

# **Annual Report**

## **North Dakota Ambient Air Quality Monitoring Program**

### **Network Plan/Assessment with Data Summary**

**2020**



Environmental Quality

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## **North Dakota Ambient Monitoring Network Plan/Assessment With Data Summary 2020**

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NORTH  
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## ACRONYMS AND ABBREVIATIONS

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- AQM – Ambient Air Quality Monitoring
- AQS – Air Quality System
- BAM – Beta Attenuation Particulate Monitor
- BART – Best Available Retrofit Technology
- CFR – Code of Federal Regulations
- CO – Carbon Monoxide
- CSN – Chemical Speciation Network
- DRR – Data Requirements Rule
- EPA – United States Environmental Protection Agency
- FEM – Federal Equivalent Method
- FRM – Federal Reference Method
- GIS – Geographic Information System
- H<sub>2</sub>S – Hydrogen sulfide
- H<sub>2</sub>SO<sub>3</sub> – Sulfurous acid
- H<sub>2</sub>SO<sub>4</sub> – Sulfuric acid
- HAP – Hazardous Air Pollutant
- IMPROVE – Interagency Monitoring of Protected Visual Environments
- MSA – Metropolitan Statistical Area
- NAAMS – National Ambient Air Monitoring Strategy
- NAAQS – National (also North Dakota) Ambient Air Quality Standards
- NCore – National Core Monitoring Network
- NH<sub>3</sub> – Ammonia
- NO – Nitric oxide
- NO<sub>2</sub> – Nitrogen dioxide
- NO<sub>x</sub> – Oxides of Nitrogen
- NO<sub>y</sub> – Total Reactive Nitrogen
- NPS – National Park Service
- NTN – National Trends Network
- NWR – National Wildlife Refuge
- O<sub>3</sub> – Ozone
- PM – Particulate Matter
- PM<sub>10</sub> – Particulate Matter less than 10 microns in diameter
- PM<sub>2.5</sub> – Particulate Matter less than 2.5 microns in diameter (fine particulate matter)
- PM<sub>10-2.5</sub> – Particulate Matter between 2.5 and 10 microns in diameter (coarse particulate matter)
- ppb – parts per billion
- PSD – Prevention of Significant Deterioration
- SLAMS – State and Local Air Monitoring Stations
- SO<sub>2</sub> – Sulfur dioxide
- SPM – Special Purpose Monitoring
- STN – Speciation Trends Network
- TAD – Technical Assistance Document
- Teledyne T640 – Light Sensing PM Monitor
- TEOM – Tapered Element Oscillating Microbalance
- TRNP – Theodore Roosevelt National Park (NU – North Unit; SU – South Unit at Painted Canyon)
- TPY – Tons Per Year
- UV – Ultraviolet
- VOC – Volatile Organic Compound

## 1.0 INTRODUCTION

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The North Dakota Department of Environmental Quality (Department), Division of Air Quality (Division)<sup>1</sup>, has the primary responsibility of protecting the health and welfare of North Dakotans from the detrimental effects of air pollution. Toward that end, the Division ensures that the ambient air quality in North Dakota is maintained in accordance with the levels established by the state and federal Ambient Air Quality Standards (NAAQS)<sup>2</sup> and the Prevention of Significant Deterioration of Air Quality (PSD) Rules.

To carry out this responsibility, the Division operates and maintains a network of ambient air quality monitoring (AQM) sites throughout the state<sup>3</sup>.

The Division conducts an annual review of the network to determine if all federal monitoring requirements as set forth in 40 CFR 58<sup>4</sup> are being met. This document is an account of the review and demonstrates that siting and operation of each monitor in the network meets the requirements of appendices A, B, C, D, and E of the part, where applicable. The annual review also serves to identify any network modifications that are necessary to meet federal requirements. Modifications could include the establishment of new sites, relocation of sites to more appropriate areas, or the removal of sites where the original justification for the site no longer exists. Modifications described in this report are proposed for a period within 18 months of report publication.

Additionally, every five years the Division completes a longer-range assessment to assure that the network has and will continue to meet all its monitoring obligations. The five-year assessment allows for the evaluation of future possible expansions or retractions of the network and the possible incorporation of new technologies.

Each year, the Division completes a data summary report for the previous 12-month data collection season. In the past, this report was issued as a separate document from the network review. Upon inspection, it was found that much of the information included in the data summary report duplicates what was included in the network review. To avoid a doubling-up of effort, beginning in 2015, the data summary for state run AQM sites was combined with the network review resulting in one single comprehensive annual report document<sup>5</sup>.

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<sup>1</sup> See Appendix A of this document for an organizational chart for the Division.

<sup>2</sup> See Appendix B of this document for a summary table of all applicable federal and state ambient air quality standards.

<sup>3</sup> See Appendix C of this document for a full description for each site, site photographs, and a site map.

<sup>4</sup> The Code of Federal Regulations - 40 CFR 58 was promulgated by the Environmental Protection Agency (EPA) on October 17, 2006 and updated effective April 27, 2016.

<sup>5</sup> This document is subject to 30 days of public comment before finalization. See Appendix E of this document for applicable public comments received.

## 1.1 Site Selection

### 1.1.1 Monitoring Objectives

The AQM network consists of a number of individual sites located throughout North Dakota which host the equipment needed to measure pollution concentrations in the air. The process of selecting a monitoring site begins by identifying a monitoring objective. Appendix D of 40 CFR 58 defines the six basic monitoring objectives used to choose the locations of sites in a monitoring program:

- To determine the highest pollutant concentrations expected to occur in an area covered by the network.
- To determine representative concentrations of pollutants in areas of high population density.
- To determine the impact on ambient pollution levels by a significant source or source categories<sup>6</sup>.
- To determine the general/background concentration levels of a given pollutant.
- To determine the impact on air quality by regional transport<sup>7</sup> of pollutants.
- To determine the welfare-related impacts (such as impacts on visibility and vegetation) of pollution.

### 1.1.2 Spatial Scale

Once an objective for a site has been identified, a spatial scale is chosen. EPA has defined a set of spatial scales based on physical dimensions that, given a particular objective, would be likely to have similar pollutant concentrations throughout. These are:

- **Micro-scale**
  - Dimensions ranging from several meters up to about 100 meters.
- **Middle Scale**
  - Areas up to several city blocks in size with dimensions ranging from about 100 meters to 0.5 km.
- **Neighborhood Scale**
  - City areas of relatively uniform land use with dimensions of 0.5 to 4.0 km.

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<sup>6</sup> Sources of interest could be point sources (a major industrial facility), area sources (a number of smaller emissions sources that collectively impact ambient air quality), or mobile sources (automobiles on a busy roadway or non-road sources including aircraft, construction vehicles, farm equipment, etc.)

<sup>7</sup> In this case, regional transport refers to the movement of air pollutants that originate from sources outside the borders of North Dakota into areas within the state.

- **Urban Scale**
  - Overall, city-wide dimensions on the order of 4 to 50 km (Usually requires more than one site for definition).
- **Regional Scale**
  - Rural areas of reasonably homogeneous geography covering from 50 km to hundreds of km.
- **National or Global Scale**
  - The entire nation or greater.

The relationships between monitoring objectives and spatial scales, as specified by EPA, are as follows:

Monitoring Objective	Appropriate Siting Scales
Highest Concentration	Micro, middle, neighborhood, (sometimes urban or regional for secondarily formed pollutants).
Population Oriented	Neighborhood, urban.
Source Impact	Micro, middle, neighborhood.
General/Background	Urban, regional.
Regional Transport	Urban, regional.
Welfare-related Impacts	Urban, regional.

Spatial scales appropriate to the criteria pollutants monitored in North Dakota are shown below<sup>8</sup>:

Criteria Pollutant	Spatial Scales
Inhalable Particulate	Micro, middle, neighborhood, urban, Regional.
Sulfur Dioxide	Middle, neighborhood, urban, regional.

<sup>8</sup> Carbon monoxide (CO) is also monitored at the North Dakota National Core (NCore) site in order to meet federal requirements. Appendix D to 40 CFR 58 does not identify an urban spatial scale (4 to 50 kilometers) for Carbon monoxide because this pollutant is primarily associated with automobile traffic on a neighborhood or smaller scale. However, because the CO monitor is present to satisfy NCore specific requirements, it has historically been considered by the Department to be an urban scale monitor in alignment with the other monitors at the site.

Ozone

Middle, neighborhood, urban, regional.

Nitrogen Dioxide

Middle, neighborhood, urban.

A good understanding of the appropriate monitoring objective and spatial scale permits a site location to be chosen. Using these criteria to locate sites allows for an objective approach, ensures compatibility among sites, and provides a common basis for data interpretation and application. The annual review process involves assessing each site and associated monitors to confirm that all still meet their intended purpose. Sites and/or monitors that no longer satisfy the intended purpose are either discontinued or modified accordingly.

## 1.2 General Monitoring Needs

Each air pollutant has certain characteristics that must be considered when establishing a monitoring site. These characteristics may result from:

- (A) Variations in the number and types of sources and emissions in question;
- (B) Reactivity of a particular pollutant with other constituents in the air;
- (C) Local site influences such as terrain and land use; and
- (D) Climatology.

The Department's AQM network is designed to monitor air quality data for six basic objectives:

- (1) Monitoring of criteria pollutant background concentrations;
- (2) Quantifying population exposure to pollutants;
- (3) Monitoring significant sources of pollutants or class category;
- (4) Long-range transport of pollutants
- (5) Regional haze; and
- (6) Air quality characterization for attainment designations.

The 2008 National Ambient Air Monitoring Strategy (NAAMS<sup>9</sup>) establishes a monitoring site classification system for the national AQM network. State and Local Monitoring Stations (SLAMS) make up the primary component for determining criteria pollutant NAAQS compliance. The Department operates nine ambient air quality monitoring sites in North Dakota (Figure 1). A tenth site, the Theodore Roosevelt National Park – South Unit site at Painted Canyon (TRNP – SU), is operated by the Department in partnership with the National Park Service (NPS). All of the state operated sites and the partnership site at Painted Canyon have been designated SLAMS sites<sup>10</sup>. Additionally, two sites (Hess Tioga Station A – South and Station B – North) have been established as SLAMS-like sites<sup>11</sup> in order to characterize air quality in Williams County in response to the

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<sup>9</sup> U.S. EPA (2008). Ambient Air Monitoring Strategy for State, Local, and Tribal Air Agencies. Available via link at: [www.epa.gov/ttn/amtic/monstratdoc.html](http://www.epa.gov/ttn/amtic/monstratdoc.html).

<sup>10</sup> See Appendix C of this report for specific information on the location of each monitoring site.

<sup>11</sup> Monitors operated in a manner equivalent to SLAMS as to meet all applicable requirements of 40 CFR 58,



Data Requirements Rule (DRR) for the 2010 1-hour SO<sub>2</sub> standard. These two sites are operated by industry overseen by the Department.

