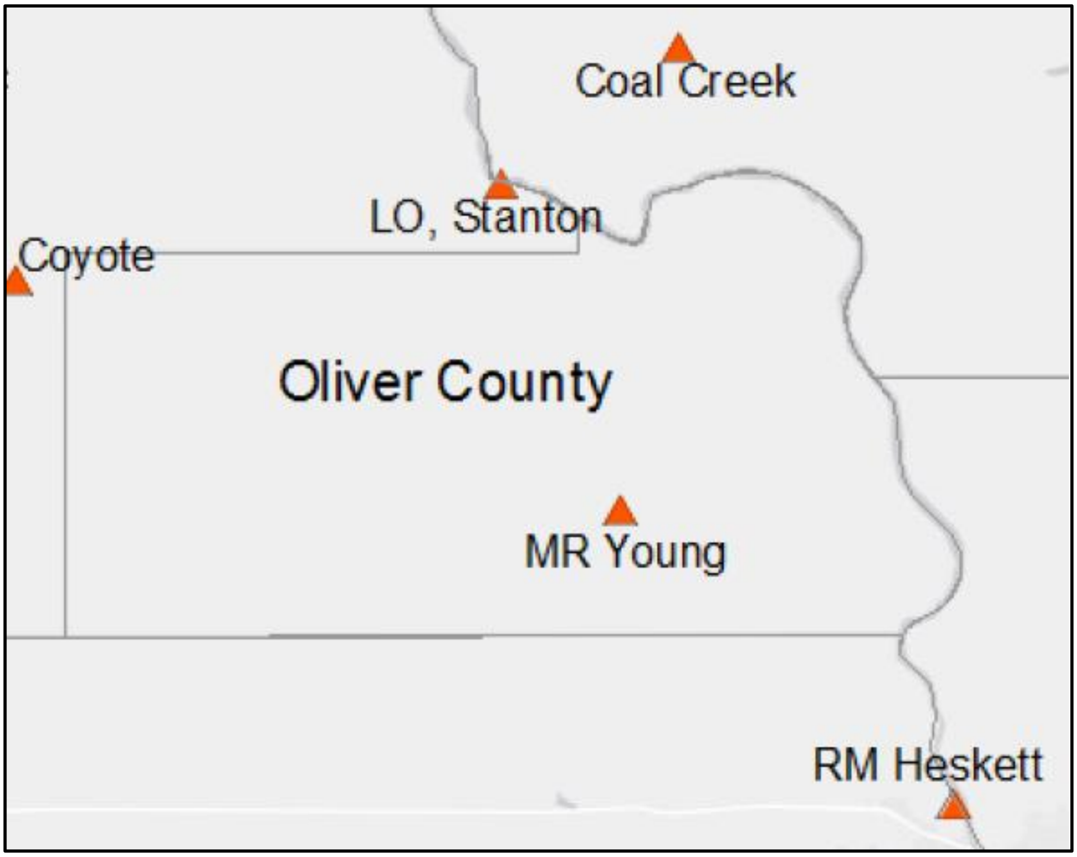
- The Milton R Young Station facility emits 2,000 tons or more annually. Specifically, Milton R Young Station emitted 2,070 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and North Dakota has chosen to characterize it via modeling.

In its submission, North Dakota recommended that the area surrounding the MR Young Station be designated as attainment based in part on an assessment and characterization of air quality impacts from this facility as well as nearby Coal Creek, Stanton, Leland Olds, and RM Heskett Stations. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the state’s assessment, supporting documentation, and all available data, the EPA agrees with the state’s conclusion that the area is meeting the NAAQS, and intends to designate the area as unclassifiable/attainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

As seen in Figure 11 below, the MR Young facility is located in central Oliver County, North Dakota. Also included in the figure are other nearby emitters of SO_2.[7] These are Coal Creek, Stanton, Leland Olds, and RM Heskett Stations.

[7] All other SO_2 emitters of 1,000 tpy or more (based on information in the NEI) are shown in Figure 11.

Figure 11. Map of the Oliver County Area Addressing the Milton R Young facility



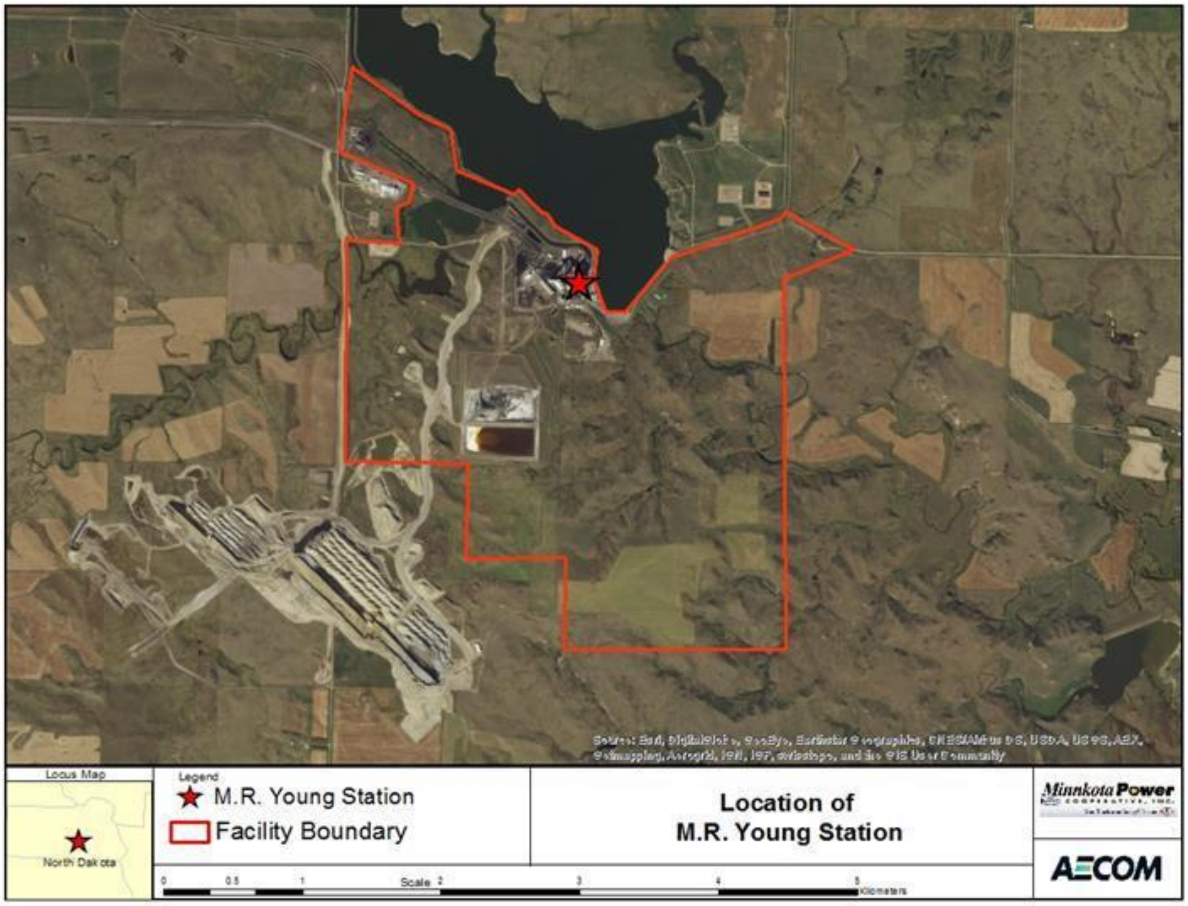
The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered one assessment from the state.

4.3.2. Modeling Analysis Provided by the State

The North Dakota Department of Health (NDDH) provided an air quality modeling assessment for the Milton R. Young Station (MRY) in Oliver, County, North Dakota (ND). Figure 12 shows the location of the facility.

Figure 12. Map of the MRY Station.



4.3.2.1.Model Selection and Modeling Components

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

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

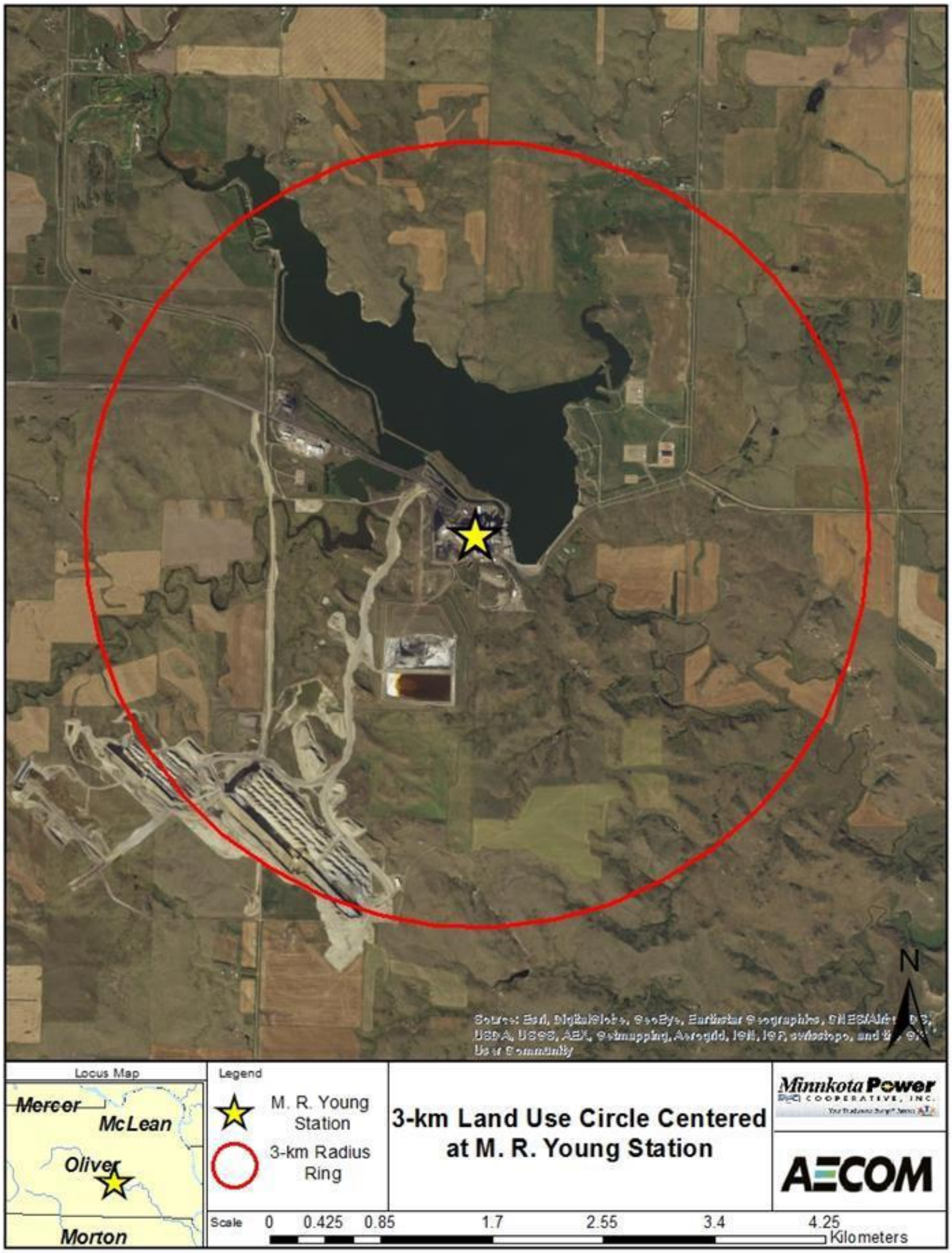
The state used AERMOD version 15181 in regulatory default mode, which was the most recent platform available to use at the time of the modeling. A discussion of the state's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

4.3.2.2.Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the “urban” or “rural” determination of a source is important in determining the boundary layer characteristics that affect the model’s prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD details the procedures used to determine if a source is urban or rural based on land use or population density.

MRY is located about 8 kilometers southeast of Center, North Dakota in Oliver County. An aerial map of the area surrounding MRY is provided in Figure 13. Figure 13 shows the land cover within a 3-km radius of the facility. For the purpose of performing the modeling for the area of analysis, the state determined that it was most appropriate to run the model in rural mode. The site location was classified as rural using the land use procedure specified in Appendix W. The area was clipped to a 3-km ring around the facility. Based on the map of land cover provided in the state’s modeling assessment report, the area surrounding the facilities is rural (see Figure 13). By the definition in Appendix W, land that contains less than 50 percent of developed land use categories should be considered rural. EPA’s assessment supports the State’s analysis on the land use classification.

Figure 13. 3-km land use circle centered at MRY with aerial imagery.

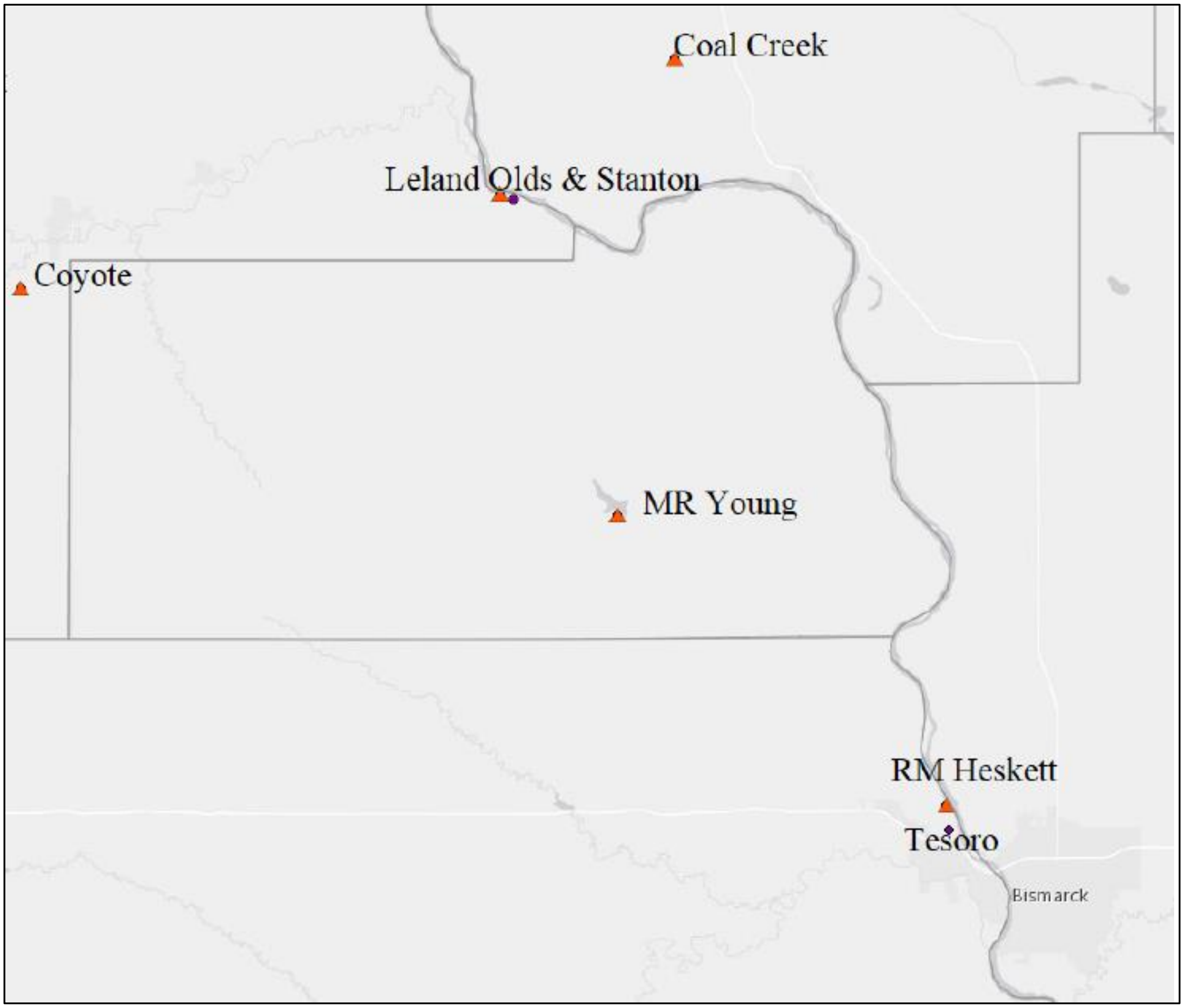


4.3.2.3.Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The source of SO_2 emissions subject to the DRR in this area are described in the introduction to this section. For the Oliver County area, NDDH identified several nearby sources within a 50 km areas of analysis to be explicitly modeled as background sources for the MRY facility. The Coal Creek Plant, Stanton Plant, Leland Olds Plant, Coyote Station, and R.M. Heskett Station were identified by NDDH as nearby sources to MRY, and therefore were included as part of the modeling for MRY. Figure 14 shows a map of the sources relative to the MRY facility. The state did not include the 257 tons per year Mandan Refinery, located about 35 km and shown in Figure 14, below, in the modeling for MRY. Given the sources size and distance from the MRY facility, the EPA does not consider the exclusion of this source from the MRY modeling analysis to be inappropriate. The EPA has reached the same conclusion regarding the 4 ton per year compressor station located roughly 49 km southwest of MRY.

Figure 14. Map of Sources Included in the Modeling Analysis.



The state determined that the selected modeling domain was appropriate to adequately characterize air quality through modeling, and to include the potential extent of any SO_2 NAAQS exceedances in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. No other sources beyond 20 km were determined by the state to have the potential to cause concentration gradient impacts within the area of analysis.

A Cartesian modeling receptor array was established to capture the 99th percentiles of the maximum daily one-hour average SO_2 impacts from MRY. A two-phased modeling approach was conducted for MRY. The first modeling phase, focused on emissions only from the MRY facility, using the following receptor grid extending from MRY out to 25 kilometers:

- 25-m receptor spacing along the MRY boundary,
- 50-m receptor spacing extending out 500m from the grid center,
- 100-m receptor spacing extending out 3 kilometers from the grid center,
- 250-m receptor spacing between 3 and 5 kilometers from the grid center,

- 500-m receptor spacing between 5 and 10 kilometers from the grid center, and
- 1000-m receptor spacing will be used beyond 10 kilometers (out to 25 km).