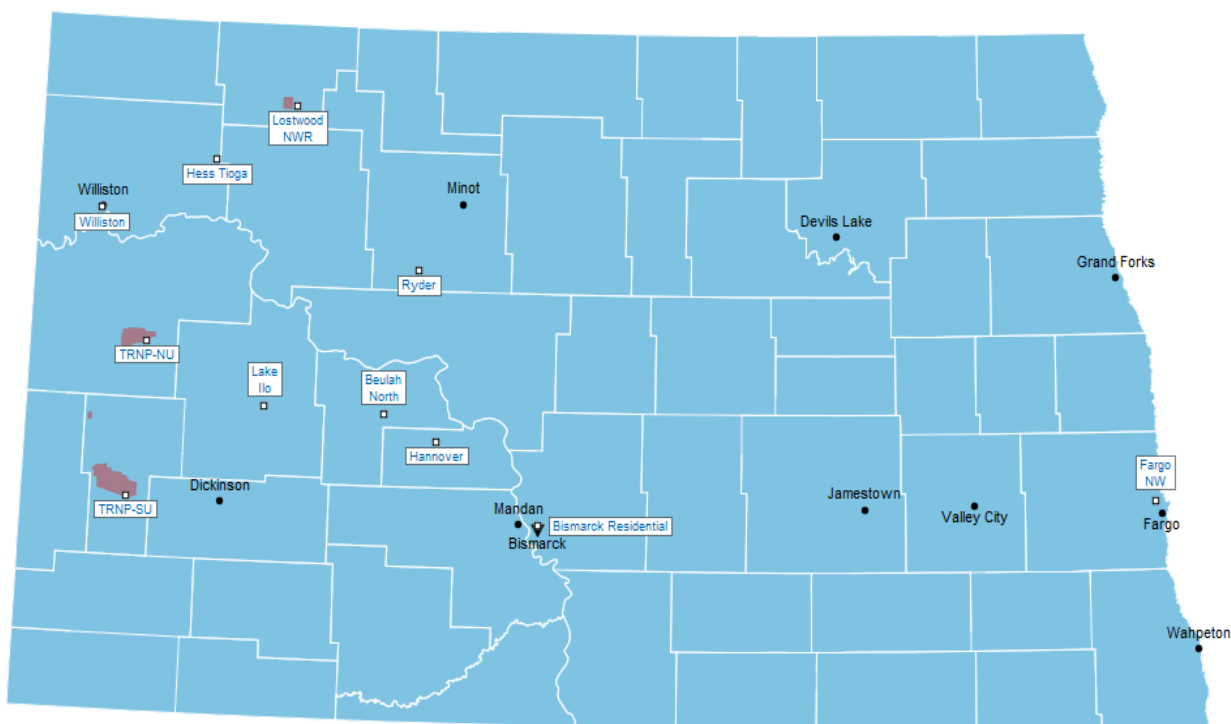


Figure 1. North Dakota Ambient Air Quality Monitoring Sites  
(Indicated with White Labels)

A National Core (NCore) site is one in a network of approximately 80 multi-pollutant monitoring sites throughout the United States designed to support specific EPA core monitoring objectives in public reporting, emissions trends tracking, and NAAQS compliance evaluation. Each state is required to have one or more NCore designated sites. In addition to being a SLAMS site, EPA has approved the Department's and has designated the Bismarck Residential site as the required NCore site in North Dakota<sup>12</sup>.

The Bismarck site is also a part of EPA's Chemical Speciation Network (CSN) as a trends site. The Speciation Trends Network (STN; a subset of the CSN) was established to monitor long term trends in concentration of selected particulate matter constituents. The NAAMS document provides additional information regarding these national networks.

appendices A, C, and E, and subject to the data certification and reporting requirements of 40 CFR 58.15 and 58.16.

<sup>12</sup> Previously the Fargo NW site was the North Dakota designated NCore site.

### 1.3 Network Monitoring Objectives

As described in section 1.1, each monitoring site is selected to satisfy certain monitoring objectives. Additionally, 40 CFR 58 outlines certain conditions whereby EPA has determined a particular type of monitor is required to satisfy a given monitoring objective. The monitoring sites in North Dakota can be divided into three categories: 40 CFR 58 required (3 sites), supplemental (7 sites), and 40 CFR 51 DRR required (2 sites). Department's three required Part 58 sites are:

The **Bismarck** monitoring site lies in the second largest metropolitan area in North Dakota. Bismarck is the designated NCore and Chemical Speciation Trends site. This site is designed to satisfy the requirements of 40 CFR 58 Appendix D 3.0 – Design Criteria for NCore Sites, and 4.7 - Fine Particulate Matter (PM<sub>2.5</sub>) Design Criteria.

The **Fargo NW** site has been designated a population orientated site because the city of Fargo is the largest population center in North Dakota and five major emissions sources are located in the area. The data from the Fargo site are used in dispersion modeling to evaluate construction and operating permit applications for projects located in the eastern part of the state. Additionally, Fargo monitors meet the requirement of 40 CFR 58 Appendix D 4.4 – Sulfur Dioxide (SO<sub>2</sub>) Design Criteria.

The **Theodore Roosevelt National Park North Unit (TRNP-NU)** site is used to evaluate background concentrations, long-range transport, and welfare-related impacts of pollutants. Monitors at this site help to meet the requirements of 40 CFR 58 Appendix D subpart 4.7 - Fine Particulate Matter (PM<sub>2.5</sub>) Design Criteria.

The seven supplemental sites are used to support air dispersion model calibration and/or validation and to supplement data collected at the required sites. Monitoring objectives for the entire network is outlined in Table 1.

Background, welfare-related and long-range transport sites are chosen to determine concentrations of air contaminants in areas remote from urban sources. These are generally sited using the regional spatial scale. Once a specific location is selected for a site, the site is established in accordance with the specific sitting criteria specified in 40 CFR 58, Appendices A, C, D and E.

The Department evaluates any monitoring requirements and site changes needed to support the visibility regulations in 40 CFR 51.300, 40 CFR 51.308 (visibility and regional haze rules) and 40 CFR 51, Appendix Y (Best Available Retrofit Technology, BART).

Table 1. Ambient Air Quality Network Description

Site Name AQS* Site Number		Parameter Monitored									Monitoring Objective	
		CO	NO <sub>2</sub>	O <sub>3</sub>	Manual PM <sub>2.5</sub>	Continuous PM <sub>2.5</sub>	Continuous PM <sub>10</sub>	SO <sub>2</sub>	PM <sub>fine</sub> Speciation	NO <sub>y</sub>	Wind Speed & Direction	
1	Beulah North 380570004		★	★		★	★	★			★	Population Exposure & Significant Source
2	Bismarck Residential 380150003	★	★	★	★	★	★	★	★	★	★	Population Exposure (NCore)
3	Lake Ilo 380250004		★	★		★	★	★			★	General Background
4	Fargo NW 380171004		★	★		★	★	★			★	Population Exposure
5	Hannover 380650002		★	★		★	★	★			★	Source Impact
6	Lostwood NWR 380130004		★	★		★	★	★			★	General Background & Significant Source
7	Painted Canyon 380070002			★		★		★			★	General Background
8	Ryder 381010003		★	★		★	★	★			★	Population Exposure & Long-range Transport
9	TRNP – NU 380530002		★	★		★	★	★			★	General Background, Long-range Transport, & Welfare-related
10	Williston 381050003			★		★	★				★	Population Exposure
11	Hess Tioga B – NE 381050106							★			★	Source Specific, DRR air quality characterization
* Air Quality System – EPA’s computer database and information system of ambient air quality data.												

## 2.0 AMBIENT AIR MONITORING NETWORK COVERAGE

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The ambient air quality monitoring sites in the state are positioned to satisfy the monitoring objectives (described in Section 1.3 of this report), to collect data to support dispersion modeling activities relating to visibility/regional haze and source permit evaluation, and to compare to the State and Federal ambient air quality standards.

The NAAQS<sup>13</sup> are established by EPA in order to meet the requirements of the Clean Air Act and address concentrations of six criteria pollutants in the ambient air. The following sections describe the pollutants and outline state monitoring efforts with respect to each pollutant. Monitoring results in relation to the NAAQS are presented in each section. Additionally, Appendix D of this document includes wind and pollution roses for each monitoring site.

### 2.1 Carbon Monoxide

Carbon monoxide (CO) is an odorless, colorless, and toxic gas. Worn or poorly adjusted and maintained combustion devices (e.g. boilers and furnaces), or those with improperly sized, blocked, disconnected, or leaking flues, can be significant sources of CO. Auto, truck, or bus exhaust can also be a source of CO. Many large urban areas in the United States have problems attaining the NAAQS for CO where the primary source of CO is automobiles. To date, North Dakota does not have large population centers with the corresponding traffic congestion and geographical/meteorological conditions to create significant CO emissions issues. However, there are several stationary sources in the state that emit more than 100 tons per year (TPY) of CO.

The effects of CO exposure can vary greatly from person to person depending on age, overall health and the concentration and length of exposure. At lower levels of exposure, CO causes mild effects that are often mistaken for a cold or the flu virus. These symptoms include headaches, dizziness, disorientation, nausea, and fatigue. In individuals with heart disease, chest pain may be a symptom. At moderate concentrations, angina, impaired vision, and reduced brain function may result. At very high concentrations, CO exposure can be fatal. Acute effects are due to the formation of carboxyhemoglobin in the blood, which inhibits oxygen intake.

#### 2.1.1 Point Sources

The major stationary CO sources (>100 TPY) are listed in Table 2. Figure 2 shows the approximate locations of these facilities (the numbers correspond to the site and source tables). Most of these sources are the same sources that are the major emitters of sulfur dioxide and oxides of nitrogen. However, the corresponding CO levels from these sources are considerably lower.

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<sup>13</sup> Appendix B.

### 2.1.2 Monitoring Network

A five-year CO monitoring study concluded in 1994. The data produced by this study led the Department to determine that ambient concentrations of CO within the state were well below the NAAQS and exceedances were unlikely. Based on this, CO monitoring in ND was suspended. Between 2009 and early 2016, the Department operated a Trace Level CO analyzer at the Fargo NW site in order to comply with the NCore requirements. Trace Level CO analysis began in Bismarck upon relocation of the NCore site from Fargo to Bismarck. The 2017 monitoring campaign was the first full year of CO data for the Bismarck NCore site, Figure 3 shows CO concentrations at Bismarck in comparison to the 1- and 8-hour NAAQS for the data that was collected.

### 2.1.3 Network Changes

There were no significant changes made to the CO monitoring network in 2019. There are no changes planned for 2020.

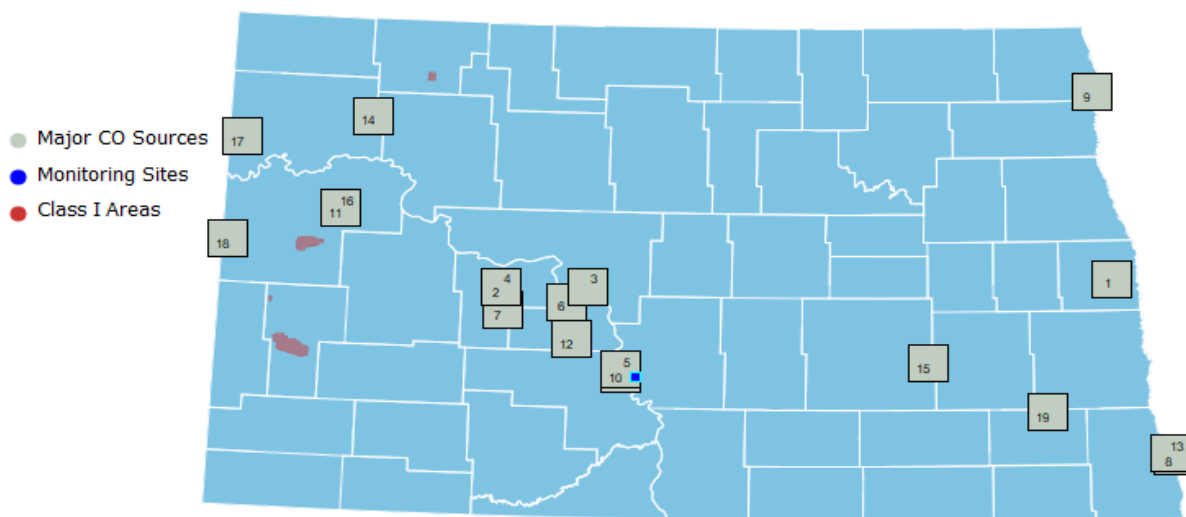


Figure 2. Major CO Sources in 2019

Table 2. Major CO Sources ( $\geq 100$  TPY) in 2018

#	COMPANY	SOURCE	EIS Facility ID
1	American Crystal Sugar Company	Hillsboro Plant	7939011
2	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
3	Great River Energy	Coal Creek Station	8011011
4	Basin Electric Power Cooperative	Antelope Valley Station	8086511
5	Montana Dakota Utilities Company	RM Heskett Station	8087011
6	Basin Electric Power Cooperative	Leland Olds Station	8086311
7	OtterTail Power Company	Coyote Station	8086611
8	Minn-Dak Farmer's Cooperative	Wahpeton Plant	7924011
9	American Crystal Sugar Company	Drayton Plant	7923811
10	Tesoro Refining and Marketing Company	Mandan Refinery	7923611
11	Oasis Midstream	Wild Basin Gas Processing	N/A
12	Minnkota Power Cooperative, Inc.	Milton R. Young Station	8087911
13	Cargill Corn Milling	Wahpeton Facility	10612711
14	Hess Tioga Gas Plant LLC	Tioga Gas Plant	8013911
15	Great River Energy	Spiritwood Station	16937511
16	ONEOK Rockies Midstream, LLC	Garden Creek Gas Plant	N/A
17	ONEOK Rockies Midstream, LLC	Stateline Gas Plant	N/A
18	ONEOK Rockies Midstream, LLC	Grasslands Gas Plant	808551
19	Northern Sun, AMD Co.	Enderlin Facility	7923911

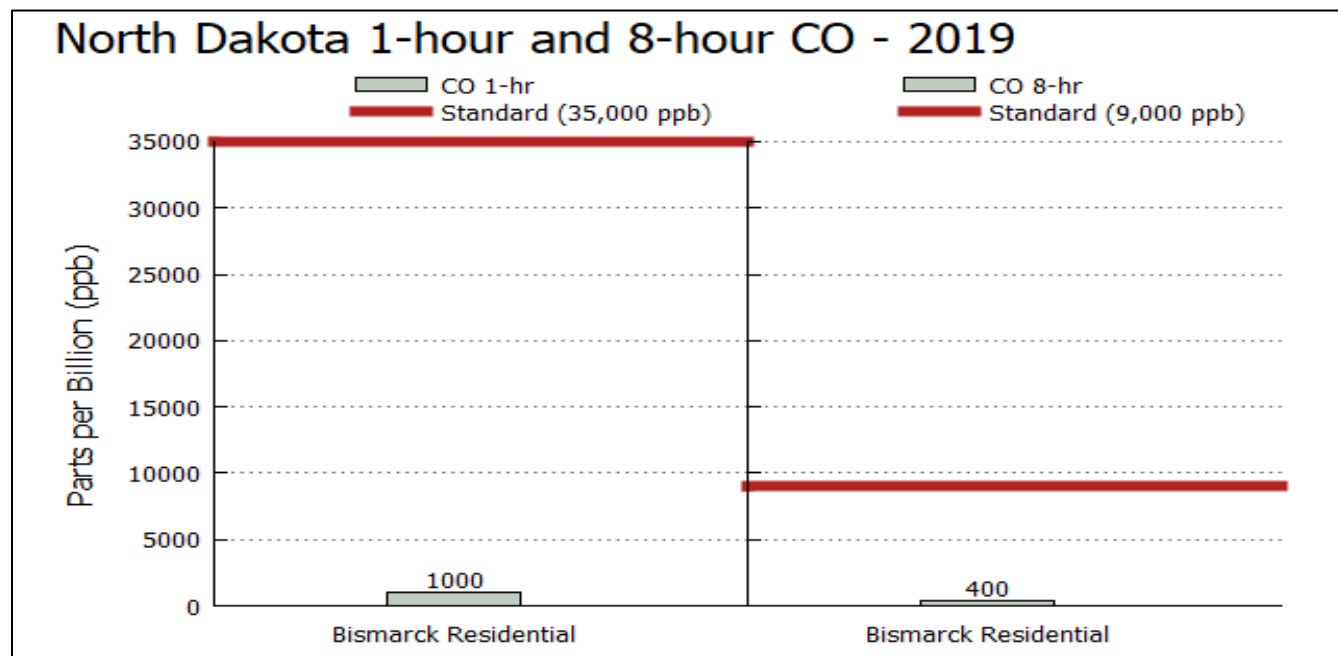


Figure 3. CO Concentrations (2<sup>nd</sup> high) Compared to the 1-hour and 8-hour Standards

## **2.2 Lead**

Lead is a heavy metal that can be emitted through some heavy industrial manufacturing processes, including metals processing. Lead is also used as a fuel additive to increase engine performance and reduce valve wear. Although phased out of general use in the United States for on-road automobile and truck fuel in the 1970s, lead additive is still used in some aviation fuels.

High lead levels in the body can affect the nervous system, kidneys, and the immune system. Reproductive and cardiovascular health can also be impacted.

Through prior sampling efforts, the Department has determined that the state has low lead concentrations and no significant lead sources. This determination, coupled with the federal lead monitoring requirements, resulted in the state lead monitoring program ending effective Dec. 31, 1983.

### **2.2.1 Network Changes**

There were no significant changes made to the lead monitoring network in 2019. There are no changes planned for 2020.

## **2.3 Oxides of Nitrogen**

Oxides of Nitrogen ( $\text{NO}_x$ ) is the term used to represent nitric oxide (NO) plus nitrogen dioxide ( $\text{NO}_2$ ). NO and  $\text{NO}_2$  are formed when the nitrogen and oxygen in the air are combined in high-temperature combustion. Major  $\text{NO}_x$  sources in North Dakota are coal conversion processes, natural gas processing plants, and natural gas compressor stations.

In its pure state,  $\text{NO}_2$  is a reddish-orangish-brown gas with a characteristic pungent odor. As a pollutant in ambient air, however,  $\text{NO}_2$  is virtually odorless – although it may be an irritant to the eyes and throat.  $\text{NO}_2$  is corrosive and a strong oxidizing agent. The dark orangish-brown colored plume that can sometimes be seen downwind from a major combustion emissions source is most likely the result of  $\text{NO}_2$  or the conversion of NO to  $\text{NO}_2$ .

There is no ambient air quality standard for NO, a colorless gas. NO released into ambient air combines with excess oxygen to form  $\text{NO}_2$ . The speed with which this conversion occurs is dependent on several factors, including the relative concentrations of NO and ozone, the amount of ultraviolet light available, and meteorological conditions.

$\text{NO}_x$  exposure can result in respiratory distress, including airway inflammation and aggravation of asthmatic symptoms. Ozone, with its own health concerns, is a byproduct of the chemical reaction of  $\text{NO}_x$  and volatile organic compounds with heat and sunlight. In the form of the corrosive species nitrous and nitric acid,  $\text{NO}_x$  can result in impacts on vegetation and materials. In combination with

ammonia and water vapor,  $\text{NO}_x$  can form small particulates, impairing visibility and impacting health.

$\text{NO}_y$ , or “total reactive nitrogen”, consists of oxidized compounds of nitrogen (i.e.  $\text{NO}_x$  + nitric acid and organic nitrates). A  $\text{NO}_y$  monitor works by converting all reactive species to NO. Non- $\text{NO}_x$  species concentrations can be determined by subtracting monitored ambient NO and  $\text{NO}_2$  concentrations from the resultant total concentration of converted NO. There is no ambient air quality standard for  $\text{NO}_y$ .

### 2.3.1 Point Sources

The major  $\text{NO}_x$  stationary point sources (>100 TPY) are listed in Table 3.

Figure 4 shows the approximate locations of these facilities (the numbers correspond to the site and source tables). The larger  $\text{NO}_x$  point sources in North Dakota are associated with coal-fired steam-powered electrical generating plants in the west-central portion of the state and large internal combustion compressor engines in the natural gas fields in the western part of the state. Figure 5 shows the contribution of point sources to the total  $\text{NO}_x$  emissions. The “Point Sources” category consists of utility boilers (power plant boilers) and oil and gas wells.