The receptor grid used in the modeling analysis was based on Universal Transverse Mercator (UTM) coordinates referenced to NAD 83 datum and in zone 14. In consultation with the agency reviewers, receptors were only excluded for what the state asserts as the secured area of MRY. The extent of this grid sufficiently captured the maximum modeled impacts from the Station. Moreover, the maximum impacts were well within 10 km of the MRY facility. The second phase of the modeling was conducted out to 10 km and included all background sources identified by NDDH. The following Cartesian receptor grid was used for Phase 2 modeling extending from MRY out to 10 kilometers:

- 25-m receptor spacing along the MRY fenceline,
- 50-m receptor spacing extending out 500m from the grid center,
- 100-m receptor spacing extending out 3 kilometers from the grid center,
- 250-m receptor spacing between 3 and 5 kilometers from the grid center, and
- 500-m receptor spacing between 5 and 10 kilometers from the grid center.

It should be noted that the Phase 1 far-field modeling (25 km domain) only modeled the emissions from MRY and excluded the SO_2 emissions from the nearby sources that are located within the 25 km domain. The nearby sources are located between 10 km and 25 km of MRY. Excluding the emissions from the nearby sources could limit the ability to identify the locations of concentration gradients, where the nearby source emissions could be interacting with the emissions coming from MRY, and how far to extend the refined receptor grid to capture any significant concentration gradients. The emissions of the nearby sources were only included in the Phase 2 modeling, which had a model domain that extended 10 km from MRY. While the nearby sources were included in the Phase 2 modeling, the modeling domain did not include discrete receptors between 10 km and 25 km in order to cover the nearby sources. Additional discussion about the impacts of excluding the nearby sources in the far-field modeling (Phase 1 modeling) and excluding discrete receptors over the nearby sources (Phase 2 modeling) is included below (section 4.3.2.10). Figure 15 shows the near-field receptor array and Figure 16 shows the far-field receptor array for the Phase 1 modeling. Figure 17 shows the 10-km receptor grid used in the Phase 2 modeling for MRY and background sources. A total of 5910 receptors were used for the 10-km domain MRY modeling.

Figure 15. Near-Field Receptor Array.

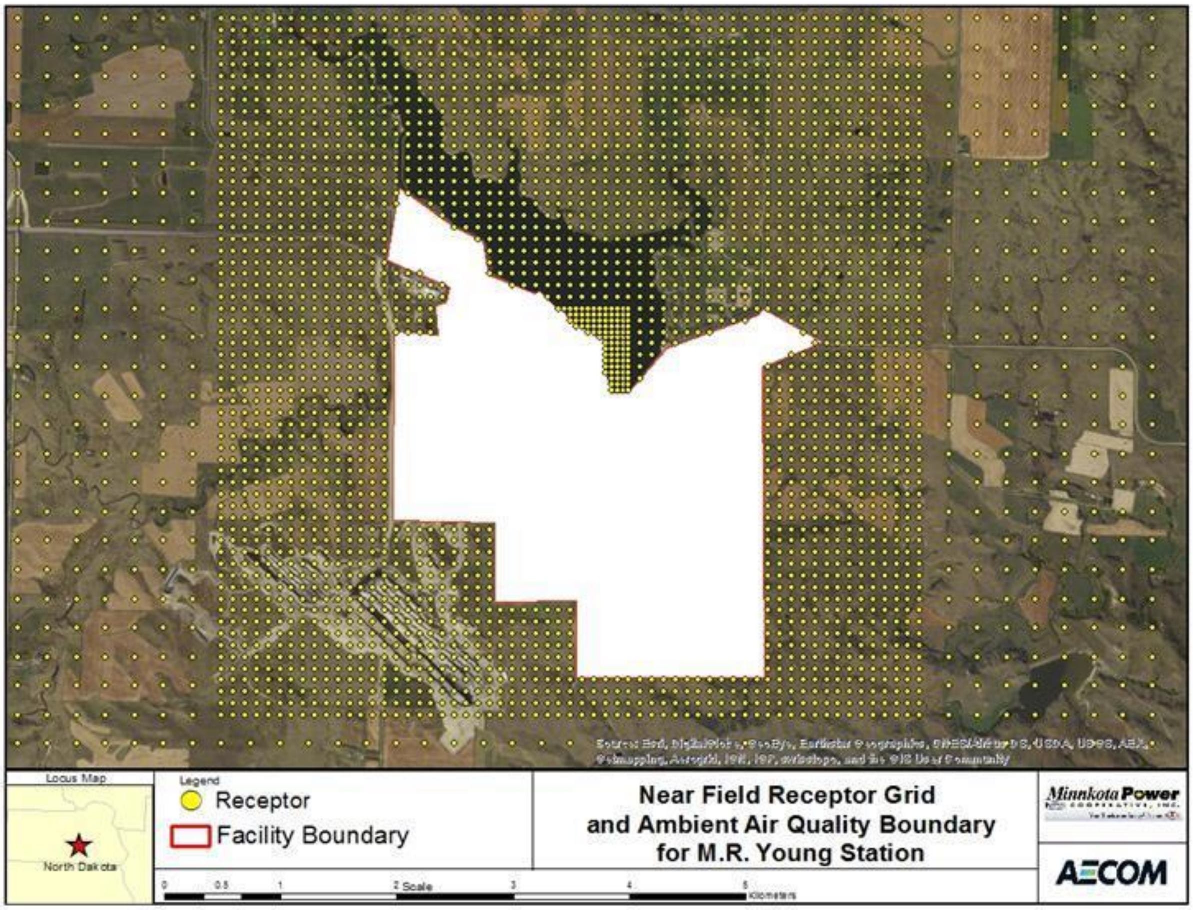


Figure 16. Far-Field Receptor Array.

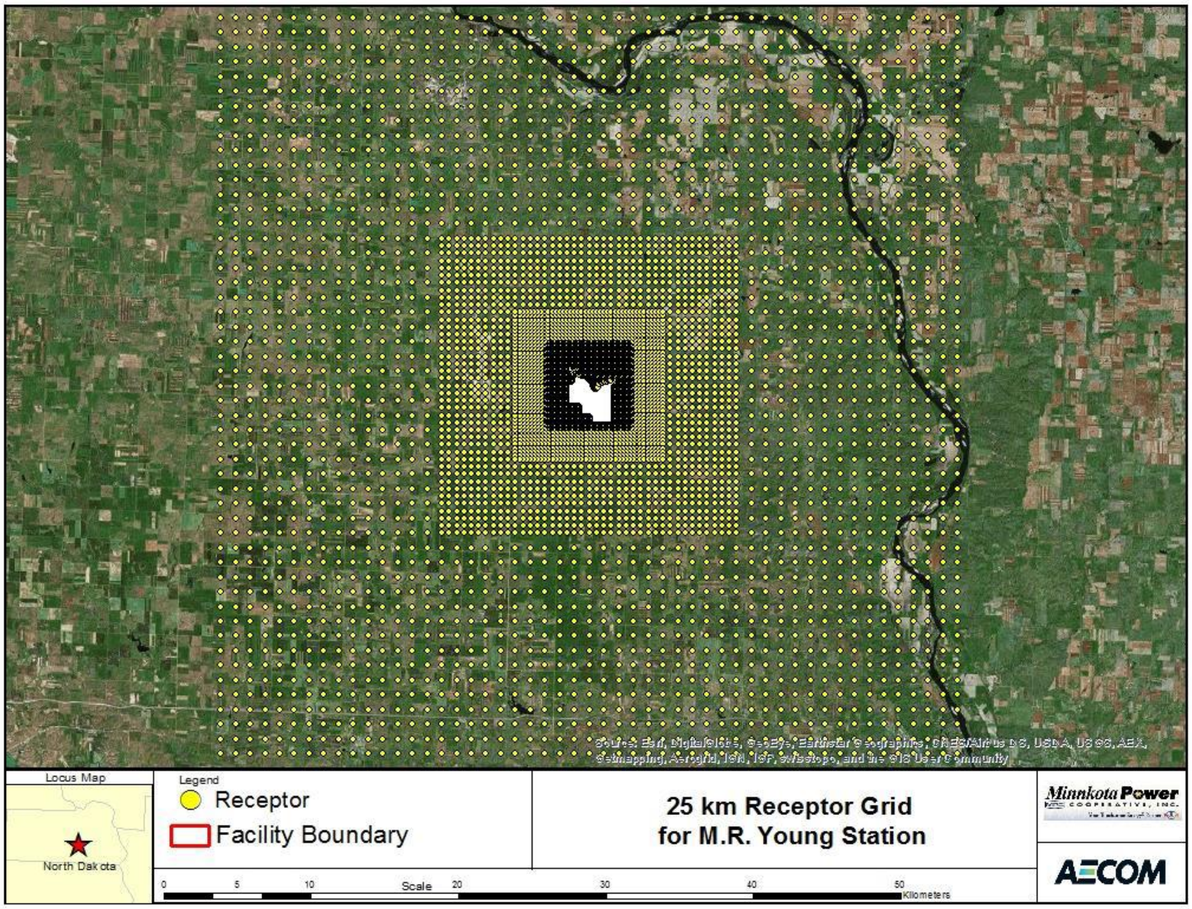
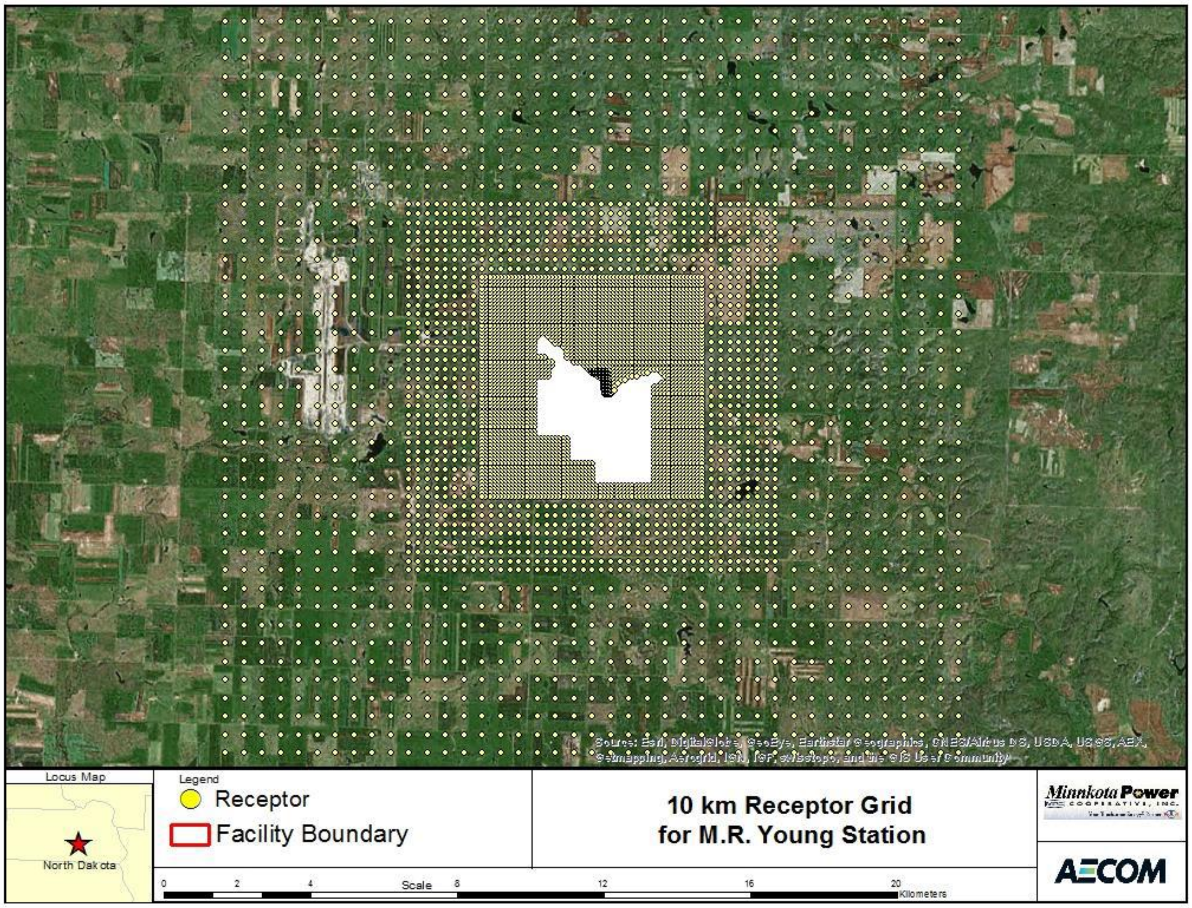


Figure 17. 10-km receptor grid for MRY – Used for MRY and background sources in the Phase 2 modeling.



The state placed receptors for the purposes of this designation effort in locations that it considered ambient air relative to each modeled facility, including other facilities' property with the exceptions of locations described in Section 4.2 of the Modeling TAD. The EPA supports the locations and coverage of receptors used in the state's air quality modeling assessment based on the state's assertion that the facility's property is secured at the fence line and the air within that boundary should not be considered ambient.

4.3.2.4.Modeling Parameter: Source Characterization

MRY consists of two coal-fired boilers, including a Unit 1 and Unit 2. Unit 1 and Unit 2 each exhaust through their own separate stack, which are 171.9 meters and 167.6 meters tall, respectively. In accordance with the Modeling TAD, the analysis used 2013-2015 actual hourly SO_2 emissions, temperature and velocity data collected by the Continuous Emissions Monitoring (CEMs) equipment at each unit and actual stack heights. Table 9 summarizes the stack parameters used in the AERMOD modeling.

The plant structures, buildings, and tanks were included for AERMOD downwash calculations using BPIPPRM (version 04274). A total of 5 structures were included in the 10 km domain modeling.

Table 9. Stack Parameters for MRY and Nearby Sources Explicitly Modeled in the Analysis.

Stack ID Number	NAD83 Zone 14 UTM Coordinates		Stack Height	Base Elevation	Stack Diameter	Exit Velocity	Exit Temperature
	Easting [m]	Northing [m]	m	m	M	m/s	K
MRY							
Unit 1	331841.890	5214890.130	171.9	597.4	6.2	varies	varies
Unit 2	331746.810	5214867.970	167.6	600.5	9.1	varies	varies
LeLand Olds							
Unit 1	324459.257	5238977.568	182.880	518.617	9.976	varies	varies
Coyote							
Unit 1	286869.200	5233589.000	151.790	590.520	6.4	varies	varies
Coal Creek							
Unit 1	337123.342	5249489.285	205.740	591.312	7.849	varies	varies
Unit 2	337224.813	5249490.233	205.740	591.312	7.849	varies	varies
Heskett							
Unit 1	356414.500	5192141.500	91.084	505.206	2.210	varies	varies
Unit 2	356448.500	5192035.200	91.084	505.206	3.658	varies	varies
Stanton							
Unit 1	323642.150	5239607.700	77.724	517.703	4.600	varies	varies

NAD83 = North American Datum 1983; UTM = Universal Transverse Mercator; m/s = meters per second; K = Kelvin degrees.

The state characterized these sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the state used actual stack heights in conjunction with actual emissions, except for Leland Olds, which used an emission rate of 488.36 g/s with the actual stack height as it is lower than GEP. The state also adequately characterized the sources' building layout and location, as well as the stack parameters (e.g., exit temperature, exit velocity, location, and diameter). Where appropriate, the AERMOD component BPIPPRM was used to assist in addressing building downwash. The EPA supports the state's analysis of the source characterizations.

4.3.2.5.Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective.

The EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information, when they are available. These data are available for many electric generating units. In the absence of CEMS data, the EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, the EPA recommends using detailed throughput, operating schedules, and emissions information from the impacted source(s).

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. Specifically, a facility that has recently adopted a new federally enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the state included MR Young and five other emitters of SO_2 within 50 km in the area of analysis. 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 PTE rates. The facilities in the state's modeling analysis and their associated actual or PTE rates are summarized below.

For the MR Young, Coal Creek, Stanton, Coyote, and RM Heskett facilities, the state provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 10. A description of how the state obtained hourly emission rates is given below this table.

Table 10. Actual SO_2 Emissions Between 2013 – 2015 from Facilities in the Area of Analysis for the Oliver County Area

	SO_2 Emissions (tpy)		
Facility Name	**2013**	**2014**	**2015**
Milton R. Young	1,891	2,069	2,726
Coal Creek	15,581	15,614	15,450
Stanton	2,016	2,573	2,117
Coyote	12,586	12,787	8,773
RM Heskett	2,987	3,373	3,060
Total Emissions from All Facilities in the Area of Analysis Modeled Based on Actual Emissions	35,061	36,416	32,126

For all of these facilities, the actual hourly emissions data were obtained from CEMs. The state has also noted that the Stanton facility permanently shut down on February 25, 2017, and that the source will be decommissioned on May 1, 2017, though the source's permit has not yet been revoked.

For the Leland Olds Station, the state provided PTE values. This information is summarized in Table 11. A description of how the state obtained hourly emission rates is given below this table.

Table 11. SO_2 Emissions based on PTE from Facilities in the Area of Analysis for the Oliver County Area

Facility Name	SO_2 Emissions (tpy, based on PTE)	Actual SO_2 Emissions, 2016
Leland Olds	16,976	1,928
Total Emissions from Facilities in the Area of Analysis Modeled Based on PTE	16,976	N/A

The PTE in tons per year for Leland Olds was determined by the facility's owner (Basin Electric) based on a very conservative rate developed for the modeling analysis to designate Leland Olds. In 2012 and 2013, Leland Olds installed wet scrubbers to meet a SIP-approved Best Available Retrofit Technology (BART) limit of 0.15 lb/mmBTU of SO_2. The modeled PTE rate for the facility would be 1162.8 lbs/hr based on continuous operation at the BART limit over its 30-day rolling average rate. 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 SO2 Nonattainment Area Guidance at 25-37, and Appendices B, C, and D). Basin Electric adjusted the emissions rate in accordance with EPA Guidance, and did so using an especially high emissions rate of 3,876 lb/hr, which is greater than three times the BART limit and much higher than the EPA's April 23, 2014 Guidance would recommend. This number was derived by multiplying 0.5 lb/MMBtu by three times the full-load heat input rate. The EPA finds that this emission rate is appropriate in that it is very conservatively high compared to a rate derived from the adjustment methodology in EPA Guidance.