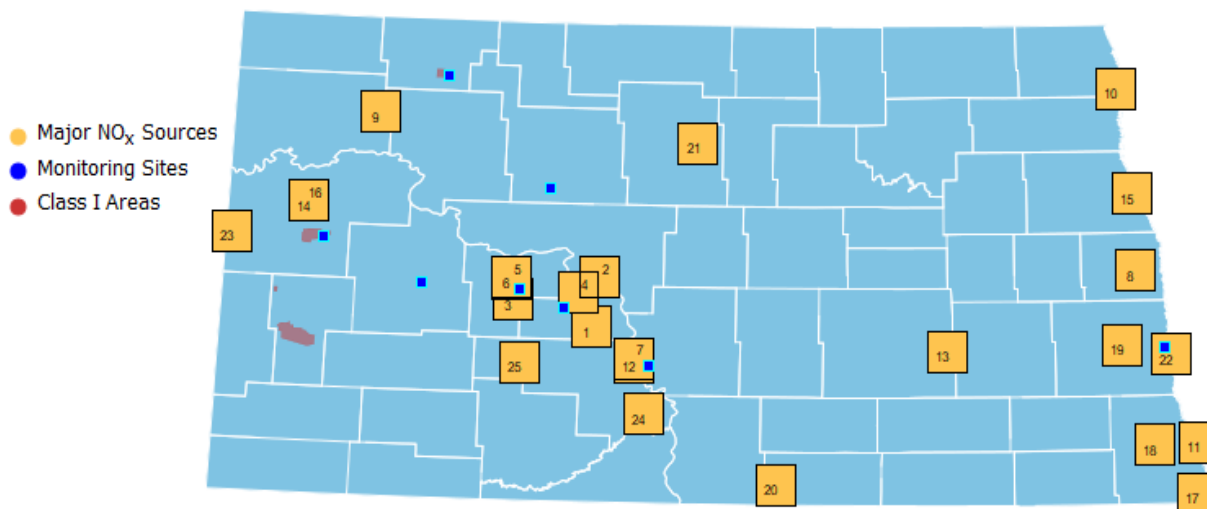


Figure 4. Major Oxides of Nitrogen Sources in 2019



Table 3. Major NO<sub>x</sub> Sources (≥ 100 TPY) in 2019

#	Company	Source	EIS Facility ID
1	Minnkota Power Cooperative, Inc.	Milton R. Young Station	8087911
2	Great River Energy	Cole Creek Station	8011011
3	Otter Tail Power Company	Coyote Station	8086611
4	Basin Electric Power Cooperative	Leland Olds Station	8086311
5	Basin Electric Power Cooperative	Antelope Valley Station	8086511
6	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
7	Montana Dakota Utilities Company	RM Heskett Station	8087011
8	American Crystal Sugar Company	Hillsboro Plant	7939011
9	Hess Corporation	Tioga Gas Plant	8013911
10	American Crystal Sugar Company	Drayton Plant	7923811
11	Minn-Dak Farmers' Cooperative	Wahpeton Plant	7924011
12	Tesoro Refining & Marketing Company	Mandan Refinery	7923611
13	Great River Energy	Spiritwood Station	16937511
14	Oasis Midstream	Wild Basin Gas Processing	N/A
15	University of North Dakota	UND Heating Plant	7292911
16	Northern Border Pipeline Company	Compressor Station #4	8085811
17	Alliance Pipeline, LP	Fairmount Compressor Station	10612211
18	Guardian Hankinson, LLC	Hankinson Renewable Energy, LLC	16663511
19	Tharaldson Ethanol Plant I	Tharaldson Ethanol Plant I, LLC	N/A
20	Northern Border Pipeline Company	Compressor Station #8	8085311
21	Alliance Pipeline, LP	Towner Compressor Station	10612311
22	North Dakota State University	NDSU Heating Plant	8448211
23	ONEOK Rockies Midstream, LLC	Grasslands Gas Plant	8085511
24	Northern Border Pipeline Company	St. Anthony Compressor Station	10612111
25	Northern Border Pipeline Company	Compressor Station #6	8087111

### 2.3.2 Area Sources

Another source of NO<sub>x</sub> is automobile emissions. North Dakota has no significant urbanized areas with respect to oxides of nitrogen; the entire population of the state is less than 1,000,000 people and the largest Metropolitan Statistical Area (MSA; includes Fargo) has a population of 238,124 (2016 estimate<sup>14</sup>).

<sup>14</sup> US Census Bureau. Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2016 – United States – Metropolitan and Micropolitan Statistical Area; and for Puerto Rico 2016 Population Estimates. <https://www.census.gov/data/tables/2016/demo/popest/total-metro-and-micro-statistical-areas.html>. Retrieved

### 2.3.3 Monitoring Network

The Department operated eight NO/NO<sub>2</sub>/NO<sub>x</sub> analyzers in 2019. From Figure 4 it can be seen that the NO/NO<sub>2</sub>/NO<sub>x</sub> analyzers are well placed with respect to the major NO<sub>x</sub> sources. Additionally, as part of the NCore network site at Bismarck, the Department operates a NO<sub>y</sub> monitor.

### 2.3.4 Network Analysis

Figures 5 and 6 show the 2019 NO<sub>2</sub> monitoring results in comparison to the 1-hour and annual NO<sub>2</sub> NAAQS, respectively. Numbers above the bars indicate monitored concentrations.

Nine of the ten largest NO<sub>x</sub> sources in the state are within 45 miles of the Beulah and Hannover monitoring sites. Figures 7 and 8 show the 1-hour and annual average concentrations for the Department-operated sites for 1980 – 2019, respectively.

### 2.3.5 Network Changes

There were no significant changes made to the NO<sub>2</sub> network in 2019. The Department is looking into changing to an alternate EPA approved method of NO<sub>2</sub> analyzers in the foreseeable future.