4.3.2.6.Modeling Parameter: Meteorology and Surface Characteristics

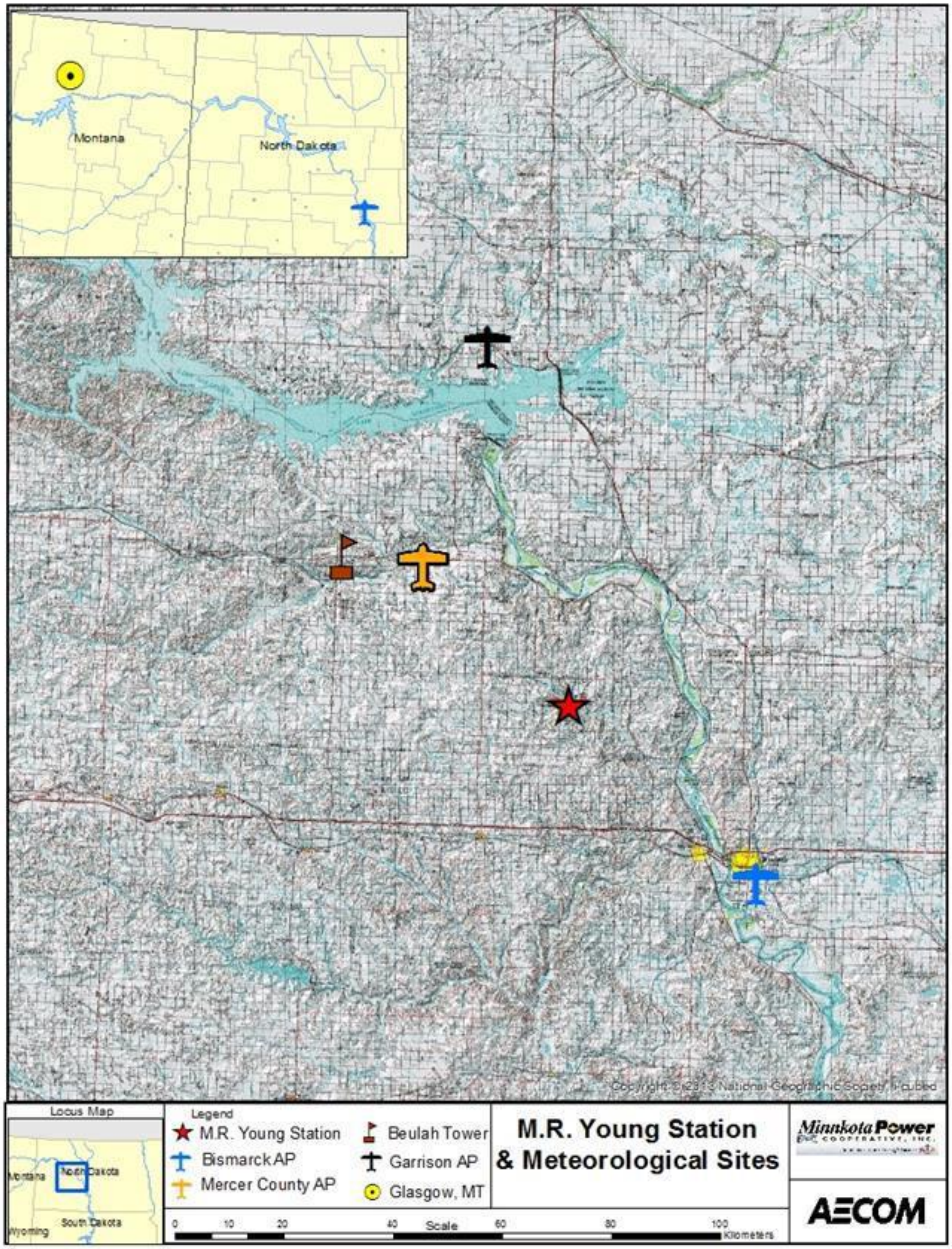
As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of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

AERMET version 15181 was used to process the hourly meteorological data for the modeling analysis. Hourly averaged surface observations were processed from the state-operated meteorological station in Beulah, North Dakota. The state has selected this data because it is the closest meteorological site to the sources. While this monitoring site is within 50 km of the source, it has similar terrain features. NWS data from nearby Garrison Municipal Airport in

Garrison, ND was provided to AERMET to substitute for wind data that were missing from the state-operated station in Beulah, North Dakota. NWS wind data, taken at hourly intervals, may not always portray wind conditions for the entire hour, which can be variable in nature. The 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 for any hours in which the NWS wind data from Garrison Municipal Airport were used, one-minute ASOS (Automated Surface Observing System) wind data from Garrison were processed using AERMINUTE (version 15272) into hourly data for input into AERMET (15181). 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. A minimum threshold wind speed of 0.3 m/s was used when processing the wind data from the Beulah station.

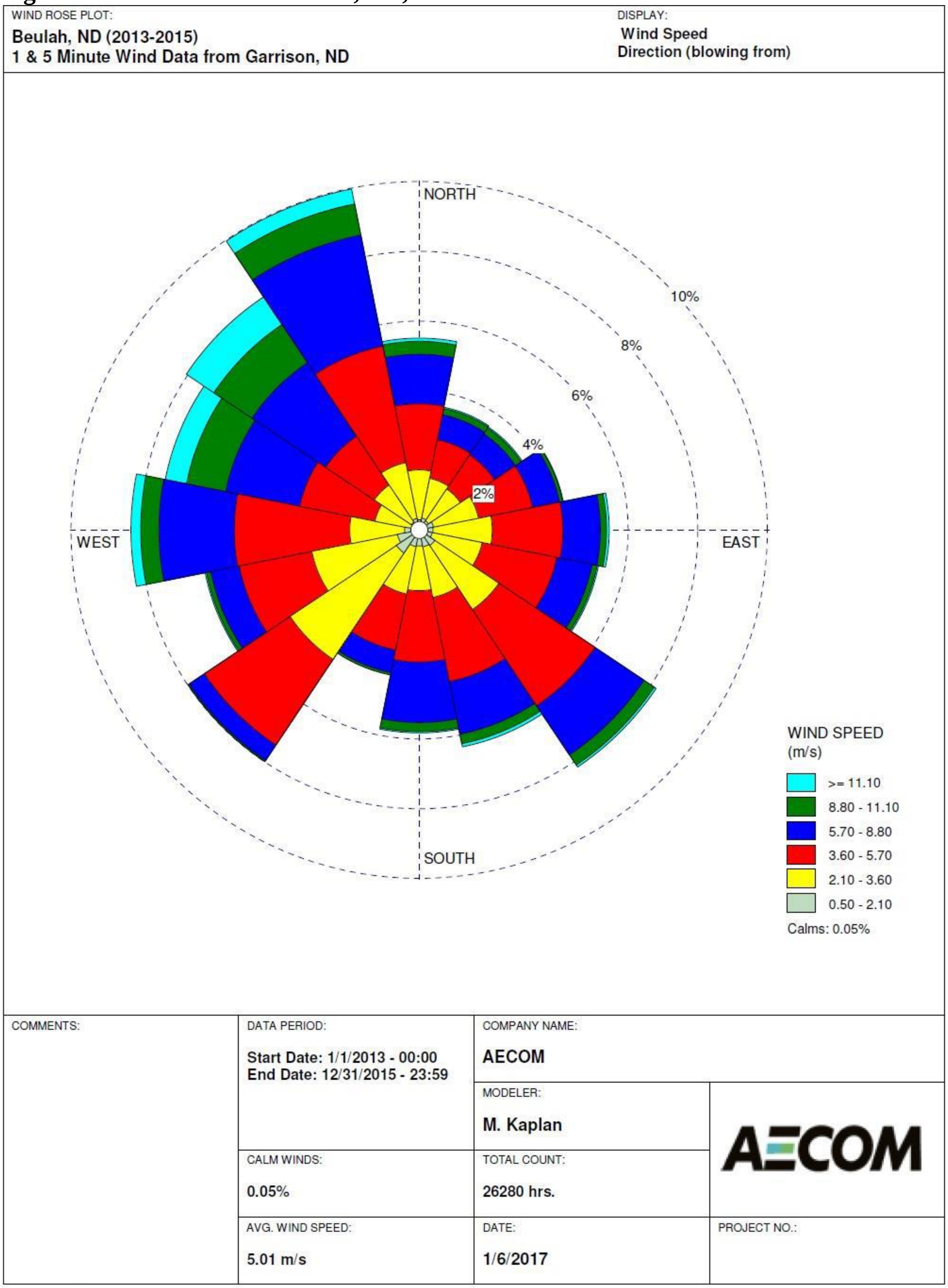
Since cloud cover data is not recorded from the Beulah meteorological station, cloud cover observations were taken from nearby Mercer County Airport in Hazen, ND. For periods (such as in portions of 2015) when cloud cover observations from the Mercer County Airport were missing, cloud cover data from the Bismarck Airport were substituted. This approach led to hourly observations to have at least 94 percent data capture. Missing upper air data from Bismarck, ND, were substituted with data from Glasgow, MT.
Figure 18 shows the locations of the meteorological stations in relation to the modeled facilities, as well as the SO_2 background station discussed below.

Figure 18. Map of Facilities and Monitoring Locations.



A surface wind rose for the entire 3-year period proposed for the modeling time period is shown in Figure 19. The wind rose shows that the dominant wind directions are from the north-north-west (about 10 percent of the time). The average wind speed is about 5 m/s, where calm winds are about 0.05 percent of the time.

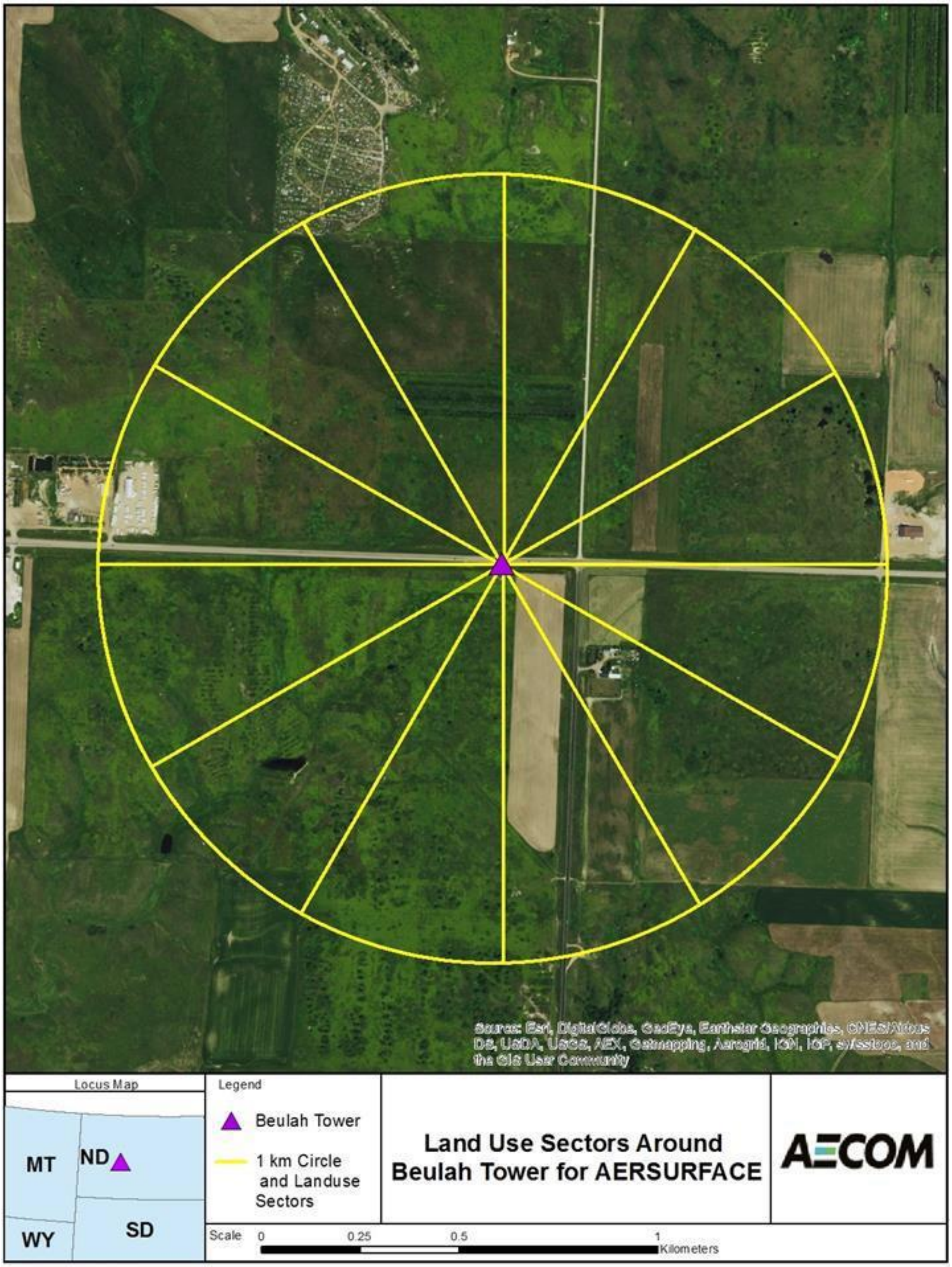
Figure 19. Wind Rose for Beulah, ND, 2013-2015.



WRPLOT View - Lakes Environmental Software

AERSURFACE (version 13016) was used to calculate the surface characteristics values, including albedo, Bowen ratio, and surface roughness length, at the surface meteorological observing site for input into AERMET. The 1992 National Land Cover Dataset (NLCD92) file for input into AERSURFACE was downloaded from the United States Geological Society (USGS) website. Figure 20 shows the 1992 NLCD Land Use for the monitoring site.

Figure 20. 1992 NLCD Land Use, Beulah, ND.



The state estimated values in 30 degree sectors, equating to 12 spatial sectors out to a 1 km radius around the monitoring site for surface roughness. The Bowen ratio and albedo were determined based on the average characteristics, over a 10 by 10 km square, centered on the monitoring site. The surface parameters were determined on a monthly basis using default season assignments. Since the meteorological site is at a state-operated meteorological monitor site, the AERSURFACE input was not marked as an airport. A secondary set of surface characteristics for the twelve sectors was developed around the backup NWS Hazen airport. Due to some missing cloud cover data at Hazen in 2015, a secondary backup set of surface characteristics for the twelve sectors was developed around the Bismarck airport. In AERMET Stage 3, the primary set of characteristics were applied for those hours in which the onsite data are used and the secondary set were applied for those hours in which the NWS surface file or 1-minute ASOS wind data are substituted for missing or calm onsite data.

For Bowen ratio, the land use values are linked to three categories of surface moisture corresponding to average, wet and dry conditions. The surface moisture condition for the site may vary depending on the meteorological data period for which the surface characteristics will be applied. AERSURFACE applies the surface moisture condition for the entire data period. Therefore, if the surface moisture condition varies significantly across the data period, then AERSURFACE can be applied multiple times to account for those variations. As recommended in the AERSURFACE User's Guide, the surface moisture condition for each season was determined by comparing precipitation for the period of data to be processed to a recent 30-year record at Garrison airport (for 2013-2014) and Bismarck airport (for 2015) precipitation records. This procedure selected "wet" conditions if precipitation was in the upper 30th percentile, "dry" conditions if precipitation was in the lower 30th percentile, and "average" conditions if precipitation was in the middle 40th percentile. Table 12 outlines the AERSURFACE bowen ratio condition designations.

Table 12. AERSURFACE bowen ratio condition designations.

Month	2013	2014	2015
January	Dry	Average	Wet
February	Average	Average	Average
March	Average	Average	Dry
April	Wet	Wet	Dry
May	Wet	Wet	Wet
June	Wet	Average	Wet
July	Average	Dry	Dry
August	Wet	Wet	Average
September	Wet	Average	Dry
October	Wet	Average	Average
November	Average	Wet	Average
December	Wet	Dry	Wet

The AERSURFACE seasonal categories by month were developed for each modeled year and applied for the primary (Beulah site) and secondary (Hazen airport in 2013-2014; Bismarck airport in 2015) sites. 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 13 outlines the selected seasonal categories for AERSURFACE.

Table 13. Summary of Precipitation Data for Miles City, MT, 1987-2014

Seasonal Description	2013	2014	2015
Late autumn after frost and harvest, or winter with no snow	3,4	3	11,2,3
Winter with continuous snow on the ground	12,1,2	11,12,1,2	12,1
Transitional spring	5	4,5	4,5
Midsummer with lush vegetation	6,7,8	6,7,8	6,7,8
Autumn with unharvested cropland	9,10,11	9,10	9,10

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 Appendix W and the Modeling TAD in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics. The EPA supports the state's analysis as best representative of meteorological conditions within the area of analysis.

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

As illustrated above, Oliver County is considered mostly flat to gently rolling terrain, with some sharper valleys nearby. To account for these terrain changes, the AERMAP terrain program (version 11103) 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. The EPA supports the state's approach for defining the terrain.

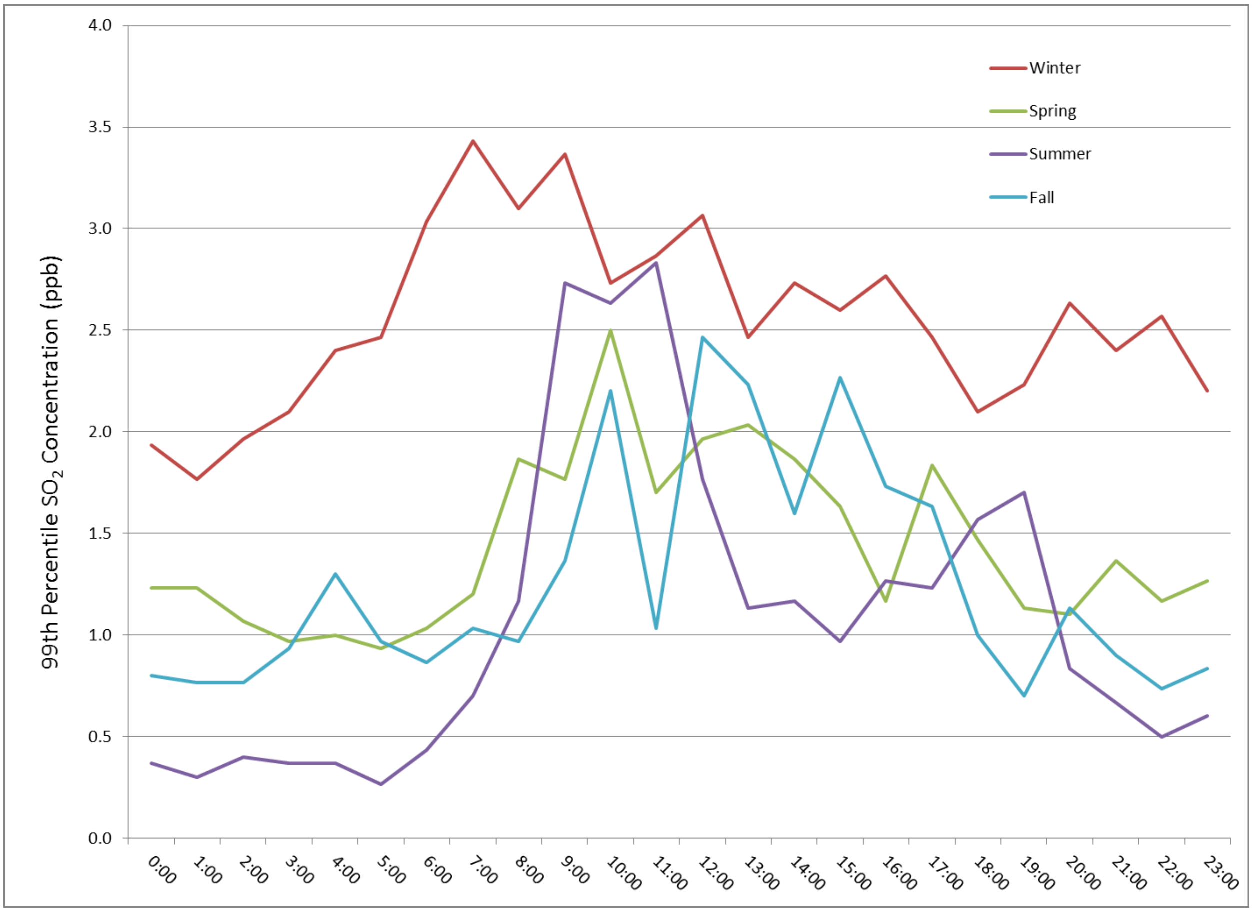
4.3.2.8.Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99th percentile monitored concentrations by hour of day and season or month. For this area of analysis, the state utilized the tier 2 approach, where the background concentrations for this area of analysis were determined by the state to vary from seasonally.