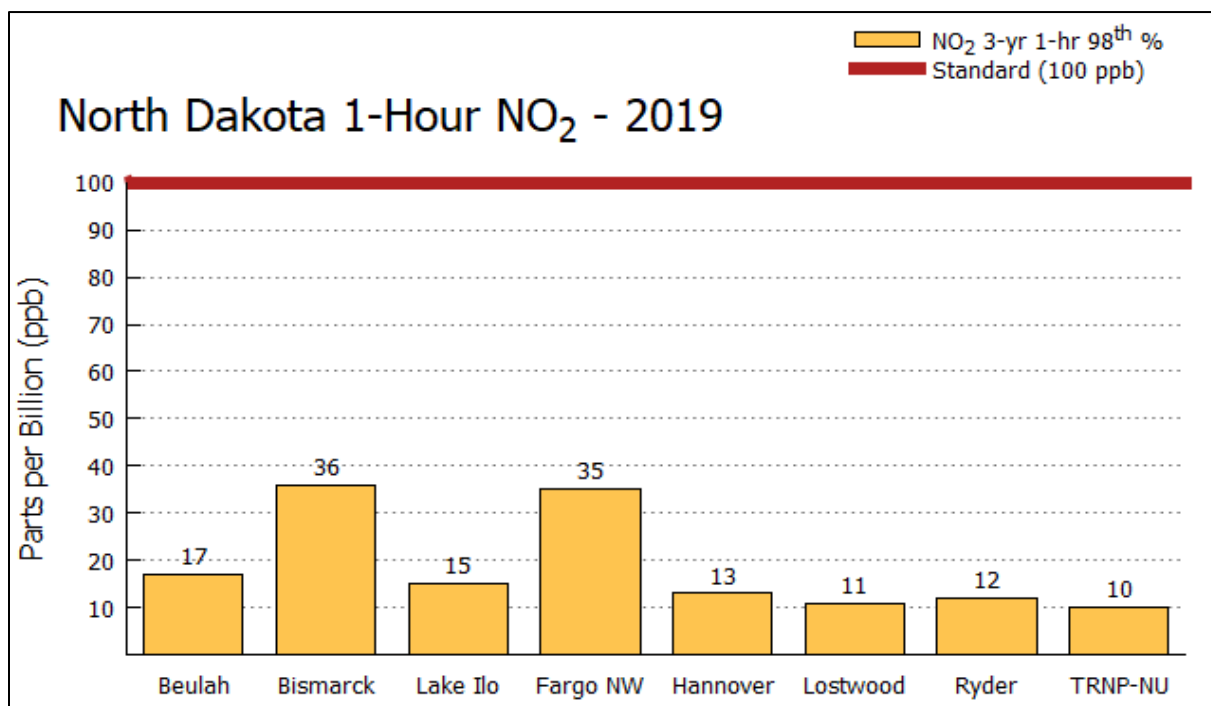


Figure 5. NO<sub>2</sub> Concentrations Compared to the 1-hour Standard

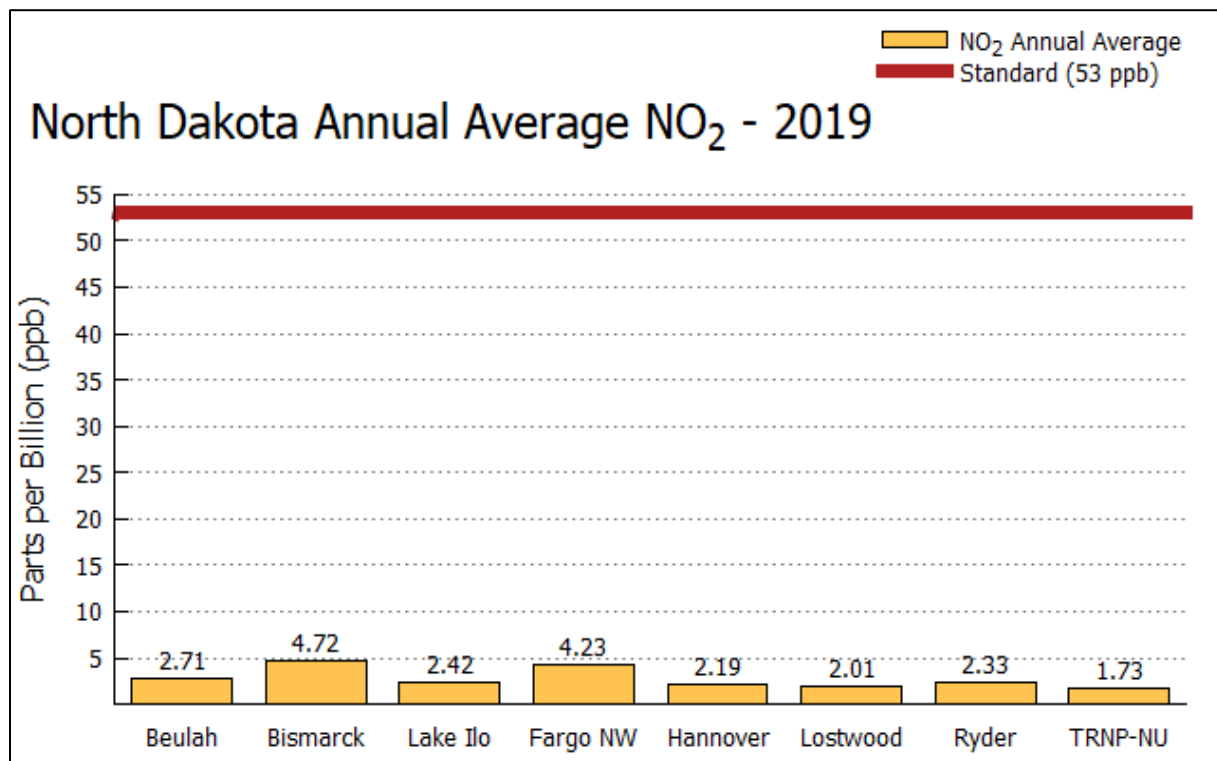


Figure 6. NO<sub>2</sub> Concentrations Compared to the Annual Standard

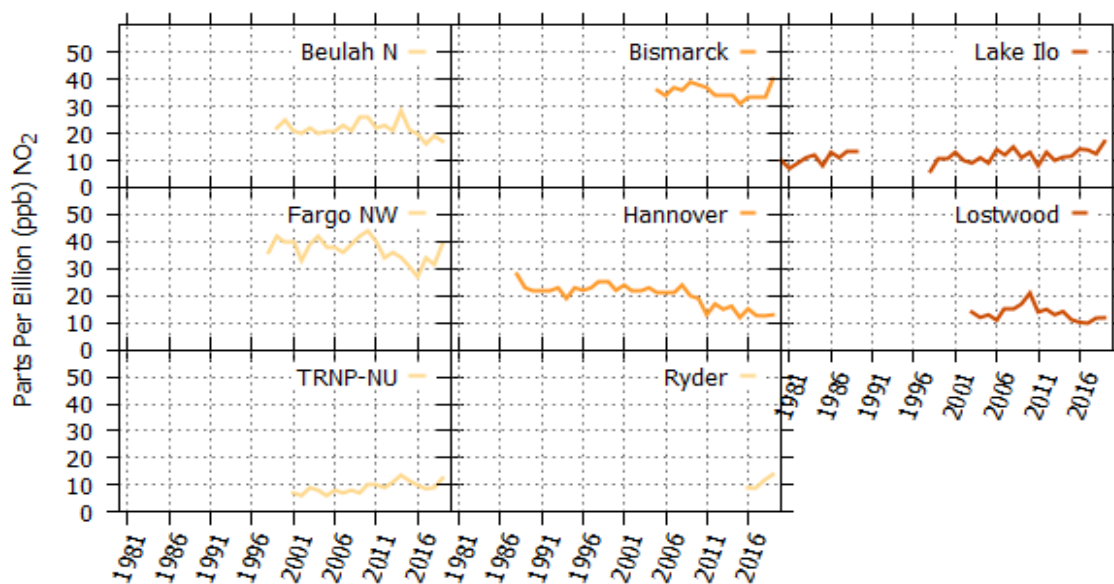


Figure 7. NO<sub>2</sub> 98<sup>th</sup> Percentile 1-Hour Concentrations

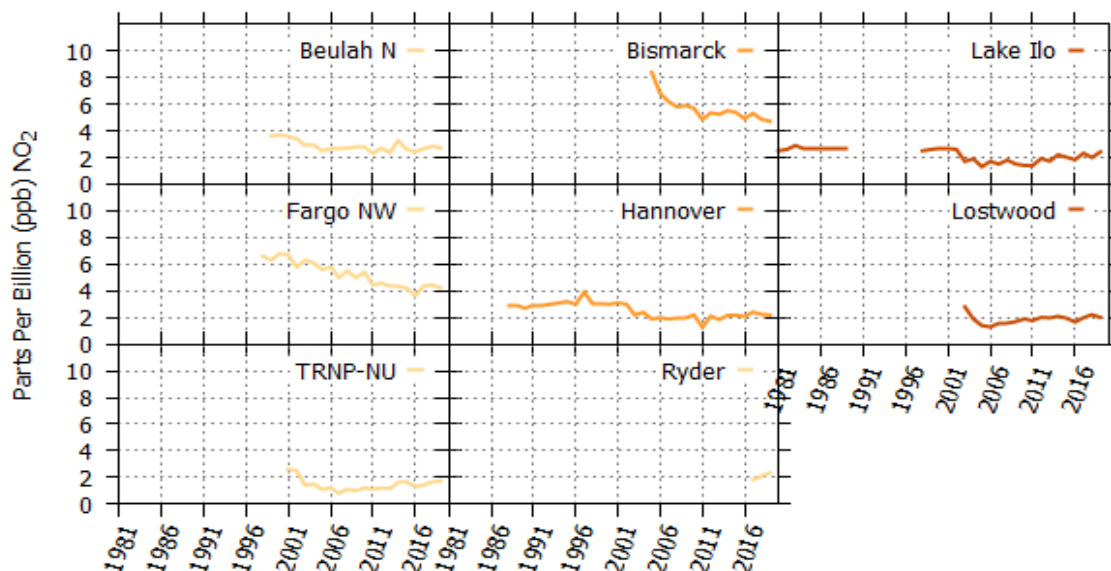


Figure 8. NO<sub>2</sub> Annual Average Concentrations

## 2.4 Ozone

Ozone (O<sub>3</sub>) is a highly reactive form of oxygen. At very high concentrations, it is a blue, unstable gas with a characteristic pungent odor. It can often be detected around an arcing electric motor, lightning storms, or other electrical discharges. However, at ambient concentrations, O<sub>3</sub> is colorless and odorless.

Unlike most other pollutants, O<sub>3</sub> is not emitted directly into the atmosphere, but results from a complex photochemical reaction between volatile organic compounds (VOC), NO<sub>x</sub>, and solar radiation. Both VOC and NO<sub>x</sub> are emitted directly into the atmosphere. Sources of VOC include automobile exhaust, gasoline and oil storage and transfer, industrial paint solvents, degreasing agents, cleaning fluids, and ink solvents. Some vegetation can also emit VOC (e.g. terpene from pine trees).

Production of O<sub>3</sub> is a year-round phenomenon. However, the highest O<sub>3</sub> levels generally occur during the summer months when sunlight is stronger and stagnant meteorological conditions can cause reactive pollutants to remain in an area for several days. Ozone produced under these conditions can be transported many miles. 40 CFR 58 defines the O<sub>3</sub> monitoring season for North Dakota as March 1 through September 30<sup>15</sup>.

<sup>15</sup> The required O<sub>3</sub> monitoring season for NCore stations is January through December. The Department typically collects O<sub>3</sub> monitoring data year-round at all ozone monitoring sites.

At ground level where it can be breathed, O<sub>3</sub> is a pollutant. However, ground-level O<sub>3</sub> should not be confused with the stratospheric O<sub>3</sub> located between 12 and 20 miles above the earth's surface. The stratospheric O<sub>3</sub> layer shields the earth from intense cancer-causing ultraviolet radiation. Concentrations of O<sub>3</sub> in this layer are approximately 10,000 to 12,000 ppb, or 100 times the state's ambient air quality standard. Occasionally, meteorological conditions can result in stratospheric O<sub>3</sub> being brought to ground level. This can increase ambient air concentrations by 50 to 100 ppb.

Short-term exposure to O<sub>3</sub> in the range of 150 to 250 ppb may impair mechanical functions of the lungs and may induce respiratory difficulties and related symptoms in sensitive individuals (those who have asthma, emphysema, or reduced lung function). Symptoms and effects of O<sub>3</sub> exposure are more readily induced in people who are exercising.

O<sub>3</sub> is the major component of photochemical "smog", although the haziness and odors of the smog are caused by other components. The deterioration and degradation of material, especially the splitting and cracking of rubber tires and windshield wiper blades, is associated with O<sub>3</sub>. Many plants, such as soybeans and alfalfa, are sensitive to O<sub>3</sub> and can be damaged by extended exposure to low levels.

#### **2.4.1 Point Sources**

The major stationary point sources (> 100 TPY) of VOC as calculated from the most recent emission inventories reported to the Department are listed in Table 4. Figure 10 shows the approximate locations of these facilities.

#### **2.4.2 Area Sources**

Point sources contribute only part of the total VOC and NO<sub>x</sub> emissions. The remaining emissions can be attributed to oilfield-related activities and mobile sources in urban areas. The EPA has specified design criteria for selecting locations for population oriented O<sub>3</sub> monitoring as any urbanized area having a population of 50,000 to less than 350,000. North Dakota has three urbanized areas (Bismarck; Fargo, ND-Moorhead, MN; and Grand Forks) that meet these criteria. However, to require monitoring, the 4<sup>th</sup> highest 8-hour average concentration must be at least 68 parts per billion. As can be seen from Figure 10 (numbers above the bars indicate concentration), none of the O<sub>3</sub> monitors at SLAMS sites reach this threshold.

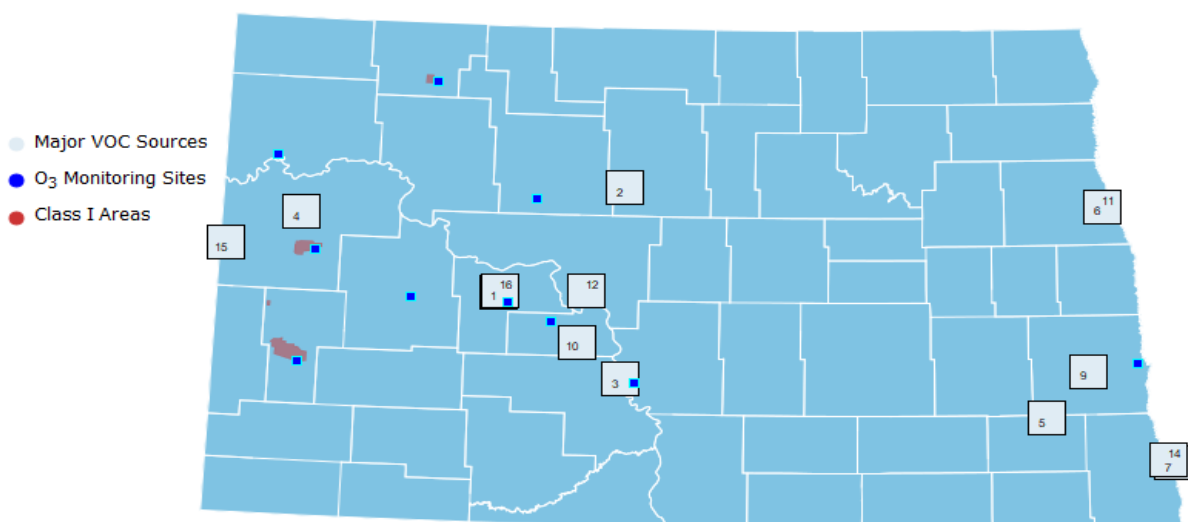


Figure 9. VOC Sources > 100 TPY in 2019

Table 4. Major VOC Sources ( $\geq 100$  TPY) in 2019

#	Company	Source	EIS Facility ID
1	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
2	ADM Processing	Velva Facility	8085211
3	Tesoro Refining and Marketing Company	Mandan Refinery	7923611
4	Oasis Midstream	Wild Basin Gas Processing	2380
5	Northern Sun (Division of ADM)	Enderlin Facility	7923911
6	LM Wind Power Blades	Grand Forks Facility	7293311
7	Minn-Dak Farmer's Cooperative	Wahpeton Plant	7924011
8	Guardian Hankinson, LLC	Hankinson Renewable Energy	N/A
9	Tharaldson Ethanol Plant I, LLC	Tharaldson Ethanol Plant I, LLC	12682411
10	Minnkota Power Cooperative, Inc.	Milton R. Young Station	8087911
11	J.R. Simplot Company	Grand Forks Facility	7293211
12	Great River Energy	Coal Creek Station	8011011
13	Hiland Partners Holdings, LLC	Watford City Gas Plant	1409
14	Cargill Corn Milling	Wahpeton Facility	10612711
15	ONEOK Rockies Midstream, LLC	Grasslands Gas Plant	8085511
16	Basin Electric Power Cooperative	Antelope Valley Station	8086511

### 2.4.3 Monitoring Network

The Department operated ten continuous ultraviolet (UV) photometric ozone analyzers in 2018 (Figure 9). Figure 10 presents the 2019 8-hour data summaries.