Sulfur dioxide background data from the NDDH-approved Dunn Center monitor was used to determine the appropriate one-hour background concentrations to add to the model predicted concentrations. The background concentrations were calculated as a 3-year (2013-2015) average of the 99th percentile by season and hour-of-day and added internally for each modeled hour in

AERMOD to the AERMOD predicted concentration for comparison with the 1-hour SO_2 standard. Figure 21 shows the seasonal and hourly background values in ppb.

Figure 21. 2013-2015 Average 99th Percentile Concentration at Dunn Center SO_2 Monitor.



The EPA supports the state's approach for determining the background concentration.

4.3.2.9.Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Oliver County area of analysis are summarized below in Table 14.

Table 14: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Oliver County Area

Input Parameter	Value
AERMOD Version	15181 (regulatory options)
Dispersion Characteristics	Rural
Modeled Sources	6
Modeled Stacks	9
Modeled Structures	5
Modeled Fencelines	1
Total receptors	5910
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Beulah, ND/Garrison, ND/Hazen, ND/Bismarck, ND
NWS Station Upper Air Meteorology	Bismarck, ND/Glasgow, MT
NWS Station for Calculating Surface Characteristics	Beulah, ND/Garrison, ND/Hazen, ND/Bismarck, ND
Methodology for Calculating Background SO_2 Concentration	Tier 2 Dunn Center between 2013 and 2015.
Calculated Background SO_2 Concentration	0.27 to 3.43 ppb

The results presented below in Table 15 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

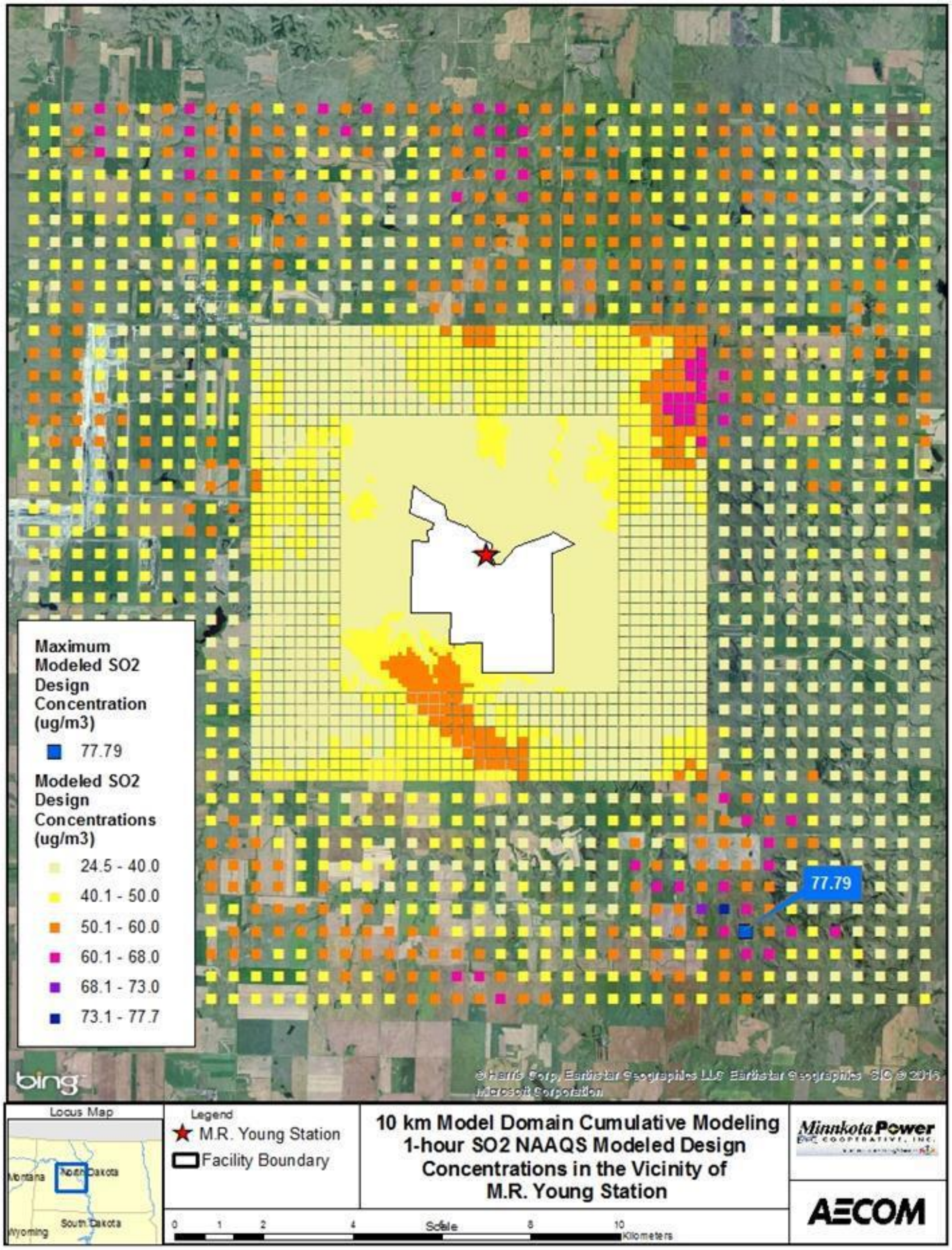
Table 15. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Oliver County Area

Averaging Period	Data Period	Receptor Location [UTM zone XX, if applicable]		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM/Latitude	UTM/Longitude	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013 - 2015	337790.00	5206380.00	77.8**	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor
**Results reported in AERMOD output file.

The state's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 77.8 $\mu g/m^3$, equivalent to 29.7 ppb. This modeled concentration included the nearby sources and background concentration of SO_2, and is based on actual emissions from the facility. Figure 22 below was included as part of the state's recommendation, and indicates that the predicted value occurred about 10.3 km southeast of the MRY facility.

Figure 22: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Oliver County Area of Analysis



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

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

The state's approach to conducting the dispersion modeling for EPA's 1-hour SO_2 designations appears to mostly align with the TAD. The state has also provided sufficient information to the EPA to determine that the modeling assessment is sufficient for supporting designation decisions. While the state used AERMOD v15181, the state elected to use regulatory default options (i.e., ADJ_U* was not used in the modeling) which should not significantly impact the predicted SO_2 concentrations.

In regards to the non-typical model domains used in the assessment, the EPA supports the approach and has concluded that the modeling assessment sufficiently captures the 1-hour SO_2 design concentration for the area surrounding MRY. Briefly, the 25-km receptor domain (Far-field/Phase 1 modeling) excluded the nearby sources, which could make it difficult to determine whether concentration gradients are captured in the 10-km receptor domain (Refined/Phase 2 modeling). Additionally, the 10-km receptor domain modeled the emissions from the nearby sources but discrete receptors did not cover these sources because the sources are located beyond 10 km. Some concern occurred with this approach because the design concentration is located near the edge of the 10 km domain. However, it is anticipated that the current modeling assessment should capture the maximum design concentration for the area surrounding MRY based on the factors discussed below. On March 29, 2017, NDDH also provided a justification on the adequacy of the receptor grids used in the MRY modeling analysis to demonstrate that the modeled maximum concentration (design concentration) meets the 1-hour SO_2 NAAQS.

After consideration of all issues involved, the EPA and NDDH have determined that significantly higher concentrations would not occur outside of the MRY grid for the following reasons. One reason includes the terrain features around the maximum design concentration. Here, the maximum design concentration from the MRY Phase 2 cumulative modeling analysis appears to include terrain enhancement on a round hill-shaped feature. This feature is similar to that in the Heskett cumulative analysis (Heskett is another SO_2 source located over 30 km southeast of MRY) on an isolated higher-terrain feature west of Heskett named Crown Butte. However, the magnitudes of the local maxima in the MRY analysis are all much less than the maximum at Crown Butte. The predicted design concentration for MRY is about 77 $\mu g\ m^{-3}$, which is well below the NAAQS (this is about 40 percent of the NAAQS) and the predicted design concentration Heskett (Heskett's design concentration is over 150 $\mu g\ m^{-3}$). Therefore, concentrations beyond the MRY grid are unlikely to be significantly higher than inside the grid because of the regular pattern of rolling hills in the vicinity of MRY, with no prominent high-terrain feature nearby to enhance or generate higher concentrations. The only prominent high-terrain feature in the area is Crown Butte, west of Heskett, which was already well modeled in the Heskett analysis.

Another reason includes the source characteristics of the nearby sources, such as emission rates and stack heights in conjunction with the surrounding terrain features. In particular, the modeled nearby sources in the MRY analysis are unlikely to produce elevated concentrations anywhere near MRY, inside or outside its grid, either because their current emission rates are relatively low (Tesoro Refinery, Leland Olds Station) or because its higher elevation and tall stacks likely produce a more elevated plume with lower ground-level concentrations (Coal Creek Station). Without terrain enhancements between the nearby sources, modeled concentrations just beyond the MRY grid will likely not be higher because the nearby sources that would cause these concentrations are too far away from the MRY grid (15-20 km away. Concentrations more than 10 km away from those sources are not likely to occur without terrain enhancement. In addition, the maximum predicted concentrations from the already-modeled nearby sources (in their own 1-hour DRR SO_2 analyses) are located near their sources and much higher, but below the 1-hour SO_2 NAAQS, than any of the concentrations in the MRY cumulative analysis. Therefore, it is unlikely that higher concentrations will occur outside the grid.

The pattern of concentrations in the MRY cumulative modeling analysis displayed in Figure 22 shows the overall maximum of 78 $\mu g\ m^3$ (refined to 80 $\mu g\ m^3$ in Table 5-2) about 10 km southeast of the stacks, as well as numerous local maxima distributed about the grid in several locations. It should be noted that none of the local maxima in Figure 22 are close to approaching the 1-hour SO_2 NAAQS of 196 $\mu g\ m^3$. The magnitudes of the local maxima in the figure range from the overall maximum of 78 $\mu g\ m^3$ down to about 55 $\mu g\ m^3$, which are only 28 percent to 41 percent of the NAAQS. The pattern of concentrations in Figure 22 does not appear to be dominated by a relatively large or prominent local maximum from one larger local source, but from more typical lower concentrations from multiple scattered plumes from more distant sources crossing the domain, with some partially impacting higher local terrain. Many of these maxima may be enhanced due to elevated local terrain, exhibiting a rounder shape reflective of the local terrain. If there is a chance of higher design concentrations beyond the MRY grid, the higher design concentrations are not expected to result in concentrations to violate the NAAQS because the concentrations would have to be about double the current concentrations and anticipated to occur in close proximity of each nearby source's modeled maximum concentration (e.g., for Heskett, Stanton, and Coyote), which have already been modeled and documented to be below the NAAQS (maximum = 161 $\mu g\ m^3$, near Stanton Station).

Therefore, the EPA and NDDH conclude that there are likely no significantly higher concentrations beyond the MRY grid, which would significantly increase the reported overall maximum concentration, 80 $\mu g\ m^3$, or threaten the NAAQS.

4.3.3. Modeling Analysis Provided by Other Organizations

As of June 2017, the EPA has not received any modeling assessments from a 3rd party.

4.4. Jurisdictional Boundaries in the Oliver County Area

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for the county. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable. As noted, the state did not supply specific boundary recommendations, but rather recommended that the EPA designate the area around the MR Young facility. There are no additional SO_2 sources in Oliver County apart from MR Young. The EPA intends to designate Oliver County using the county's boundaries.

4.5. Other Information Relevant to the Designations for the Oliver County Area

North Dakota indicated that the Stanton facility, which was modeled as part of this analysis using 2013-2015 CEMS data, permanently shut down as of February 2017. Because the facility's permit has not yet been revoked, this shut down was not accounted for in the modeling analysis, but this shut down will decrease emissions of SO_2 in Oliver County, North Dakota.

4.6. The EPA's Assessment of the Available Information for the Oliver County Area

Based on our review of the modeling data provided by the state, the EPA has determined that Oliver County meets the 2010 SO_2 NAAQS and does not contribute to any nearby area that does not meet the NAAQS, as there are no such areas anywhere near this county. The ambient monitoring data in the area reported values well below the NAAQS. These data were available to EPA for consideration in the designations process; however, since it is unclear if these monitors are located in areas of maximum concentration, it is unclear if the data are representative of the area's actual air quality.

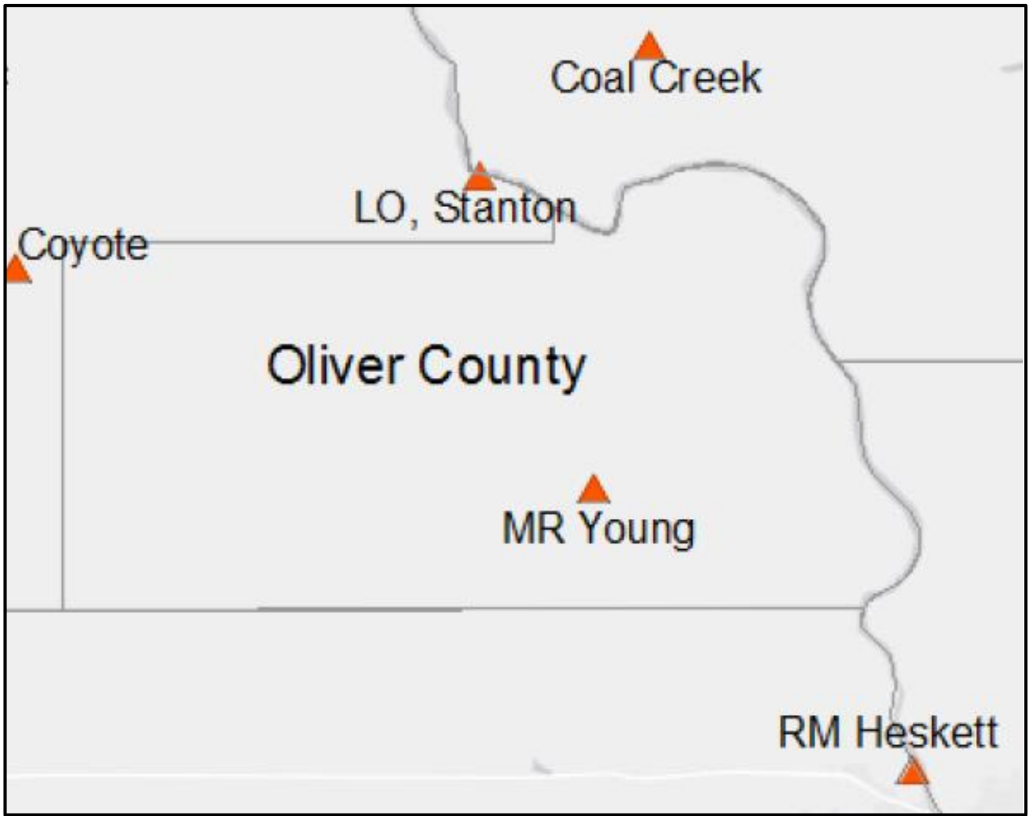
The EPA believes that our intended unclassifiable/attainment area, bounded by borders of Oliver County, North Dakota, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area. This designation is based on the state's modeling analysis, which took into account the only SO_2 source above one ton per year in the county (MR Young) as well as large SO_2 sources from several surrounding counties, and found SO_2 levels to be well below the NAAQS.

4.7. Summary of Our Intended Designation for the Oliver County, North Dakota Area

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate Oliver County, North Dakota, as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of the borders of Oliver County.

Figure 23 shows the boundary of this intended designated area.

Figure 23. Boundary of the Intended Oliver County Unclassifiable/Attainment Area



At this time, our intended designations for the state only apply to this area and the other areas presented in this technical support document. The EPA intends in a separate action to evaluate and designate all remaining undesignated areas in North Dakota by December 31, 2020.

5. Technical Analysis for the Bismarck, North Dakota Area

5.1. Introduction

The EPA must designate the Bismarck, North Dakota, area by December 31, 2017, because the area has not been previously designated and North Dakota has not installed and begun timely operation of a new, approved SO_2 monitoring network to characterize air quality in the vicinity of any sources in the Bismarck area.

5.2. Air Quality Monitoring Data for the Bismarck Area

This factor considers the SO_2 air quality monitoring data in the area of Bismarck. The state included monitoring data from the following monitor(s):

- Air Quality System monitor 380150003. This monitor is located at 1810 N 16th Street in the Burleigh County portion of Bismarck, and is located about 9 km southeast of the RM Heskett facility. Data collected at this monitor indicates that the NAAQS are being met at this location, with a 2014-2016 design value of 15 ppb. As noted, the state referenced their entire SO_2 network in the 2011 recommendation (including this monitor). However, the EPA has not received any information indicating that this monitor is adequately sited for the purposes of designating this area. Therefore, the EPA is not concluding that this monitor data should be the basis of an attainment designation in the Bismarck area.