### 2.4.4 Network Analysis

Only three of the 10 monitoring sites are in an area not significantly influenced by VOC sources (see Figure 9). Beulah and Hannover are within 45 miles of five of the 12 major VOC sources in the state. Lostwood National Wildlife Refuge (NWR) and TRNP - NU are located in Class I areas<sup>16</sup> surrounded by oil fields. Bismarck Residential and Fargo NW are located in population centers and influenced by city traffic. Williston is also in a population center located in the heart of oil country. Lake Ilo is located in a rural area surrounded by crop land. With this diversity of site locations and influences, one would expect to see a diversity of ozone concentrations. On the contrary, Figure 10 shows a striking similarity among the 4<sup>th</sup> maximum 8-hour annual concentrations. Since 1980, only four 8-hour averages have been higher than 70 ppb. Another, even stronger, indication of a uniform ozone distribution is the 8-hour concentrations: for all sites, the difference among the 4<sup>th</sup> highest average is 3 ppb (see Figure 10). Figure 11 shows the annual average concentrations for the Department-operated sites for 1980 - 2018.

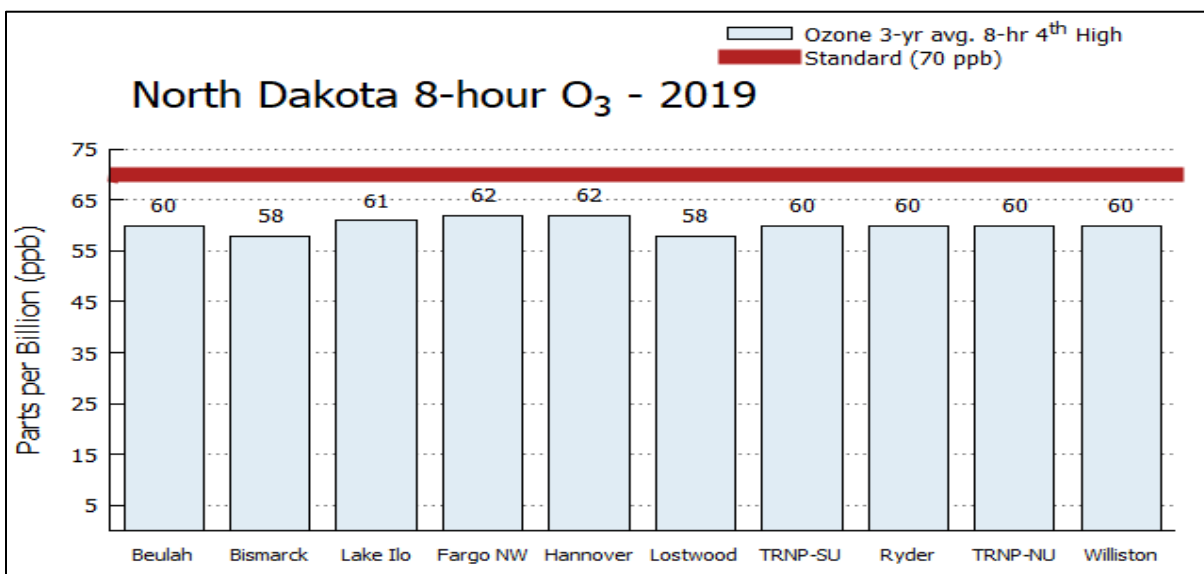


Figure 10. Ozone Concentrations compared to the 8-hour Standard

<sup>16</sup> A Class I area is one of 156 parks and wilderness areas given special protection under the Clean Air Act for the purpose of visibility protection.

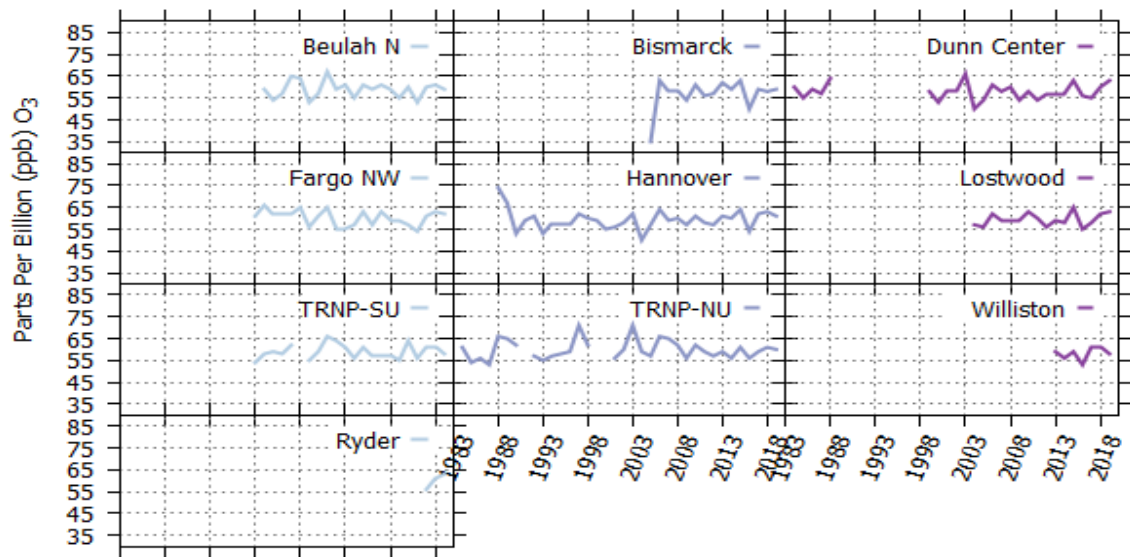


Figure 11. Annual 4<sup>th</sup> Highest 8-HR Ozone Concentrations  
(As of December 28, 2015 the ozone standard changed from 75 ppb to 70 ppb)



#### 2.4.5 Network Changes

There were no significant changes made to the O<sub>3</sub> network in 2019. The Department is looking into changing to an alternate EPA approved method of O<sub>3</sub> analyzers in the foreseeable future.

### 2.5 Particle Pollution

Particulate matter (PM) is the term given to the tiny particles of solid or semi-solid material found in the atmosphere. The inhalable PM standards are designed to protect against those particulates that can be inhaled deep into the lungs and cause respiratory problems.

Particles larger than 10 micrometers are usually due to “fugitive dust” (windblown sand and dirt from roadways, fields, and constructions sites) and contain large amounts of silica (sand-like) materials. The majority of anthropogenic (man-made) PM is in the 0.1 to 10 micrometer particle diameter range. Within the NAAQS, there are two subgroups of PM identified: PM<sub>10</sub> and PM<sub>2.5</sub>. The PM<sub>10</sub> particles have an aerodynamic diameter less than or equal to a nominal 10 microns, while the PM<sub>2.5</sub> particles have an aerodynamic diameter less than or equal to a nominal 2.5 microns.

PM<sub>10</sub> is generally created during a burning process and includes fly ash (from power plants), carbon black (from automobiles and diesel engines), and soot (from fireplaces and wood-burning stoves); or industrial processes including grinding, crushing, or agricultural processing. PM<sub>10</sub> from these sources contain a large percentage of elemental and organic carbon, which play a role in both visual haze and health issues. PM<sub>2.5</sub> can also form directly through combustion processes but can also be the result of indirect formation through chemical reactions between various other compounds and meteorological factors in the atmosphere. The EPA has also defined PM subgroup of particles called “coarse fraction,” designated PM<sub>10-2.5</sub>, with an aerodynamic diameter between 10 and 2.5 microns.

The health risk from an inhaled dose of PM depends on the size and concentration of the particulate. Size determines how deeply the inhaled particulate will penetrate into the respiratory tract, where it can persist and do damage. Particles less than 10 micrometers in diameter are easily inhaled deeply into the lungs. PM<sub>2.5</sub> (also called fine particulate pollution) affects the health of certain subgroups, which can be identified as potentially at risk of adverse health effects from airborne pollutants. There is very strong evidence that asthmatics are much more sensitive (i.e., respond with symptoms at relatively low concentrations) to the effects of particulates than is the general healthy population.

The effects of PM exposure may be the most widespread of all pollutants. Because of the potential for extremely long-range transport of PM<sub>2.5</sub> particles and because of the chemical reactions that occur, no place on earth has been spared from the particulate generated by urban and rural sources. The effects of PM range from visibility degradation to climate changes to vegetation damage. General soiling can have long-term effects on paint and other materials. Acid deposition can be detected in the most remote areas in the world.

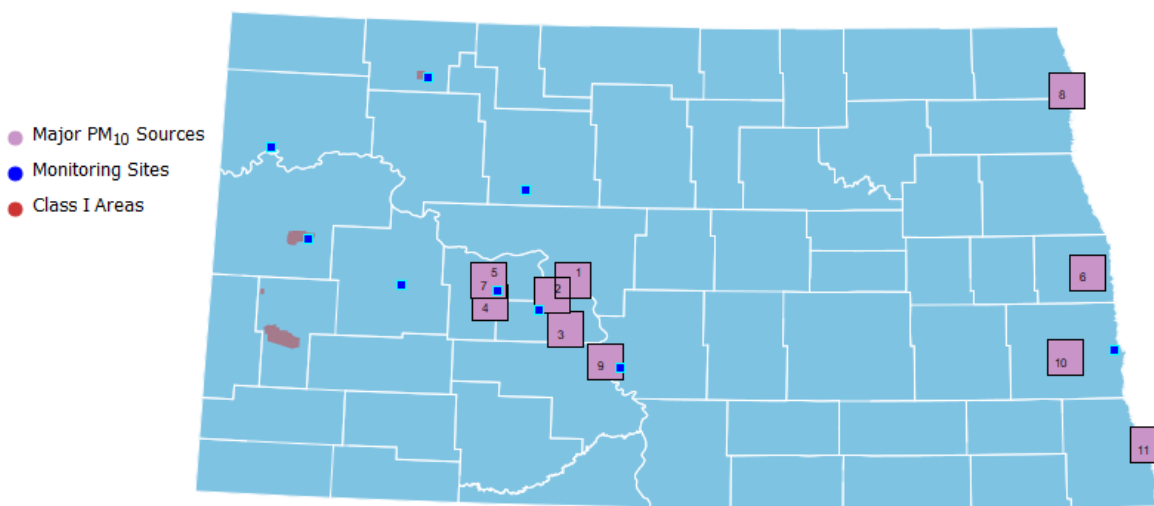


Figure 12. Major PM<sub>10</sub> Sources in 2019

Table 5. Major PM 10 Sources ( $\geq 100$  TPY)\* in 2019

#	COMPANY	SOURCE	EIS Facility ID
1	Great River Energy	Coal Creek Station	8011011
2	Basin Electric Power Cooperative	Leland Olds Station	8086311
3	Minnkota Power Cooperative, Inc.	Milton R. Young Station	8087911
4	Otter Tail Power Company	Coyote Station	8086611
5	Basin Electric Power Cooperative	Antelope Valley Station	8086511
6	American Crystal Sugar Company	Hillsboro Plant	7939011
7	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
8	American Crystal Sugar Company	Drayton Plant	7923811
9	Montana Dakota Utilities Company	RM Heskett Station	8087011
10	Tharaldson Ethanol, LLC	Tharaldson Ethanol Plant	1085
11	Minn-Dak Farmers Cooperative	Wahpeton Plant	7924011

\* Total PM<sub>10</sub>-Filterable + PM-Condensable as reported.