5.3. Air Quality Modeling Analysis for the Bismarck Area Addressing the RM Heskett Station

5.3.1. Introduction

This section 5.3 presents all the available air quality modeling information for the portion of the Morton County and Burleigh County area that includes RM Heskett Station. (This portion of these counties will often be referred to as “the Bismarck area” within this section 5.3). This area contains the following SO_2 sources, principally the sources around which North Dakota is required by the DRR to characterize SO_2 air quality, or alternatively to establish an SO_2 emissions limitation of less than 2,000 tons per year:

- The RM Heskett Station facility emits 2,000 tons or more annually. Specifically, Heskett Station emitted 3,369 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and North Dakota has chosen to characterize it via modeling.

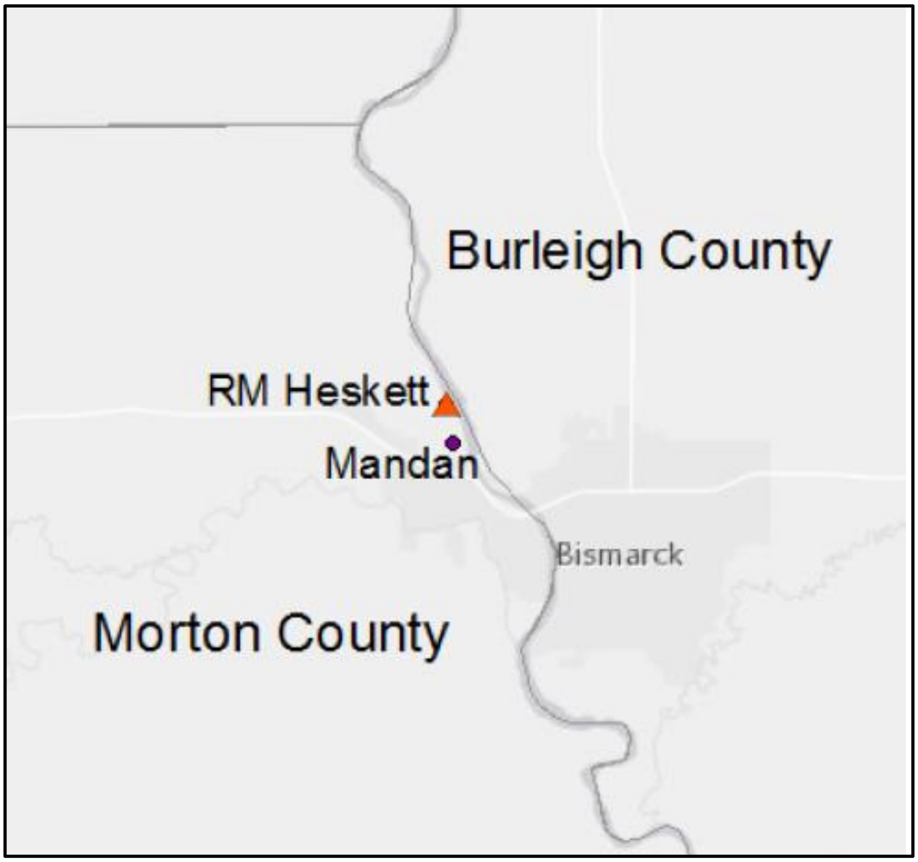
- The Mandan Refinery is not on the DRR source list, but was included in the state’s modeling analysis due to its proximity to the RM Heskett facility.

In its submission, North Dakota recommended that the area surrounding the RM Heskett Station be designated as attainment based in part on an assessment and characterization of air quality impacts from this facility as well as the nearby Mandan Refinery. This assessment and characterization was performed using air dispersion modeling software, i.e., AERMOD, analyzing actual emissions. After careful review of the state’s assessment, supporting documentation, and all available data, the EPA agrees with the state’s conclusion that the area is meeting the NAAQS, and intends to designate the area as unclassifiable/attainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

The area that the state has assessed via air quality modeling is located in eastern Morton County and western Burleigh County, including the entirety of the city of Bismarck. As seen in Figure 24 below, the RM Heskett facility is located about 10 km northwest of Bismarck, North Dakota. The facility is located just to the west of the border of Morton and Burleigh counties. Also included in the figure are other nearby emitters of SO_2, specifically the Mandan Refinery, located about 1.5 km south of the RM Heskett facility.

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

Figure 24. Map of the Bismarck Area Addressing RM Heskett



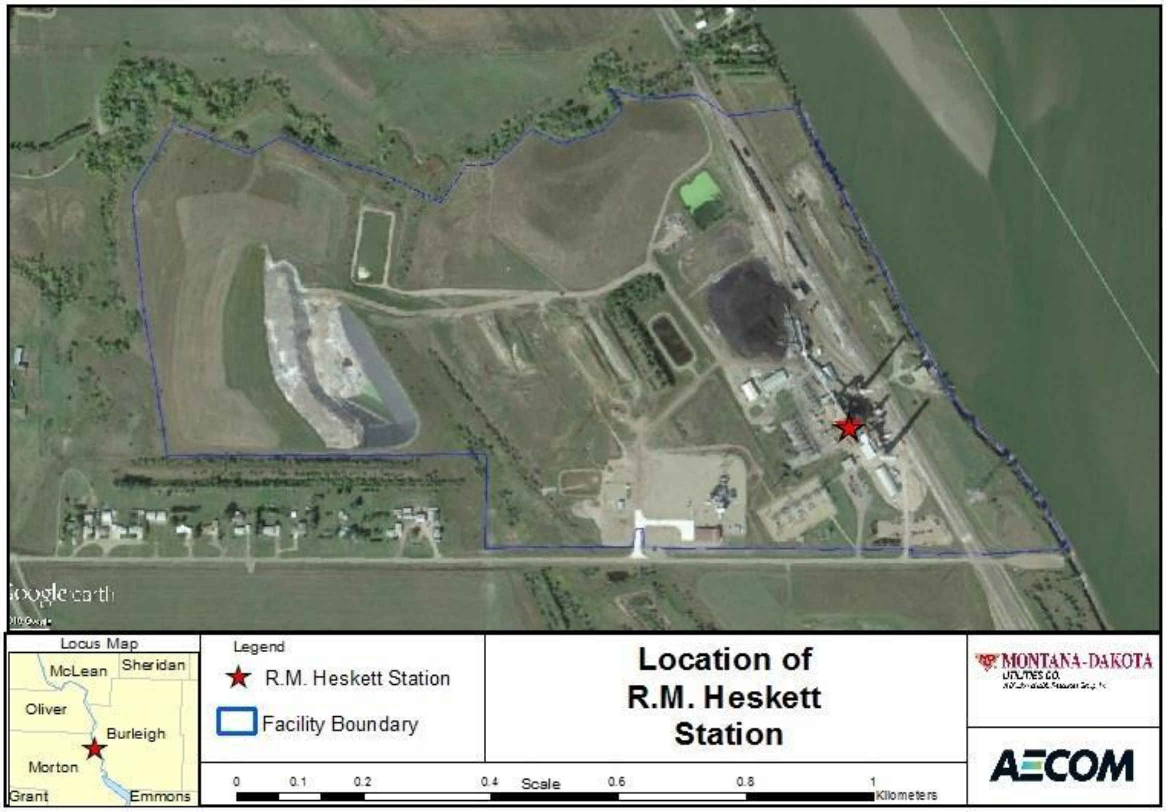
The discussion and analysis that follows below will reference the Modeling TAD and the factors for evaluation contained in the EPA's July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.

For this area, the EPA received and considered one assessment from the state.

5.3.2. Modeling Analysis Provided by the State

The North Dakota Department of Health (NDDH) provided an air quality modeling assessment for the RM Heskett Station (Heskett) owned by Montana-Dakota Utilities Co. in Morton County, North Dakota (ND). Figure 25 shows the location of the facility.

Figure 25. Location of the Heskett facility.



5.3.2.1.Model Selection and Modeling Components

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

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

The state used AERMOD version 15181, which was the most recent platform available to use at the time of the initial modeling provided to EPA in January 2017. For the initial modeling, the state did request approval to use ADJ_U* with version 15181. The request followed the appropriate process for approval by submitting the request through EPA Region 8. The EPA approved the request and obtained concurrence through the Model Clearinghouse. The state submitted an official request to use ADJ_U* in the modeling assessment in June 2016. Region 8 approved the request, with concurrence from the Model Clearinghouse, in August 2017 (https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=16-VIII-01). The currently approved AERMOD platform is version 16216r that includes updates. In particular, updates were made to the ADJ_U* routine to correct an error found in the ADJ_U* algorithm. As a result, modeling that used AERMOD v15181 and ADJ_U* will not predict defensible SO_2 concentrations that can be used for designation purposes. In July 2017, the state provided the EPA with updated modeling that used AERMOD v16216r and ADJ_U*. A discussion of the state's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

5.3.2.2.Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the "urban" or "rural" determination of a source is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD details the procedures used to determine if a source is urban or rural based on land use or population density.

The area surrounding Heskett is considered to have complex terrain, with elevations above the stack top within 4 km of the plant. The facility is located about 10 km northwest of Bismarck, ND. Figure 26 shows the location of Heskett and Figure 27 shows the topography surrounding the station. For the purpose of performing the modeling for the area of analysis, the state determined that it was most appropriate to run the model in rural mode. The site location was classified as rural using the land use procedure specified in Appendix W. The area was clipped to a 3-km ring around the facility. Based on the map of land cover provided in the state's modeling assessment report, the area surrounding the facilities is rural (see Figure 33). By the definition in Appendix W, land that contains less than 50 percent of developed land use categories should be considered rural. Figure 33 shows the land cover within a 3-km radius of the facility. For these reasons, the EPA's assessment supports the State's analysis on the land use classification.

Figure 26. Location of the Heskett Station.

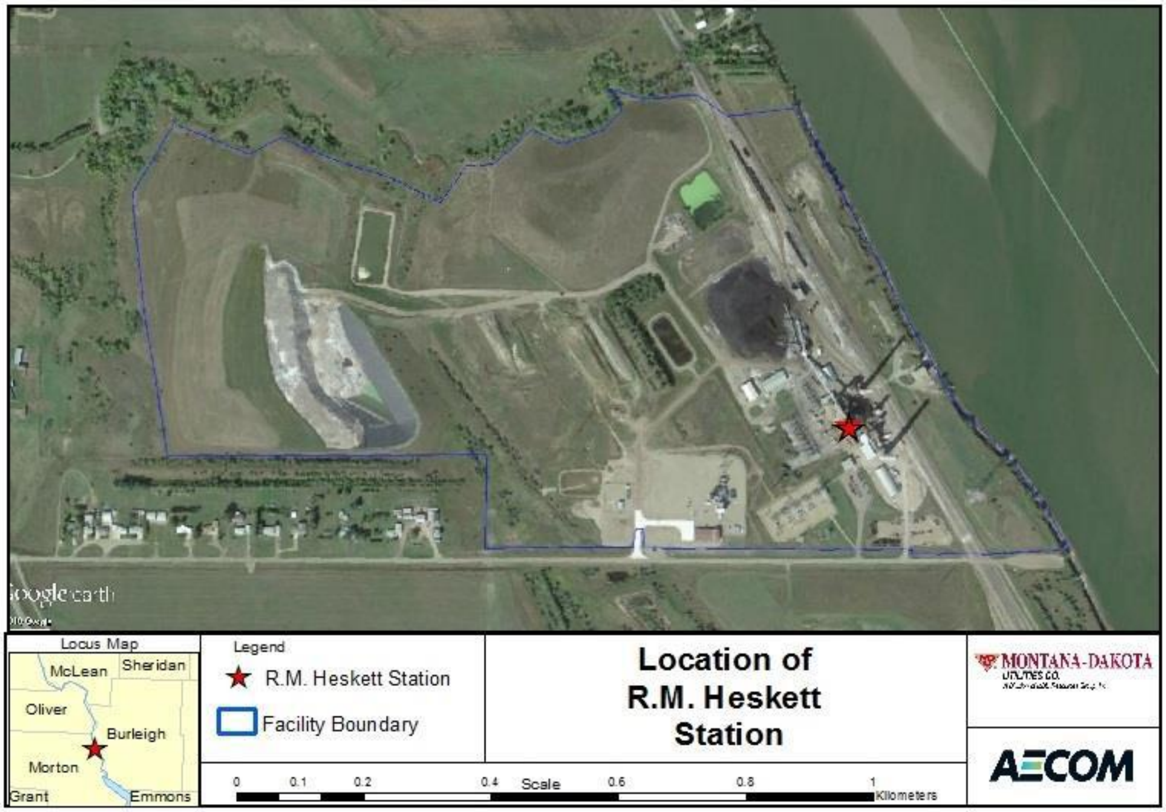
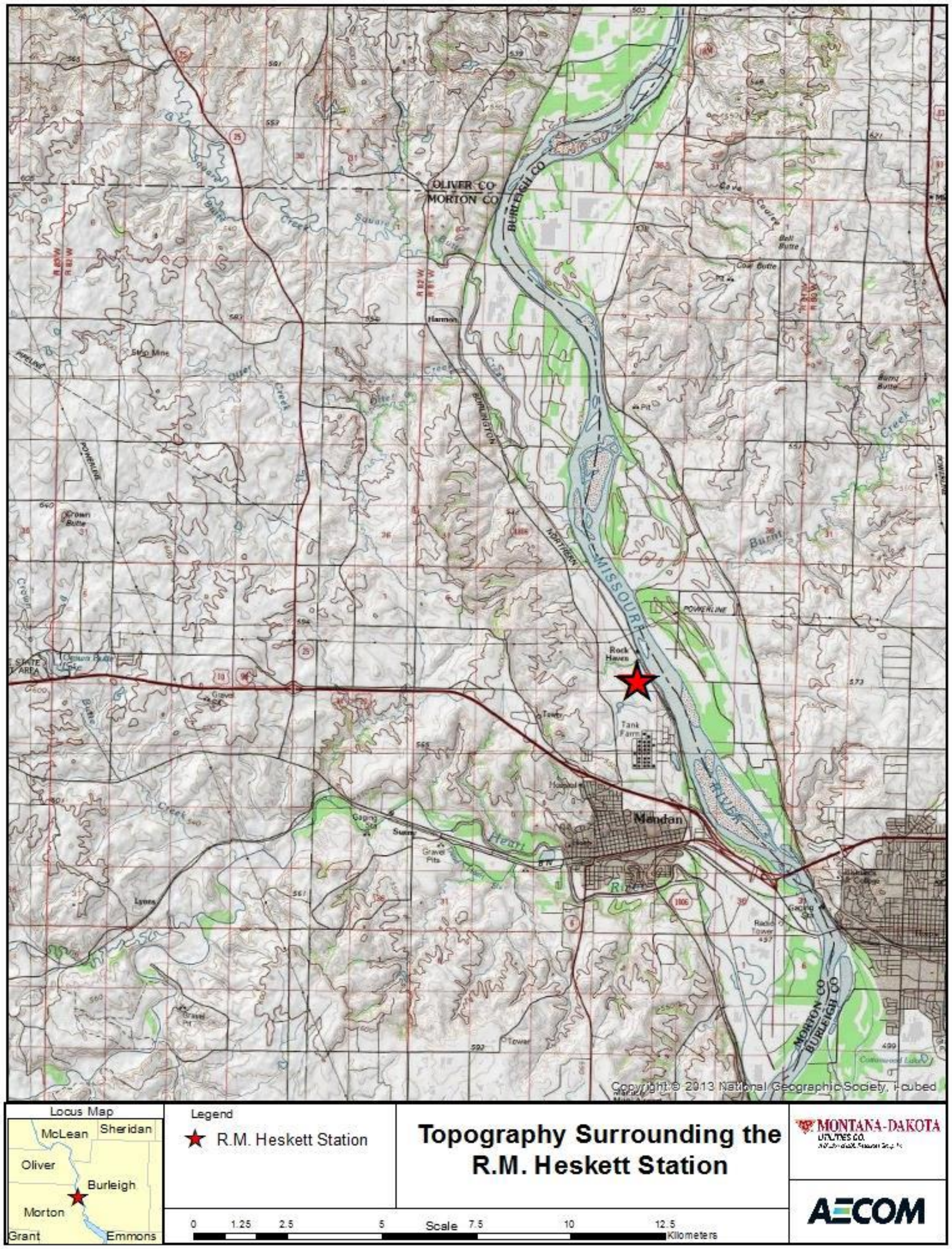


Figure 27. Topography in the vicinity of the Heskett Station.