### 2.5.1 Point Sources

The major PM<sub>10</sub> point sources ( $>100$  TPY of PM<sub>10</sub>-Filterable + PM-Condensable) are listed in Table 5 and the major PM<sub>2.5</sub> point sources ( $>100$  TPY of PM<sub>2.5</sub>-Filterable + PM-Condensable) are shown in Table 6. Figures 12 and 14 show the approximate locations of these facilities, respectively (the numbers correspond to the site and source tables). Most of these sources are large coal-fired facilities, and the particles are part of the boiler stack emissions; however, some of the emissions are the result of processing operations. Not included in this table are sources of fugitive dust such

as coal mines, gravel pits, agricultural fields and unpaved roads.

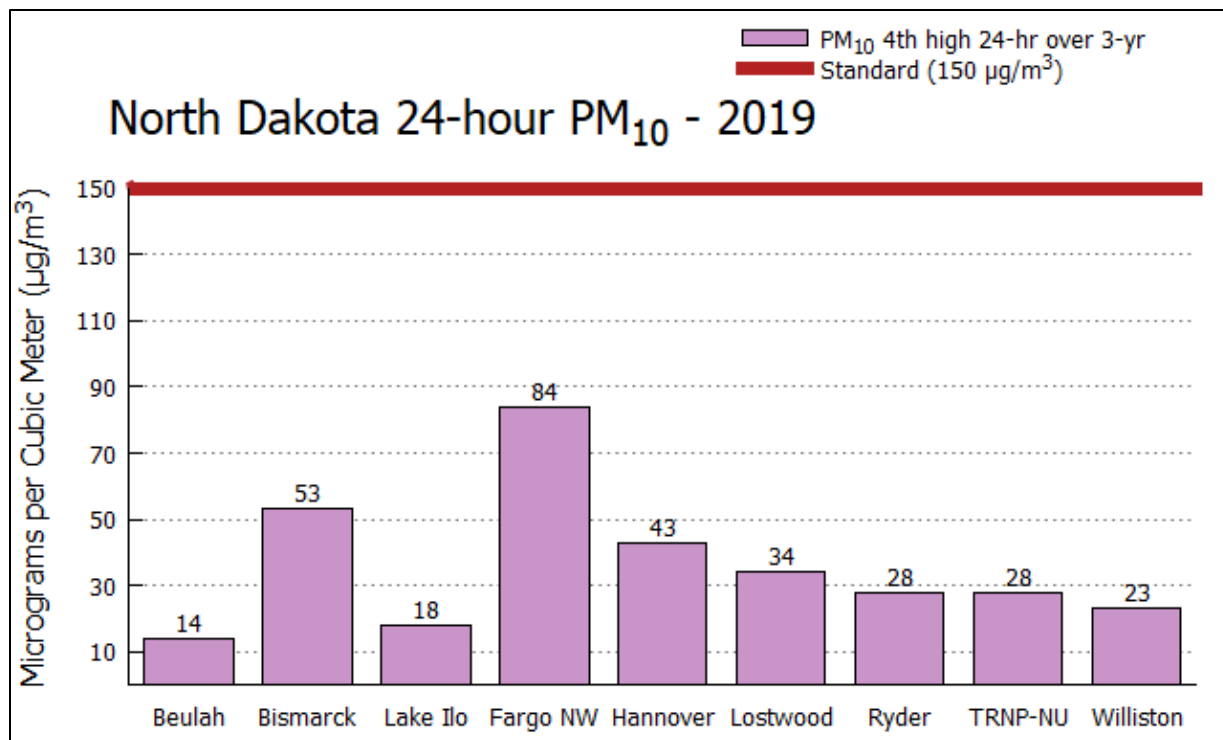


Figure 13. PM<sub>10</sub> Concentrations Compared to the 24-hour Standard<sup>17</sup>

### 2.5.2 Monitoring Network

The Department operated eight continuous PM<sub>10</sub> analyzer sites (Figure 12), one Federal Reference Method (FRM) manual PM<sub>2.5</sub> site (at the Bismarck NCore site), nine Federal Equivalent Method (FEM) continuous PM<sub>2.5</sub> analyzer sites (Figure 14), and one speciation sampler site (also at the Bismarck site) in 2019.

### 2.5.3 PM<sub>10</sub> Network Analysis

PM<sub>10</sub> and smaller particles are of concern mainly because of their health effects. Continuous PM<sub>10</sub> analyzers are used with the continuous PM<sub>2.5</sub> analyzers to determine the PM<sub>10-2.5</sub> fraction. The data also are compared to both the state and federal ambient air quality standards. Figure 13 shows the 2019 PM<sub>10</sub> particulate monitoring results in comparison to the 24-hour NAAQS. Numbers above the bars indicate monitored concentrations.

<sup>17</sup> Values shown represent the maximum yearly second high value over a three year period.

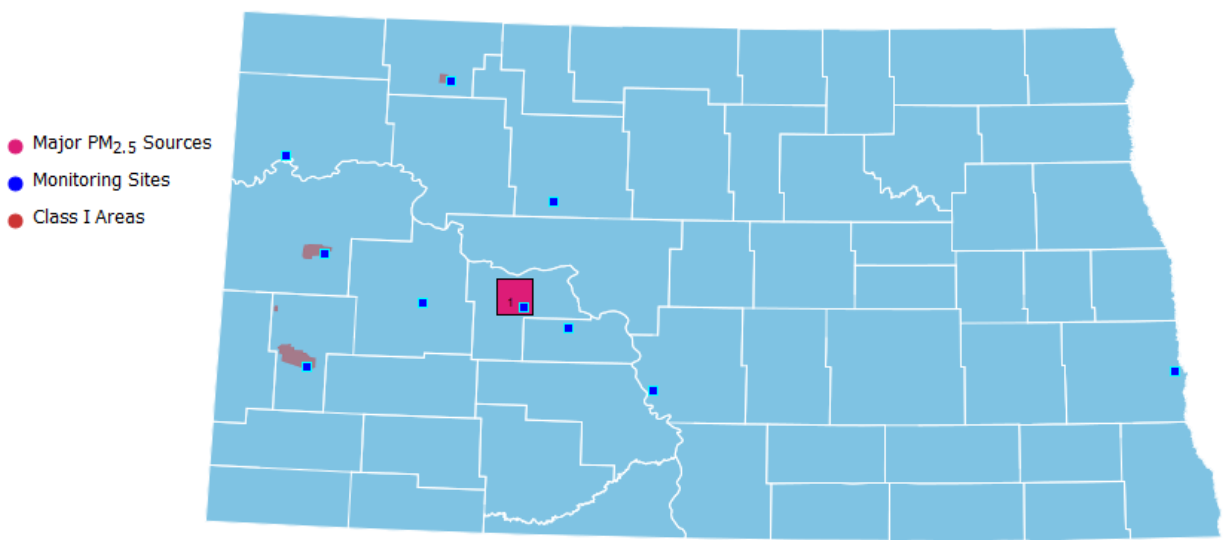


Figure 14 Major PM<sub>2.5</sub> Sources in 2019

Table 6. Major PM 2.5 Sources ( $\geq 100$  TPY)\* in 2019

#	COMPANY	SOURCE	EIS Facility ID
1	Dakota Gasification Company	Great Plains Synfuels Facility	8086711

\* Total PM<sub>2.5</sub>-Filterable.