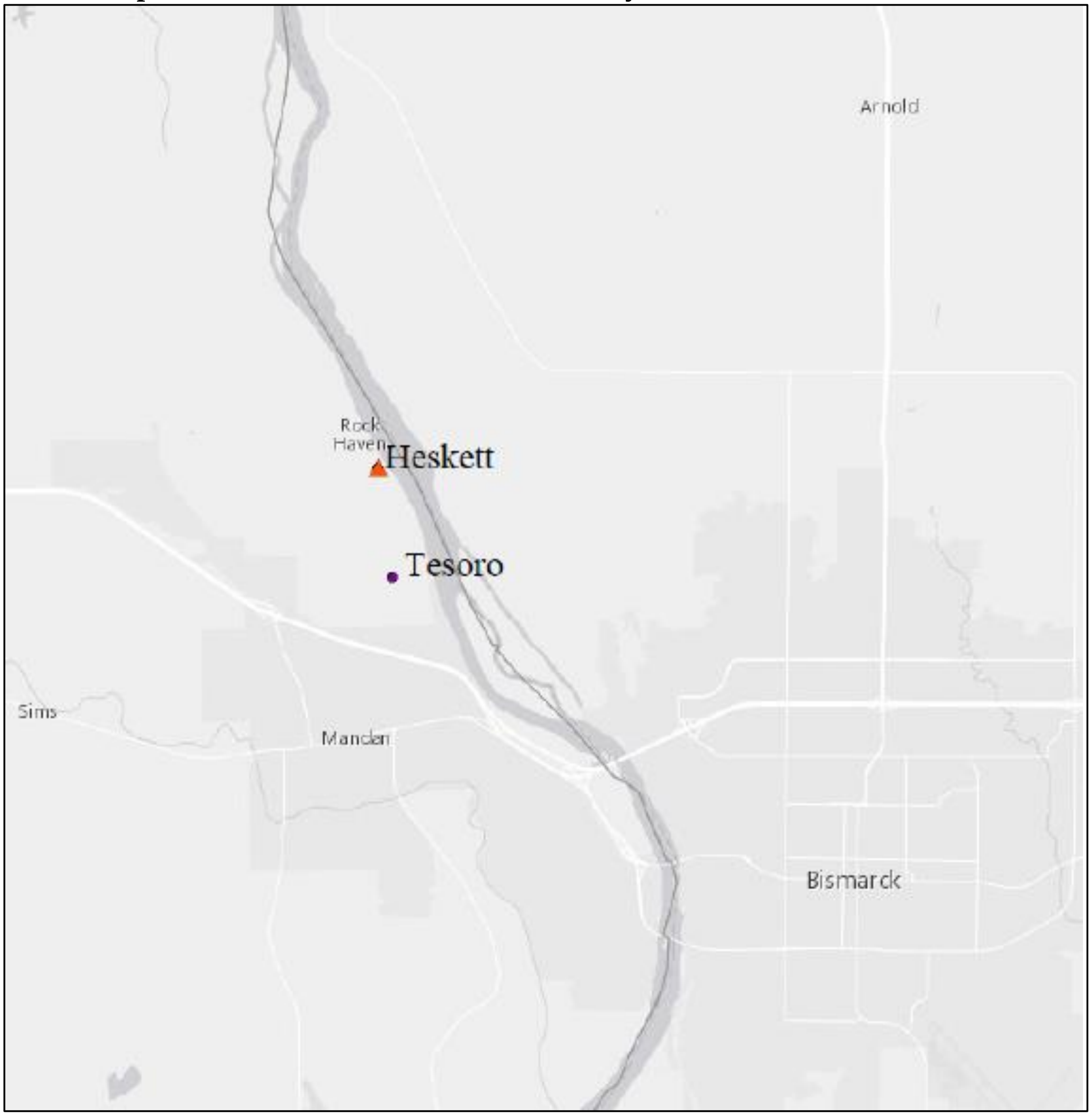


5.3.2.3.Modeling Parameter: Area of Analysis (Receptor Grid)

The TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The source of SO_2 emissions subject to the DRR in this area are described in the introduction to this section. For the Bismarck area, the state has included one other emitter of SO_2 within 20 km of the Heskett facility. The facility included was the Tesoro Mandan Refinery. There are no other sources above one ton per year of SO_2 within 20 m of Heskett. The state determined that the selected modeling domain was appropriate to adequately characterize air quality through modeling, and to include the potential extent of any SO_2 NAAQS exceedances in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. No other sources beyond 20 km were determined by the state to have the potential to cause concentration gradient impacts within the area of analysis. Figure 28 shows a map of the source relative to the Heskett facility.

Figure 28. Map of Sources Modeled in Heskett Analysis.



A Cartesian modeling receptor array was established to capture the 99th percentiles of the maximum daily one-hour average SO_2 impacts from Heskett. The receptor grid is a relatively dense receptor array with the following spacing beyond the fence line:

- 25-m receptor spacing along the Heskett Station boundary for the SO_2 characterization.
- 50-m receptor spacing extending out 1.7 kilometers from the grid center. This distance brings the 50-m grid spaced receptors to at least 500 m from the Heskett fence line, in accordance with the NDDH modeling protocol.
- 100-m receptor spacing between 1.7 and 5 kilometers from the grid center.
- 250-m receptor spacing between 5 and 10 kilometers from the grid center.
- 500-m receptor spacing beyond 10 kilometers (out to 20 km).

The receptor grid used in the modeling analysis was based on Universal Transverse Mercator (UTM) coordinates referenced to NAD 83 datum and in zone 14. Figure 29 shows the near-field receptor array and Figure 30 shows the far-field receptor array. A total of 23,396 receptors were used for modeling Heskett.

Figure 29. Near-Field Receptor Array.

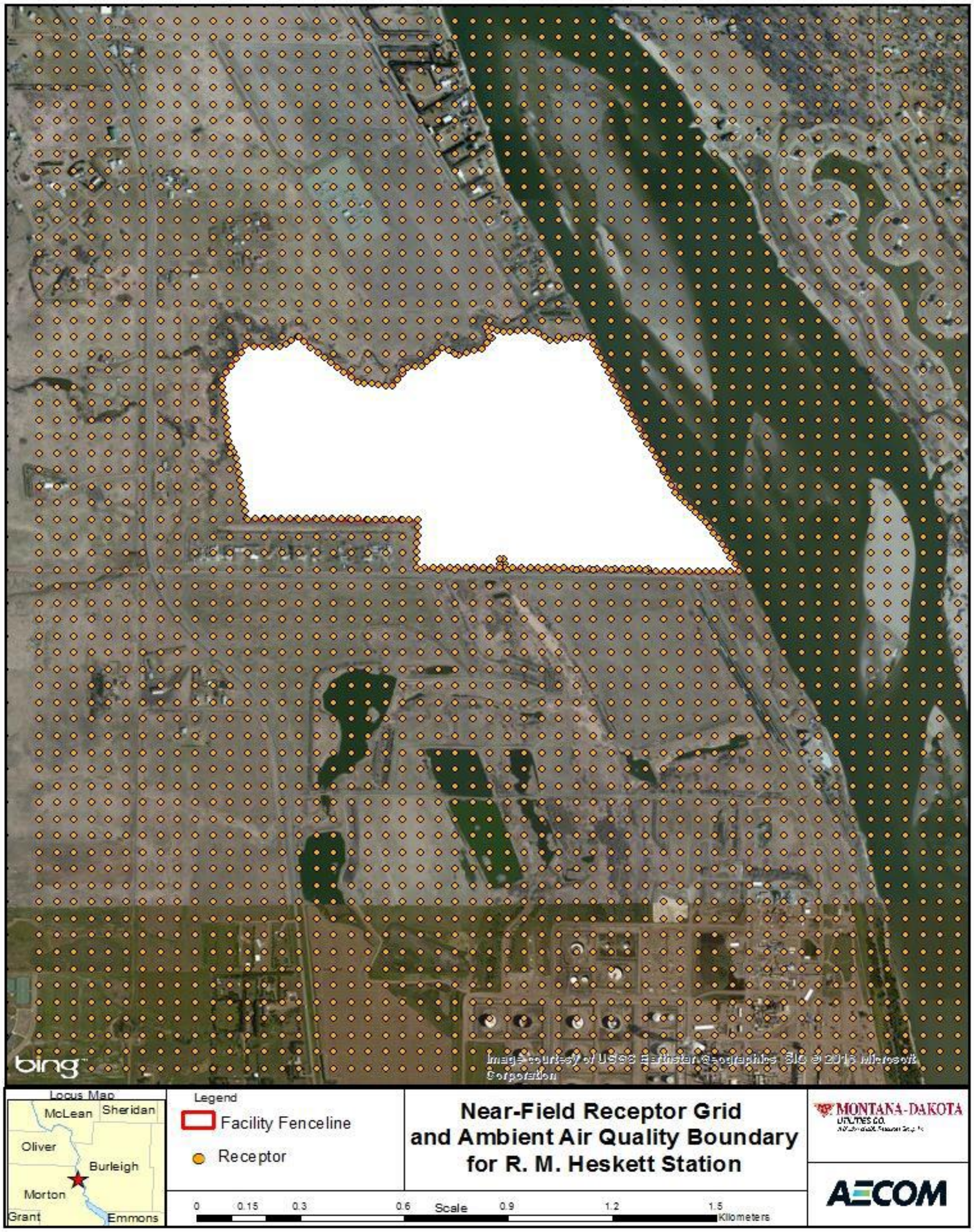
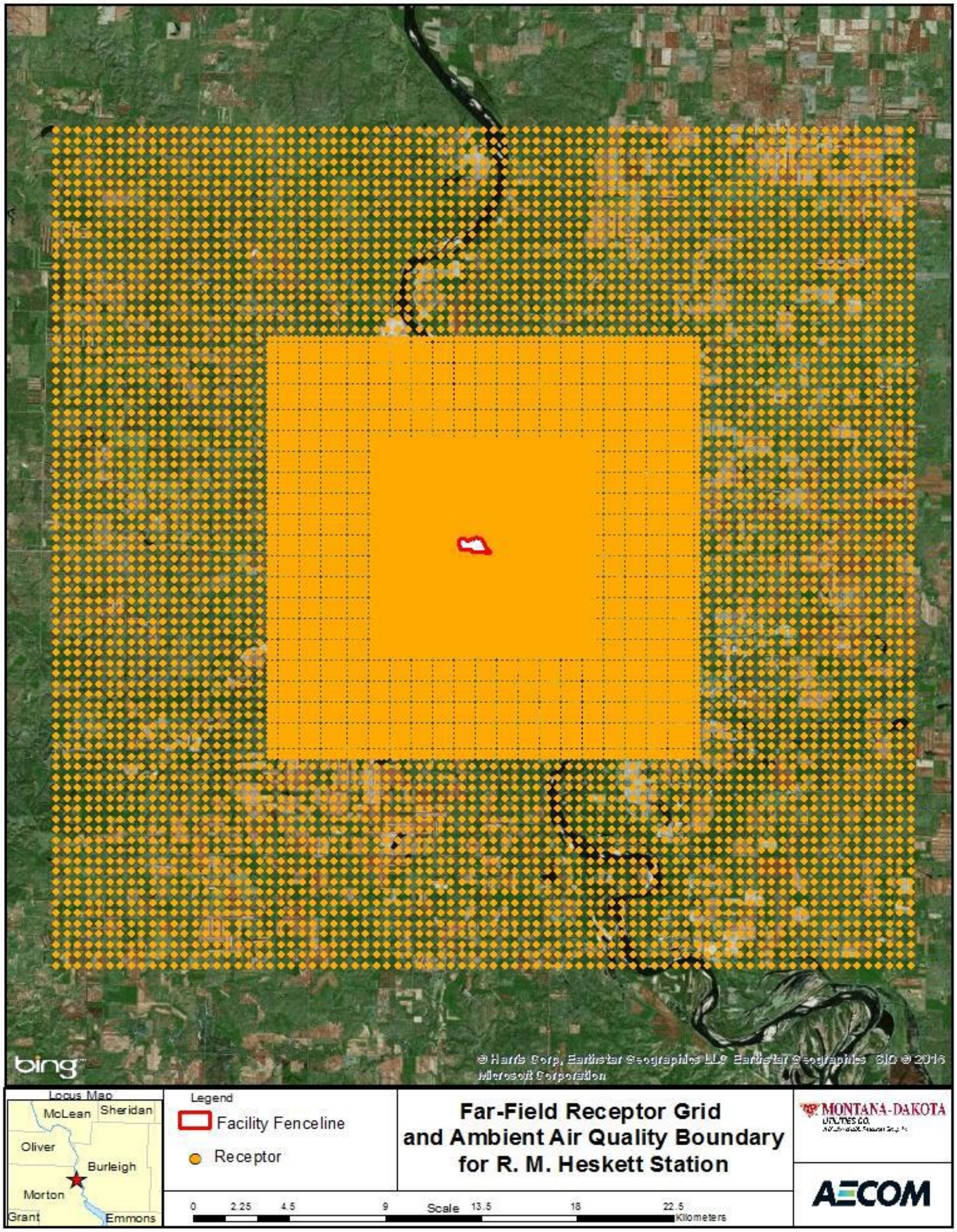


Figure 30. Far-Field Receptor Array.



The state placed receptors for the purposes of this designation effort in locations that it considered ambient air relative to each modeled facility, including other facilities' property. The

EPA supports the locations and coverage of receptors used in the state's air quality modeling assessment based on the state's assertion that the facility's property is secured at the fence line and the air within that boundary should not be considered ambient.

5.3.2.4.Modeling Parameter: Source Characterization

R.M. Heskett Station has two existing coal-fired boilers (Unit 1 & Unit 2), each of which exhaust through their own, separate 91.08 meter (298.8-ft) tall stacks. In accordance with the Modeling TAD, the analysis used 2013-2015 actual hourly SO_2 emissions, temperature, and velocity data collected by the Continuous Emissions Monitoring (CEMs) equipment at each unit. Table 16 summarizes the stack parameters used in the AERMOD modeling.

The plant structures, buildings, and tanks were included for AERMOD downwash calculations using BPIPPRM. A total of 39 structures were included in the modeling.

Table 16. Stack Parameters for Heskett and Nearby Sources.

Stack ID Number	NAD83 Zone 14 UTM Coordinates		Stack Height	Base Elevation	Stack Diameter	Exit Velocity	Exit Temperature
	Easting [m]	Northing [m]	m	m	m	m/s	K
Heskett							
Unit 1	356414.5	5192141.5	91.084	505.206	2.21	varies	varies
Unit 2	356448.5	5192035.2	91.084	505.206	3.66	varies	varies
Tesoro							
Unit 1	356648.9	5190452.1	60.66	520.5	2.44	varies	varies
Unit 2	356636.7	5190396.1	35.26	520.5	1.73	varies	varies
Unit 3	356873	5190904.8	31.39	516.8	1.59	varies	varies
Unit 4	356861.4	5190904.8	27.43	517	1.44	varies	varies
Unit 5	356857.1	5190723.1	30.78	517	1.45	varies	varies
Unit 6	356847	5190573.1	30.48	516.8	2.13	varies	varies
Unit 7	356854.5	5190574.1	32.43	516.5	0.99	varies	varies
Unit 8	356860.5	5190573.1	30.48	516.3	1.52	varies	varies
Unit 9	356826.2	5190572.1	21.3	517.5	0.52	varies	varies
Unit 10	356798.5	5190363.1	31	519	1.58	varies	varies
Unit 11	356800.3	5190345.1	32.5	518.9	1.58	varies	varies
Unit 12	356800	5190338.1	32	518.9	1.88	varies	varies
Unit 13	356862.9	5190428.3	60.8	518.3	0.6	varies	varies
Unit 14	356875.3	5190757.1	27.68	517.3	0.83	varies	varies
Unit 15	356875.3	5190742.1	22.79	517.2	0.61	varies	varies
Unit 16	356852.6	5190737.1	36.58	517.2	1.14	varies	varies

NAD83 = North American Datum 1983; UTM = Universal Transverse Mercator; m/s = meters per second; K = Kelvin degrees.

The state characterized these source within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, the state used actual stack heights in conjunction with actual emissions. The state also adequately characterized the sources' building layout and location, as well as the stack parameters (e.g., exit temperature, exit velocity, location, and diameter). Where appropriate, the AERMOD component BPIPPRM was used to assist in addressing building downwash. EPA supports the state's analysis of the source characterizations.

5.3.2.5.Modeling Parameter: Emissions

The EPA's Modeling TAD notes that for the purpose of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data. However, the TAD also indicates that it would be acceptable to use allowable emissions in the form of the most recently permitted (referred to as PTE or allowable) emissions rate that is federally enforceable and effective.

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

In certain instances, states and other interested parties may find that it is more advantageous or simpler to use PTE rates as part of their modeling runs. For example, a facility that has recently adopted a new federally enforceable emissions limit or implemented other federally enforceable mechanisms and control technologies to limit SO_2 emissions to a level that indicates compliance with the NAAQS. These new limits or conditions may be used in the application of AERMOD for the purposes of modeling for designations, even if the source has not been subject to these limits for the entirety of the most recent 3 calendar years. In these cases, the Modeling TAD notes that a state should be able to find the necessary emissions information for designations-related modeling in the existing SO_2 emissions inventories used for permitting or SIP planning demonstrations. In the event that these short-term emissions are not readily available, they may be calculated using the methodology in Table 8-1 of Appendix W to 40 CFR Part 51 titled, "Guideline on Air Quality Models."

As previously noted, the state included the RM Heskett facility and one other emitter of SO_2 within 2 km of Heskett in the area of analysis. The state has chosen to model these facilities using actual emissions. The facilities in the state's modeling analysis and their associated annual actual SO_2 emissions between 2013 and 2015 are summarized below.

For the Heskett facility and nearby Mandan Refinery, the state provided annual actual SO_2 emissions between 2013 and 2015. This information is summarized in Table 17. A description of how the state obtained hourly emission rates is given below this table.

Table 17. Actual SO_2 Emissions Between 2013 – 2015 from Facilities in the Bismarck Area

Facility Name	SO_2 Emissions (tpy)		
	2013	**2014**	**2015**
RM Heskett	2,987	3,373	3,060
Tesoro Mandan Refinery	279	257	250
Total Emissions from All Modeled Facilities in the State's Area of Analysis	3,266	3,630	3,310

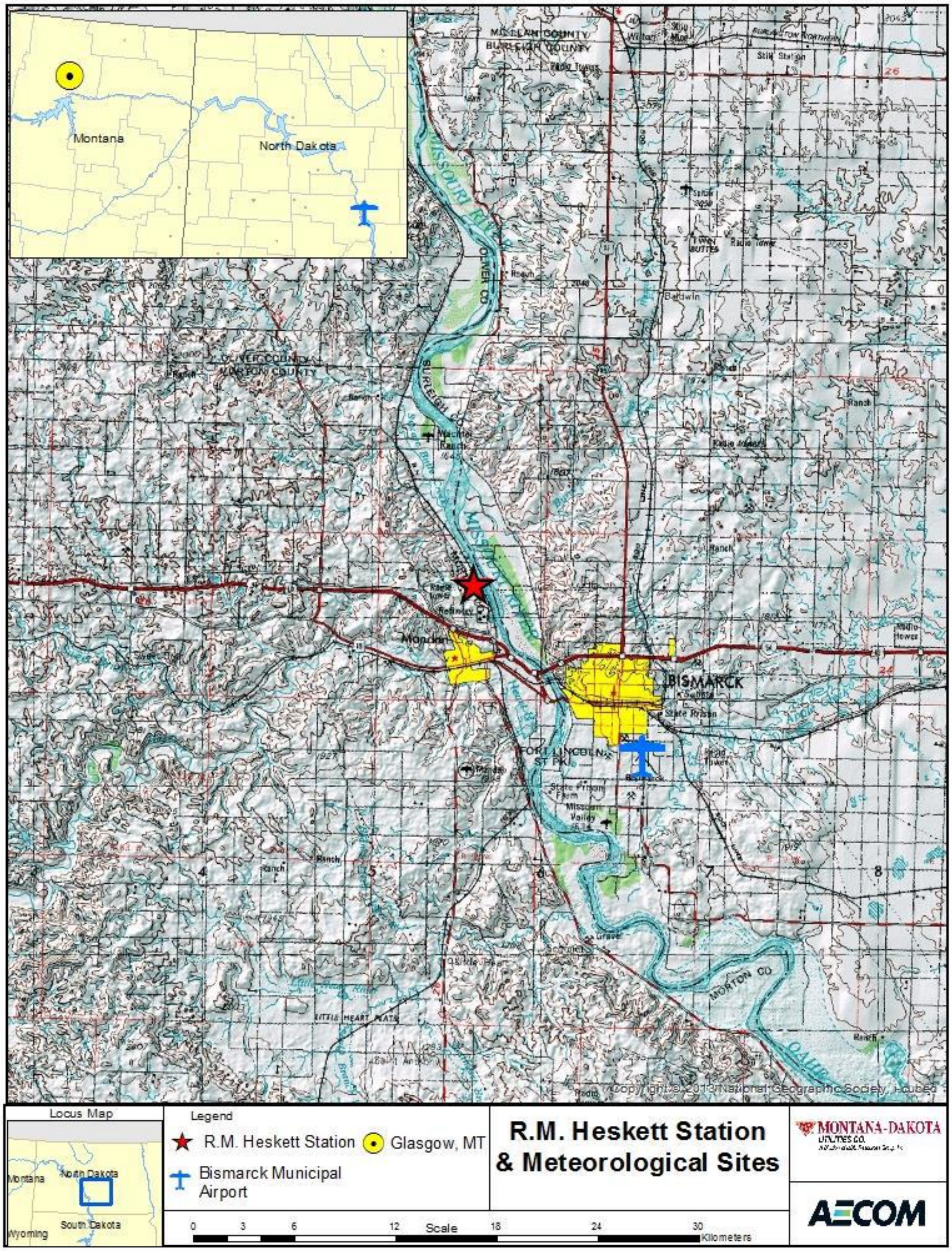
For both sources, the actual hourly emissions data were obtained from CEMs.

5.3.2.6.Modeling Parameter: Meteorology and Surface Characteristics

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

AERMET version 15181 was used to process the hourly meteorological data for the initial modeling analysis. In July 2017, the state provided EPA with updated modeling that used v16216 to address the issues associated with ADJ_U*. Hourly averaged surface observations and 1-minute/5-minute ASOS were processed from the Bismarck Municipal Airport (Bismarck, ND). AERMET was run utilizing three concurrent years (2013-2015) of hourly surface observations from the Bismarck Municipal Airport in Bismarck, ND, along with concurrent upper air data from Bismarck, ND. The hourly surface observations at Bismarck Municipal Airport routinely had at least 90 percent data capture. Missing upper air data from Bismarck, ND were substituted with data from Glasgow, MT. Figure 31 shows the locations of the meteorological stations in relation to the Heskett Station.

Figure 31. Map of Facilities and Monitoring Locations.

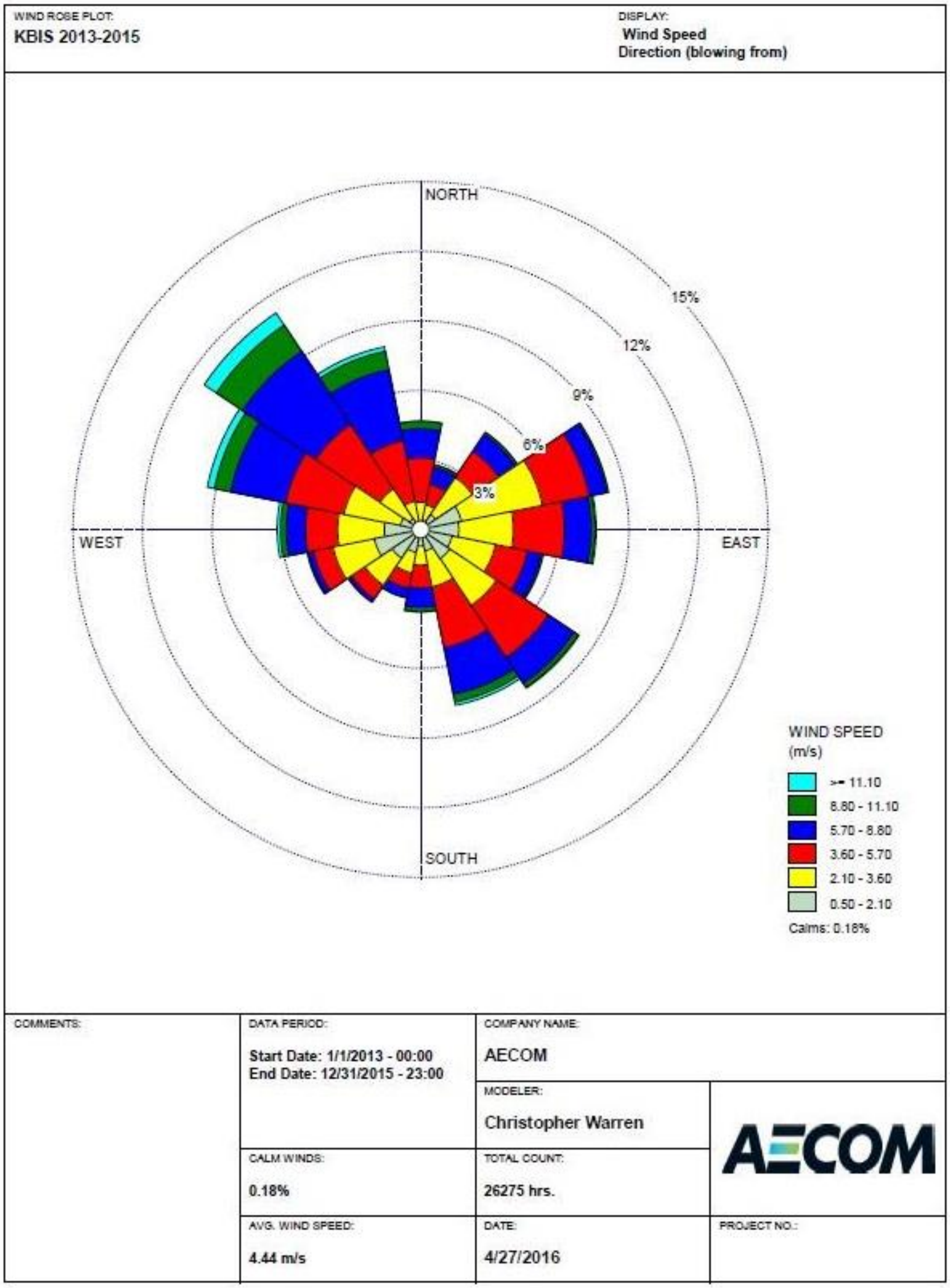


Hourly surface meteorological data records are read by AERMET, and include all the necessary elements for data processing. However, wind data taken at hourly intervals may not always portray wind conditions for the entire hour, which can be variable in nature. Hourly wind data may also be overly prone to indicate calm conditions, which are not modeled by AERMOD. In order to better represent actual wind conditions at the meteorological tower, one-minute ASOS (Automated Surface Observing System) wind data from the Bismarck Municipal Airport (Bismarck, ND) were processed using AERMINUTE (version 15272) into hourly data for input into AERMET. 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. A minimum threshold wind speed was not specified for the hourly wind speeds derived from the 1-minute data; therefore, no hours with a recorded wind speed above 0.0 m/s were treated as calm.

The 1-hour SO_2 characterization modeling was also conducted using AERMET with the ADJ_U* option. As described above, meteorological preprocessing with AERMET was originally performed using the beta ADJ_U* option in version 15181 and subsequently updated using the regulatory ADJ_U* option in version 16216. The error in version 15181 was not announced until the release of version 16216 on December 20, 2016 as part of the updated Appendix W Guideline final rule.

A surface wind rose for the entire 3-year period proposed for the modeling time period is shown in Figure 32. The wind rose shows that the dominate wind directions are from the northwest (about 12 percent of the time) and northeast and southeast (about 8 percent of the time). The average wind speed is about 5 m/s, where calm winds are about 0.18 percent of the time.

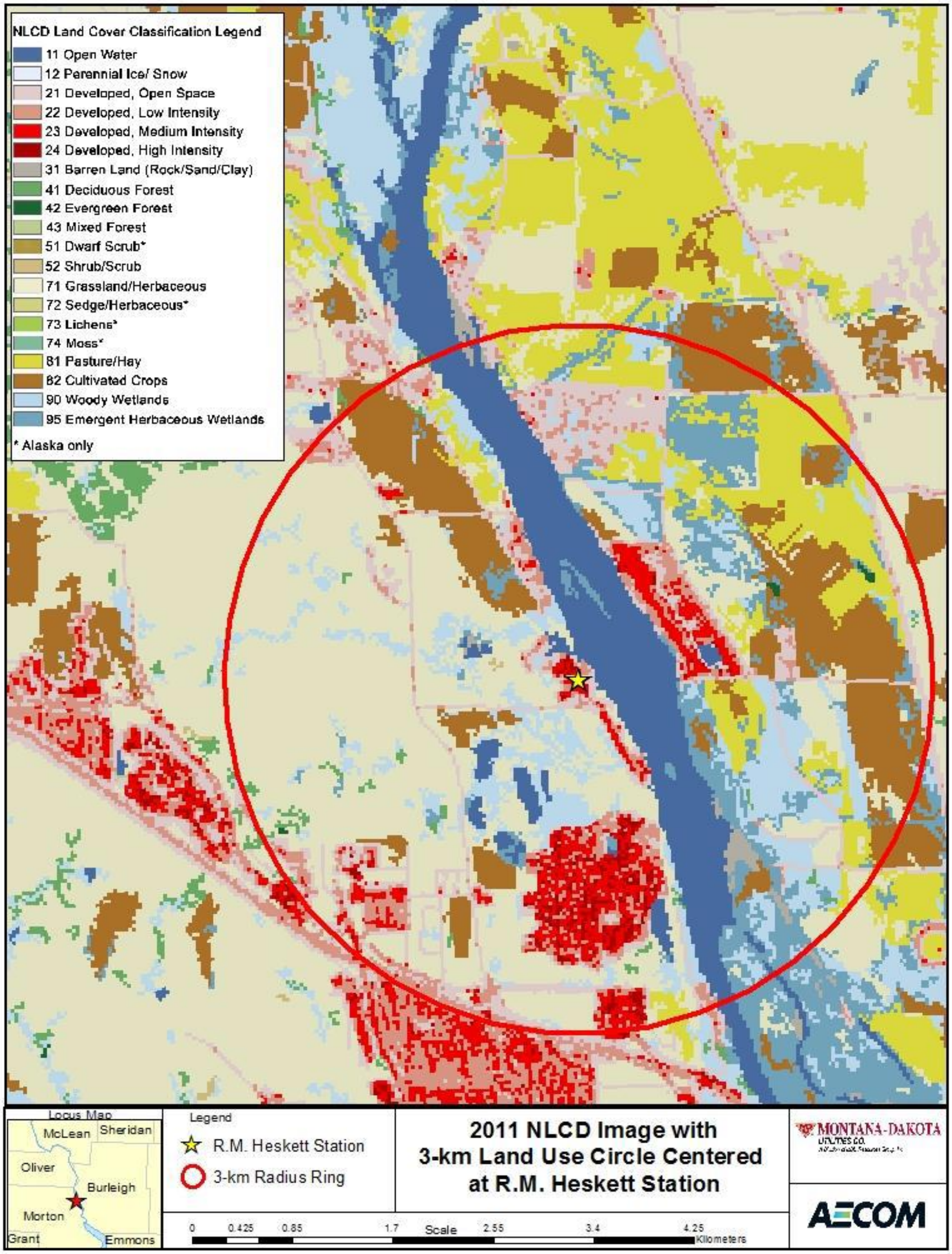
Figure 32. Wind Rose for Bismarck, Municipal Airport, ND, 2013-2015.



AERSURFACE (version 13016) was used to calculate the surface characteristics values, including albedo, Bowen ratio, and surface roughness length, at the surface meteorological observing site for input into AERMET. The 1992 National Land Cover Dataset (NLCD92) file for input into AERSURFACE was downloaded from the United States Geological Society (USGS) website. Figure 33 shows the 3-km circle centered at Heskett Station with aerial imagery. Figure 34 shows aerial image with 3-km radius centered on Heskett Station showing less than 50 percent compact residential and industrial development. For this application, AERMOD was run with rural dispersion as less than 10 percent of the area within 3 kilometers of Heskett is classified as developed (low, medium, and high intensity) (pink/red) as shown in the USGS National Land Cover Database (NLCD) (2011) imagery in Figure 34. Therefore, rural dispersion characterization was used for this modeling effort.

Figure 33. 3-km land use circle center at Heskett with aerial imagery.

Figure 34. 3-km land use circle center at Heskett with 2011 NLCD image.



The state estimated values in 30 degree sectors, equating to 12 spatial sectors out to a 1 km radius around the monitoring site for surface roughness. The Bowen ratio and albedo were determined based on the average characteristics, centered on the monitoring site. The surface parameters were determined on a monthly basis using default season assignments. Based on NDDH guidance, the "South Central" region seasonal classification was used:

- October, November, December, March = Late autumn after frost and harvest, or winter with no snow;
- January, February = Winter with continuous snow on ground;
- April, May = Transitional spring with partial green coverage or short annuals;
- June, July, August = Midsummer with lush vegetation; and
- September = Autumn with un-harvested cropland.

For Bowen ratio, the land use values are linked to three categories of surface moisture corresponding to average, wet and dry conditions. The surface moisture condition for the site may vary depending on the meteorological data period for which the surface characteristics will be applied. AERSURFACE applies the surface moisture condition for the entire data period. Therefore, if the surface moisture condition varies significantly across the data period, then AERSURFACE can be applied multiple times to account for those variations. As recommended in the AERSURFACE User's Guide, the surface moisture condition for each season was determined by comparing precipitation for the period of data to be processed to a recent 30-year record at Bismarck airport (1986 through 2015) precipitation records. This procedure selected "wet" conditions if precipitation was in the upper 30th percentile, "dry" conditions if precipitation was in the lower 30th percentile, and "average" conditions if precipitation was in the middle 40th percentile. Table 18 outlines the AERSURFACE bowen ratio condition designations.

Table 18. AERSURFACE bowen ratio condition designations.

Month	2013	2014	2015
January	Dry	Average	Wet
February	Average	Dry	Average
March	Average	Average	Dry
April	Wet	Wet	Dry
May	Wet	Dry	Wet
June	Average	Average	Wet
July	Dry	Dry	Dry
August	Average	Wet	Average
September	Wet	Dry	Dry
October	Wet	Dry	Average
November	Dry	Average	Average
December	Wet	Dry	Wet

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 Appendix W and the Modeling TAD in the processing of the raw meteorological data into an AERMOD-ready format, and used AERSURFACE to best represent surface characteristics.

The EPA supports the state's data and approach for developing the platform for the meteorological conditions as resubmitted using AERMOD version 16216.

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

As illustrated above, Bismarck is considered to be surrounded by complex terrain. To account for these terrain changes, the AERMAP terrain program (version 11103) 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. The EPA supports the state's approach for defining the terrain.

5.3.2.8. Modeling Parameter: Background Concentrations of SO_2

The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99^{th} percentile monitored concentrations by hour of day and season or month. For this area of analysis, the state utilized the tier 2 approach, where the background concentrations for this area of analysis were determined by the state to vary from seasonally.

Use of seasonal and hour-of-day varying background concentrations consistent with EPA guidance were used in the modeling analysis. The Bismarck Residential monitoring station (located at 1810 N 16th Street) concentrations observed during the 2013-2015 three-year period are listed in Table 19.

Table 19. Bismarck Residential Station 99th Percentile Hour of the Day and by Season Concentrations ($\mu g/m^3$).

Average	**0:00**	**1:00**	**2:00**	**3:00**	**4:00**	**5:00**	**6:00**	**7:00**	**8:00**	**9:00**	**10:00**	**11:00**
Winter	19.21	13.36	14.93	16.07	14.24	16.33	21.22	23.84	11.79	14.15	20.16	27.07
Spring	9.87	9.08	9.00	7.69	7.16	8.30	7.77	9.61	18.60	12.58	15.46	9.43
Summer	4.63	4.80	5.24	5.41	4.28	2.97	11.62	10.22	10.74	12.49	14.76	11.53
Fall	7.34	6.64	7.07	5.50	8.03	8.30	10.22	11.88	13.27	12.66	11.79	18.60
Average	**12:00**	**13:00**	**14:00**	**15:00**	**16:00**	**17:00**	**18:00**	**19:00**	**20:00**	**21:00**	**22:00**	**23:00**
Winter	21.66	27.16	24.98	18.60	20.26	18.17	14.76	17.47	23.41	20.26	18.95	19.13
Spring	10.04	12.49	11.18	11.35	8.47	10.22	7.77	9.96	7.60	7.51	8.73	7.16
Summer	8.91	7.34	5.59	6.72	7.07	6.03	5.85	5.59	4.37	4.10	4.02	4.37
Fall	15.55	12.49	11.62	13.45	14.41	10.13	12.31	8.21	14.06	7.34	6.29	6.38

EPA supports the state's approach for determining the background concentration.

5.3.2.9.Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Bismarck area of analysis are summarized below in Table 20.

Table 20: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Bismarck Area

Input Parameter	Value
AERMOD Version	Initial Modeling: 15181 (ADJ_U* option) Updated Modeling: 16216r (ADJ_U* option)
Dispersion Characteristics	Rural
Modeled Sources	2
Modeled Stacks	18
Modeled Structures	39
Modeled Fencelines	1
Total receptors	23,396
Emissions Type	Actual
Emissions Years	2013-2015
Meteorology Years	2013-2015
NWS Station for Surface Meteorology	Bismarck, ND
NWS Station Upper Air Meteorology	Bismarck, ND
NWS Station for Calculating Surface Characteristics	Bismarck, ND
Methodology for Calculating Background SO_2 Concentration	Tier 2 Bismarck Residence Monitor between 2013 and 2015.
Calculated Background SO_2 Concentration	2.97 to 27.16 $\mu g/m^3$

The results presented below in Table 21 show the magnitude and geographic location of the highest predicted modeled concentration based on the input parameters.

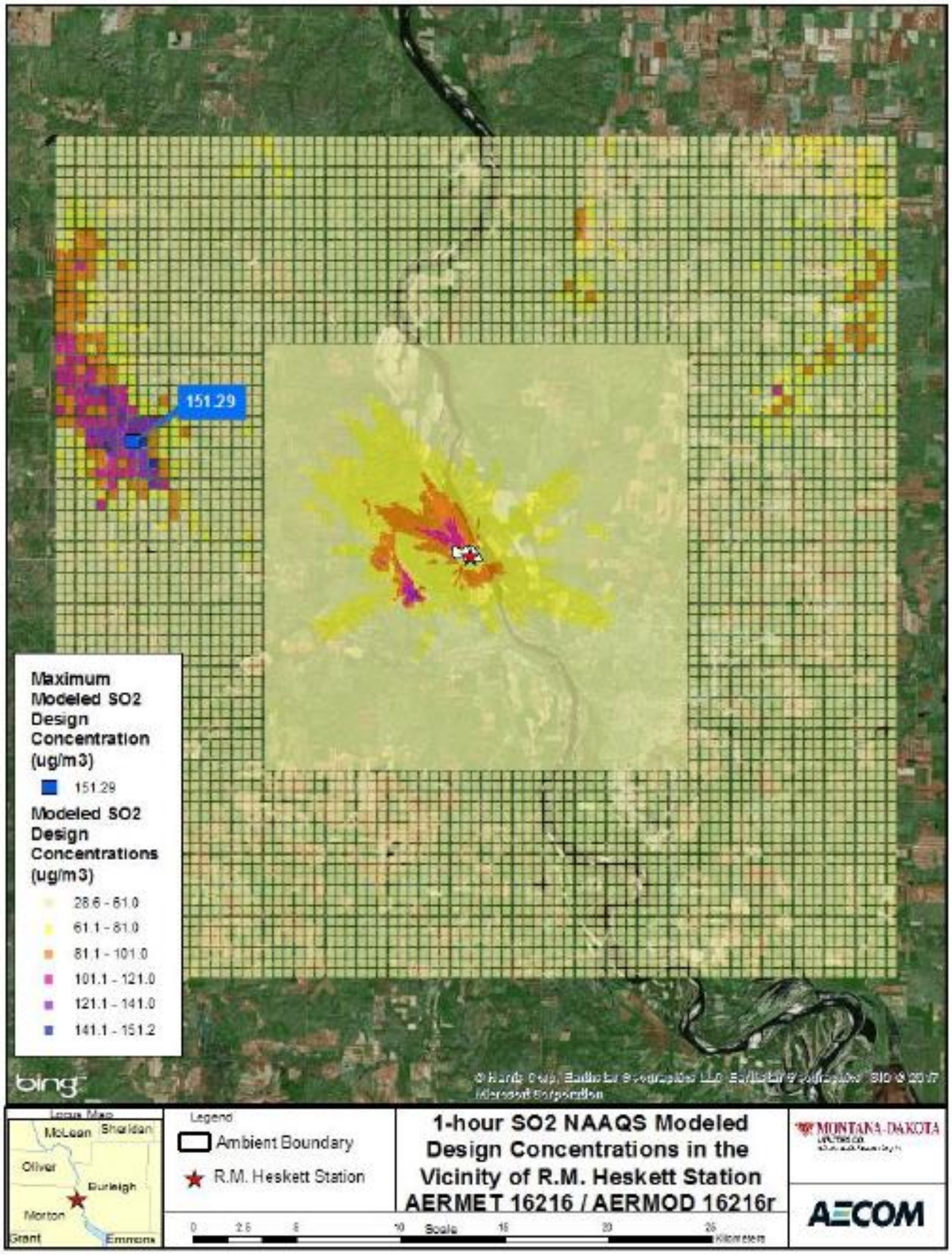
Table 21. Maximum Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Bismarck Area

Averaging Period	Data Period	Receptor Location		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM/Latitude	UTM/Longitude	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2013 - 2015	340431.50	5197388.50	156.33	196.4*

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

The state's modeling indicates that the highest predicted 99th percentile daily maximum 1-hour concentration within the chosen modeling domain is 156.33 $\mu g/m^3$, equivalent to 59.6 ppb. This modeled concentration included the background concentration of SO_2, and is based on actual emissions from the modeled facilities. Figure 35 below was included as part of the state's recommendation, and indicates that the predicted value occurred about 17 km northwest of the Heskett facility.

Figure 35: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Bismarck Area



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

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

The state's approach to conducting the dispersion modeling for the EPA's 1-hour SO_2 designations appears to align with the Modeling TAD. The state provided sufficient information to the EPA to determine that the methodology used to the conduct the modeling assessment was consistent with the Modeling TAD. The updated modeling provided to the EPA in July 2017 is sufficient to support designation decisions.

The EPA has not received any additional modeling assessments from NDDH or any other organizations.

5.4. Jurisdictional Boundaries in the Bismarck, North Dakota Area

Existing jurisdictional boundaries are considered for the purpose of informing the EPA's designation action for the Bismarck area. Our goal is to base designations on clearly defined legal boundaries, and to have these boundaries align with existing administrative boundaries when reasonable. As noted, the state did not supply specific boundary recommendations, but rather recommended that the EPA designate the area around the Heskett Station.

As shown in Figure 24, portions of the Bismarck, North Dakota metropolitan area are located in both Burleigh and Morton counties. The Heskett Station and Mandan Refinery are located next to the eastern border of Morton County (the Missouri River), near western Burleigh County. Figure 35 projects that SO_2 emissions from these two sources will impact both counties. There are other sources of SO_2 below 100 tpy elsewhere in Morton County. These sources were not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that these areas may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS. For these reasons, the EPA intends to designate both Burleigh and Morton counties using each respective county's borders as the designation boundary.

5.5. The EPA's Assessment of the Available Information for the Bismarck Area

The EPA has determined, based on our review of the updated modeling data provided by the state, that both Burleigh and Morton Counties meet the 2010 SO_2 NAAQS and do not contribute to any nearby area that does not meet the NAAQS, as there are no such areas near either county. For this reason, we intend to designate both counties as unclassifiable/attainment. The available SO_2 monitoring data in the area recorded a design value of 15 for 2014-2016. These monitoring data were available to EPA for consideration in the designations process, however, since it is unclear if these monitors are located in areas of maximum concentration, it is unclear if the data are representative of the area's actual air quality.

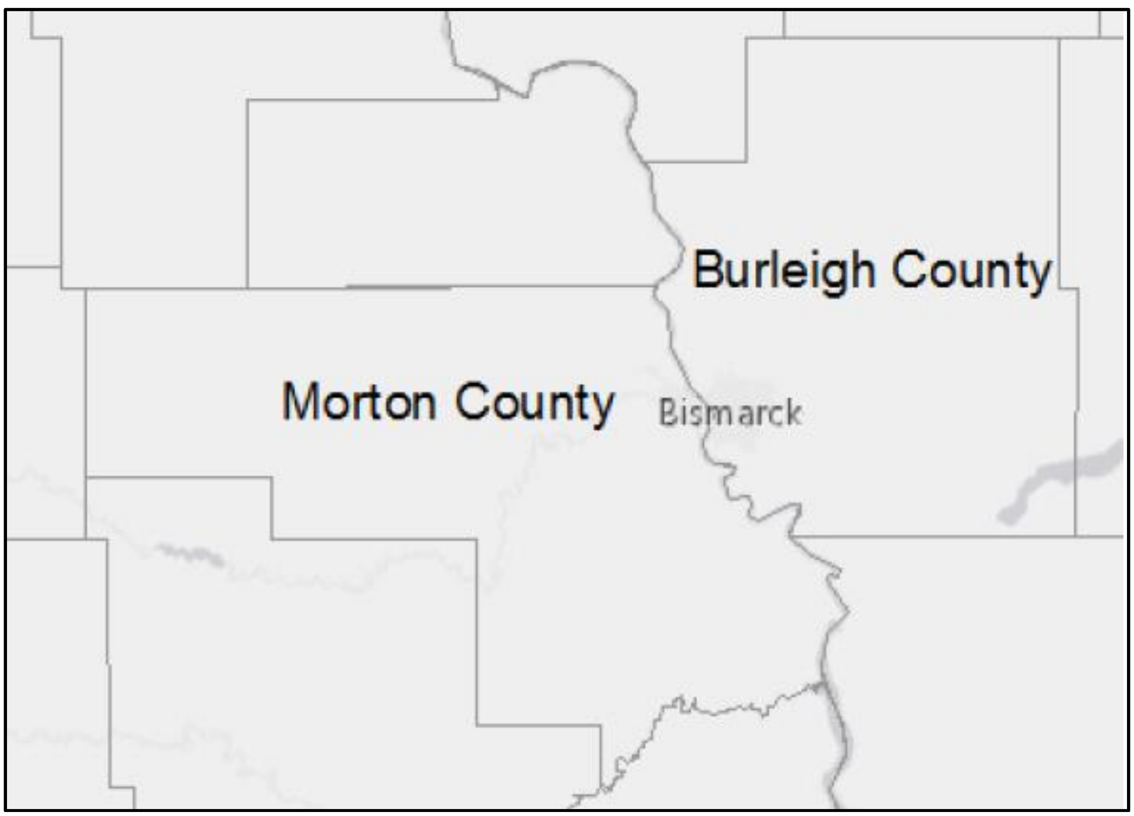
The EPA believes that our intended unclassifiable/attainment area, bounded by the outer borders of Burleigh County and Morton County, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area. The EPA is selecting full county designations because, apart from the Heskett Station and Mandan Refinery which the state explicitly modeled, there are no other sources required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that these areas may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

5.6. Summary of Our Intended Designation for the Bismarck, North Dakota Area

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate Bismarck, North Dakota, area as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of the outer borders of Burleigh County and Morton County.

Figure 36 shows the boundary of this intended designated area.

Figure 36. Boundary of the Intended Bismarck, North Dakota Unclassifiable/Attainment Area



At this time, our intended designations for the state only apply to this area and the other areas presented in this technical support document. The EPA intends in a separate action to evaluate and designate all remaining undesignated areas in North Dakota by December 31, 2020.

6. Technical Analysis for All Other North Dakota Counties Apart from Williams County

6.1. Introduction

The state has installed and begun timely operation of a new, approved SO_2 monitoring network meeting EPA specifications referenced in EPA's SO_2 DRR for a source of SO_2 emissions in Williams County. Accordingly, the EPA must designate all other areas in North Dakota by December 31, 2017. At this time, there are no air quality modeling results available to the EPA for these areas. In addition, there is no air quality monitoring data that indicate any violation of the 1-hour SO_2 NAAQS. The EPA intends to designate all other previously undesignated areas in the state as "unclassifiable/attainment" since these areas were not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS.

Table 22. Remaining Areas of the State that the EPA Intends to Designate Unclassifiable/Attainment

County or Partial County (p)	North Dakota's Recommended Area Definition	North Dakota's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Remaining Undesignated Areas to Be Designated in this Action*	Full County	Attainment	Full County	Unclassifiable/Attainment

* Includes portions of Indian Country located in the area.

Table 22 also summarizes North Dakota's recommendations for these areas. Specifically, the state recommended that the entire state apart from Williams County be designated as attainment based on all of the available monitoring data in the state indicating attainment of the SO_2 NAAQS. After careful review of the state's assessment, supporting documentation, and all available data, the EPA intends to designate the areas as unclassifiable/attainment.

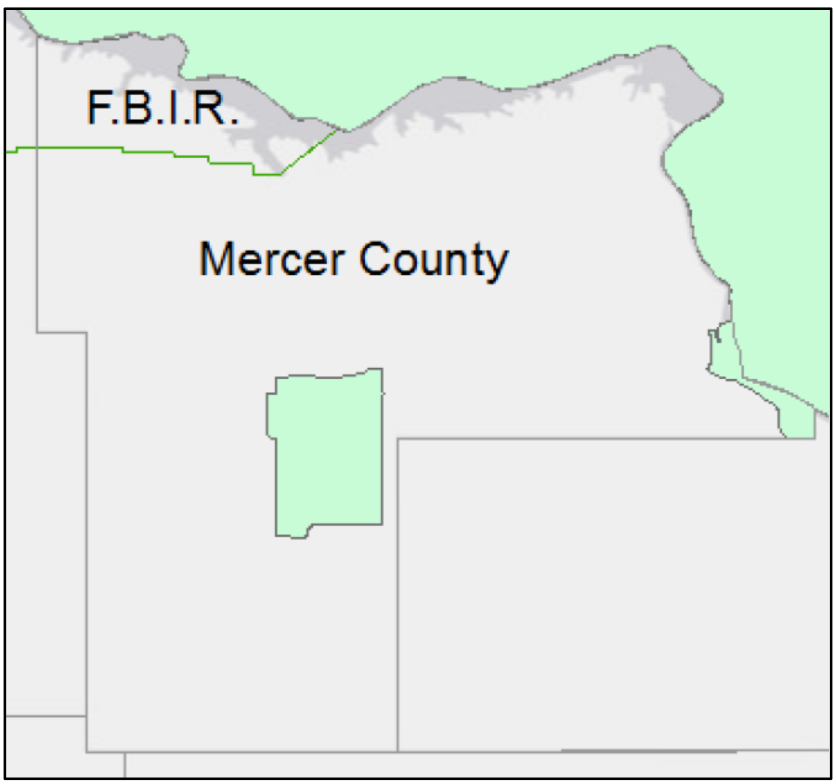
As referenced in the Introduction (see Table 2), the county associated with the source for which North Dakota has installed and begun timely operation of a new, approved SO_2 monitoring network (Williams County) is required to be designated by December 31, 2020, but is not being addressed at this time. Counties previously designated in Round 2 (*See* 81 *Federal Register* 45039) will remain unchanged unless otherwise noted.

6.2. The EPA's Assessment of the Available Information for the All North Dakota Counties Apart from Williams County

These counties were not required to be characterized under 40 CFR 51.1203(c) or (d) and the EPA does not have available information including (but not limited to) appropriate modeling analyses and/or monitoring data that suggests that the area may (i) not be meeting the NAAQS, or (ii) contribute to ambient air quality in a nearby area that does not meet the NAAQS. These counties therefore meet the definition of an "unclassifiable/attainment" area. Therefore, the EPA intends to designate all undesignated areas of the state apart from the three areas described in the previous sections of this TSD and Williams County as a single unclassifiable/attainment for the 2010 SO_2 NAAQS.

The EPA intends to include the portion of Mercer County containing the Fort Berthold Indian Reservation ("F.B.I.R." in Figure 37, below) in this "rest of state" unclassifiable/attainment area.

Figure 37. Portion of Mercer County containing the Fort Berthold Indian Reservation



Our intended unclassifiable/attainment area, which includes all remaining undesignated areas of the state that have not been addressed via modeling in the earlier section of this document apart from Williams County, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended unclassifiable/attainment area.

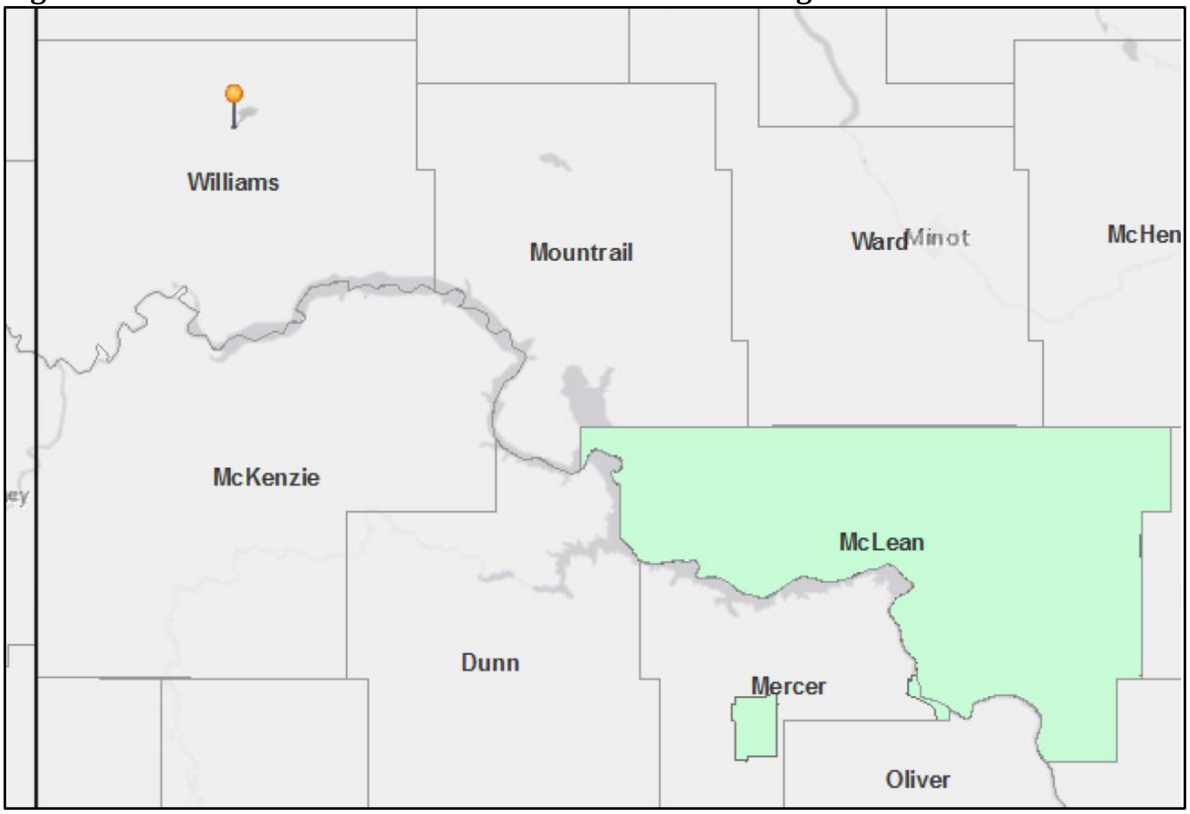
As noted, the EPA does not intend to designate Williams County, North Dakota, in this round of designations. In Williams County, the state has installed a new SO_2 monitor and retained and converted a former industrial monitor into a regulatory monitor.

6.3. Summary of Our Intended Designation for All Other North Dakota Counties Apart from Williams County

After careful evaluation of the state's recommendation and supporting information, as well as all available relevant information, the EPA intends to designate all remaining undesignated portions of North Dakota not addressed in the earlier sections of this document apart from Williams County as unclassifiable/attainment for the 2010 SO_2 NAAQS. Specifically, the boundaries are comprised of the remaining undesignated portions of the state not addressed in the earlier sections of this document, apart from Williams County.

Figure 38 shows the only previously designated portions of North Dakota, which consist of McLean County and portions of Mercer County, in green. Figure 38 also shows Williams County (see orange pinpoint). These are the only areas of the state that the EPA does not intend to designate in this round.

Figure 38. Portions of North Dakota the EPA will not Designate in this Round



At this time, our intended designations for North Dakota apply to all undesignated areas of the state apart from Williams County, which the EPA intends to evaluate and designate by December 31, 2020.