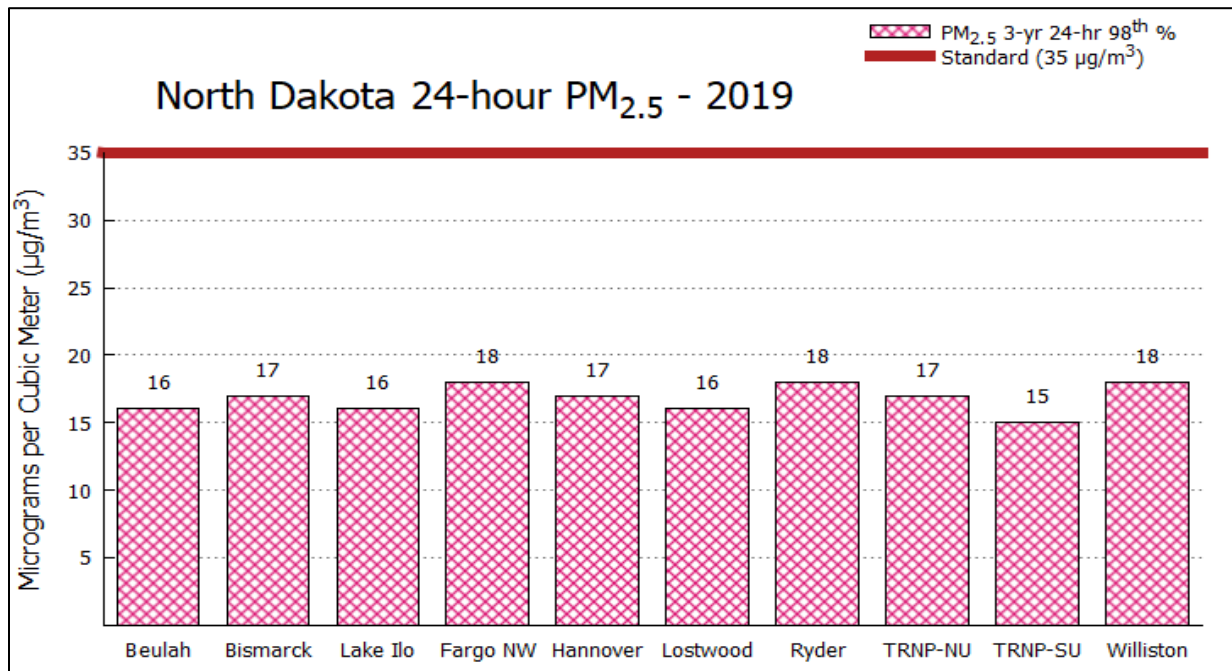


Figure 15. PM<sub>2.5</sub> Concentrations Compared to the 24-hour Standard

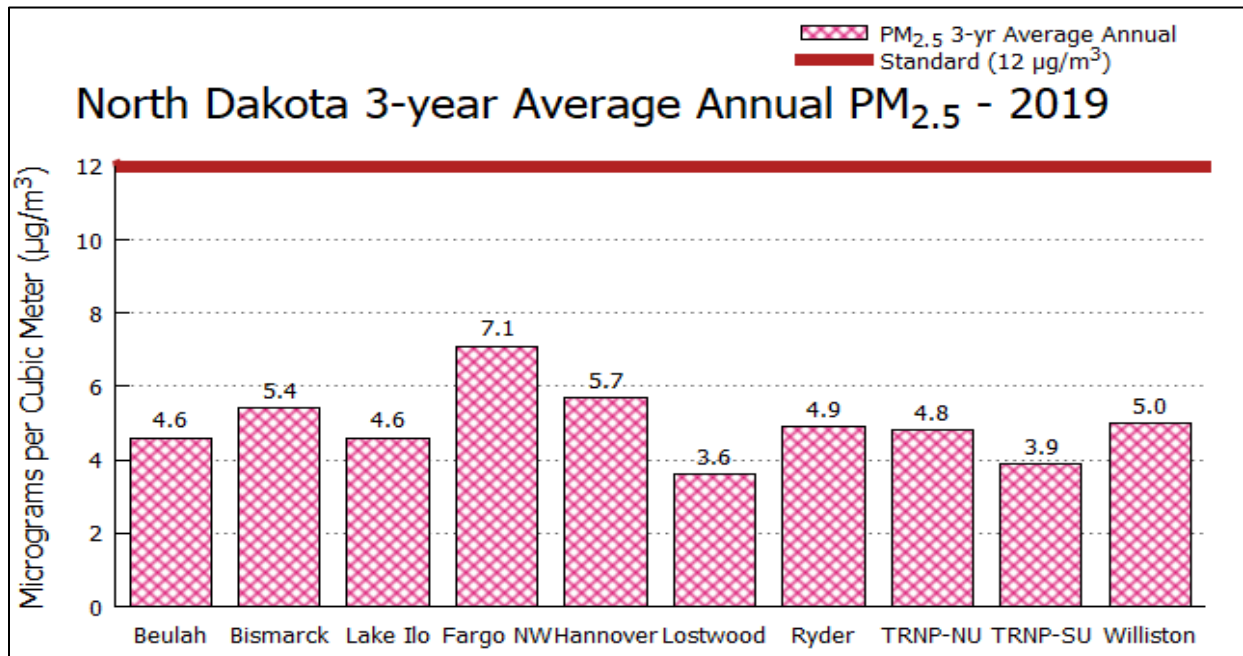


Figure 16. PM<sub>2.5</sub> Concentrations Compared to the Annual Standard

#### 2.5.4 PM<sub>2.5</sub> Network Analysis

The manual PM<sub>2.5</sub> samplers at Bismarck operate on a 1-in-3-day schedule. FEM continuous PM<sub>2.5</sub> analyzers have been installed at all sites in the network (Figure 14). Figures 15 and 16 show the

2019 PM<sub>2.5</sub> particulate monitoring results in comparison to the 24-hour and annual standards, respectively. Numbers above the bars indicate monitored concentrations.

### 2.5.5 Speciation Network

One speciation sampler is installed as a National Trends Network sampler in Bismarck. The data collected by this sampler are added to the Air Quality System (AQS) database by an EPA contractor<sup>18</sup>.

### 2.5.6 Network Changes

The Department has installed a co-located PM<sub>2.5</sub> monitors, a BAMM 1020 at the Beulah Site. In addition to the BAMM the Department also installed a new Teledyne T640x PM<sub>2.5</sub> / PM<sub>10</sub> monitor at the Beulah monitoring site for the 2019 monitoring year. The Department has started to convert its PM<sub>2.5</sub> network over to Teledyne T640 PM analyzers. During the 2020 monitoring year the Department is planning on converting most of the network over as funding becomes available.

## 2.6 Sulfur Dioxide

Sulfur dioxide (SO<sub>2</sub>) is a colorless gas with a pungent odor detectable by the human nose at concentrations of 500 to 800 ppb. It is highly soluble in water where it forms sulfurous acid (H<sub>2</sub>SO<sub>3</sub>). In the atmosphere, sulfurous acid is easily converted to sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), the major acidic component of “acid rain”, which then may convert again to form particulate sulfate compounds. On a worldwide basis, sulfur dioxide is considered to be a major pollutant. It is emitted mainly from stationary sources that burn coal and oil. Energy development in the west and west-central portions of North Dakota has produced a number of sources of SO<sub>2</sub>. These sources include coal-fired steam-powered electrical generating facilities, a coal gasification plant, natural gas processing plants, oil refineries, and flaring at oil/gas well sites.

Sulfuric acid aerosols and particulate sulfate compounds, the result of conversions of SO<sub>2</sub> in the atmosphere, are corrosive and potentially carcinogenic (cancer-causing). The major health effects of SO<sub>2</sub> appear when it is associated with high levels of other pollutants, such as particulate. SO<sub>2</sub> also may play an important role in the aggravation of chronic illnesses, such as asthma. The incidence and intensity of asthma attacks have increased when asthmatics are exposed to higher levels of sulfur dioxide and particulate matter sulfates<sup>19</sup>.

Particulate matter sulfates resulting from SO<sub>2</sub> emissions can also affect visibility. In combination with high humidity, sulfates can develop to sizes that are effective at scattering sunlight, thus resulting in reduced visibility through haze formation. SO<sub>2</sub> is one of the Department's primary

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<sup>18</sup> RTI International

<sup>19</sup> U.S. EPA (2008). Integrated Science Assessment (ISA) for Sulfur Oxides – Health Criteria (Final Report). Available at: <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=198843>.

interests with respect to visibility: first, to aid in establishing the visibility baseline, then to track visibility improvement over time.

### **2.6.1 Point Sources**

The major SO<sub>2</sub> point sources (>100 TPY) based on 2018 emissions are listed in Table 7. Figure 17 shows the approximate locations of these facilities.

### **2.6.2 Other Sources**

The western part of the state has a number of potential SO<sub>2</sub> sources including oil wells, oil storage facilities, and natural gas compressor stations. These sources may directly emit amounts of hydrogen sulfide to the ambient air (see Section 2.7 for further discussion on hydrogen sulfide) or they may flare the hydrogen sulfide creating SO<sub>2</sub> and contributing to concentrations of this pollutant.

### **2.6.3 Monitoring Network**

In 2018 there were nine SO<sub>2</sub> monitoring sites in the state. As can be seen in Figure 17, the majority of the sites are concentrated in the vicinity of the oil and gas development in the west and the coal-fired steam electrical generating plants in the west-central part of the state.

### **2.6.4 Network Analysis**

Figure 18 shows the 2018 SO<sub>2</sub> monitoring results in comparison to the 1-hour SO<sub>2</sub> NAAQS. Numbers above the bars indicate monitored concentrations.

Nine major SO<sub>2</sub> sources are within 45 miles of both the Beulah and Hannover sites. This makes these two sites very important in tracking the impact of these sources on the ambient air. Also, Lostwood NWR is within 45 miles of four major sources: two natural gas processing plants and two power plants. The two power plants are located near Estevan, Saskatchewan, approximately 40 miles to the northwest.

One would expect that as the large sources in Oliver and Mercer counties came online beginning in 1980, a noticeable change would be seen on the ambient air quality. This has not been the case. The data has demonstrated possible short-term influences, but no significant long-term impacts by the combined sources.. Figure 19 presents 1-hour maximums for the Department-operated sites.

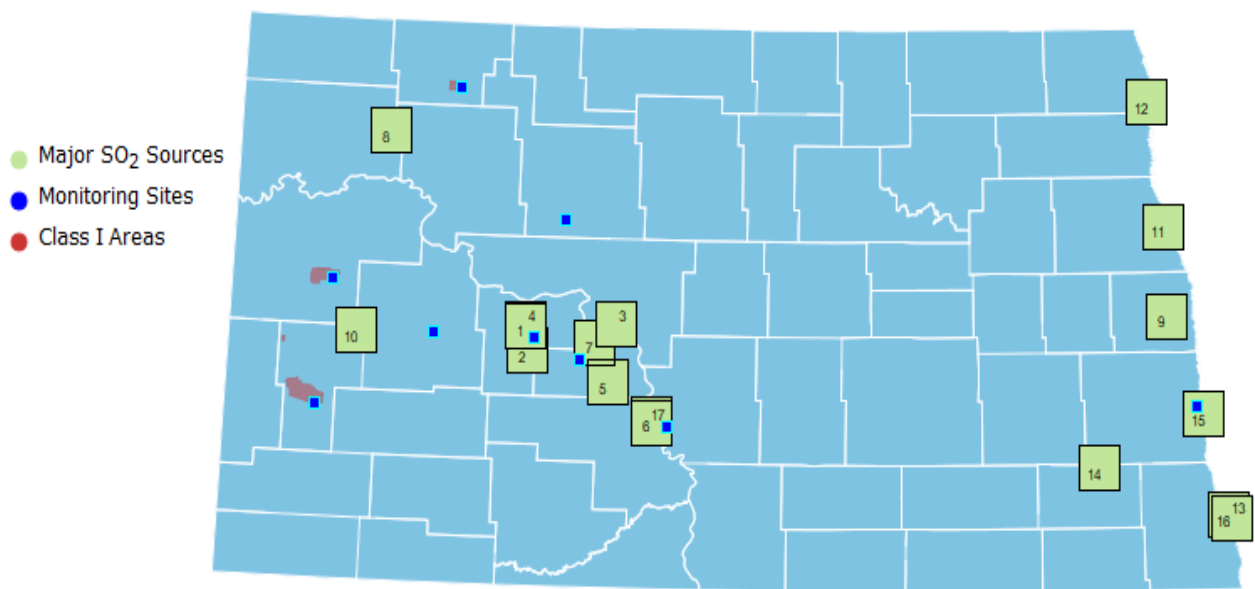




Figure 17. Major Sulfur Dioxide Sources in 2019

Table 7. Major SO<sub>2</sub> Sources (≥100 TPY) in 2019

#	Company Name	Source	EIS Facility ID
1	Basin Electric Power Cooperative	Antelope Valley Station	8086511
2	Otter Tail Power Company	Coyote Station	8086611
3	Great River Energy	Coal Creek Station	8011011
4	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
5	Minnkota Power Cooperative, Inc.	Milton R. Young Station	8087911
6	Montana Dakota Utilities Company	RM Heskett Station	8087011
7	Basin Electric Power Cooperative	Leland Olds Station	8086311
8	Hess Tioga Gas Plant LLC	Tioga Gas Plant	8013911
9	American Crystal Sugar Company	Hillsboro Plant	7939011
10	Petro-Hunt, LLC	Little Knife Gas Plant	8023811
11	University of North Dakota	UND Heating Plant	7292911
12	American Crystal Sugar Company	Drayton Plant	7923811
13	Minn-Dak Farmers' Cooperative	Wahpeton Plant	7924011
#	Company Name	Source	EIS Facility ID
14	Northern Sun, Division of ADM Co.	Enderlin Facility	7923911
15	North Dakota State University	NDSU Heating Plant	8448211
17	Cargill Corn Milling	Wahpeton Facility	10612711
14	Tesoro Refining & Marketing Company LLC	Mandan Refinery	7923611

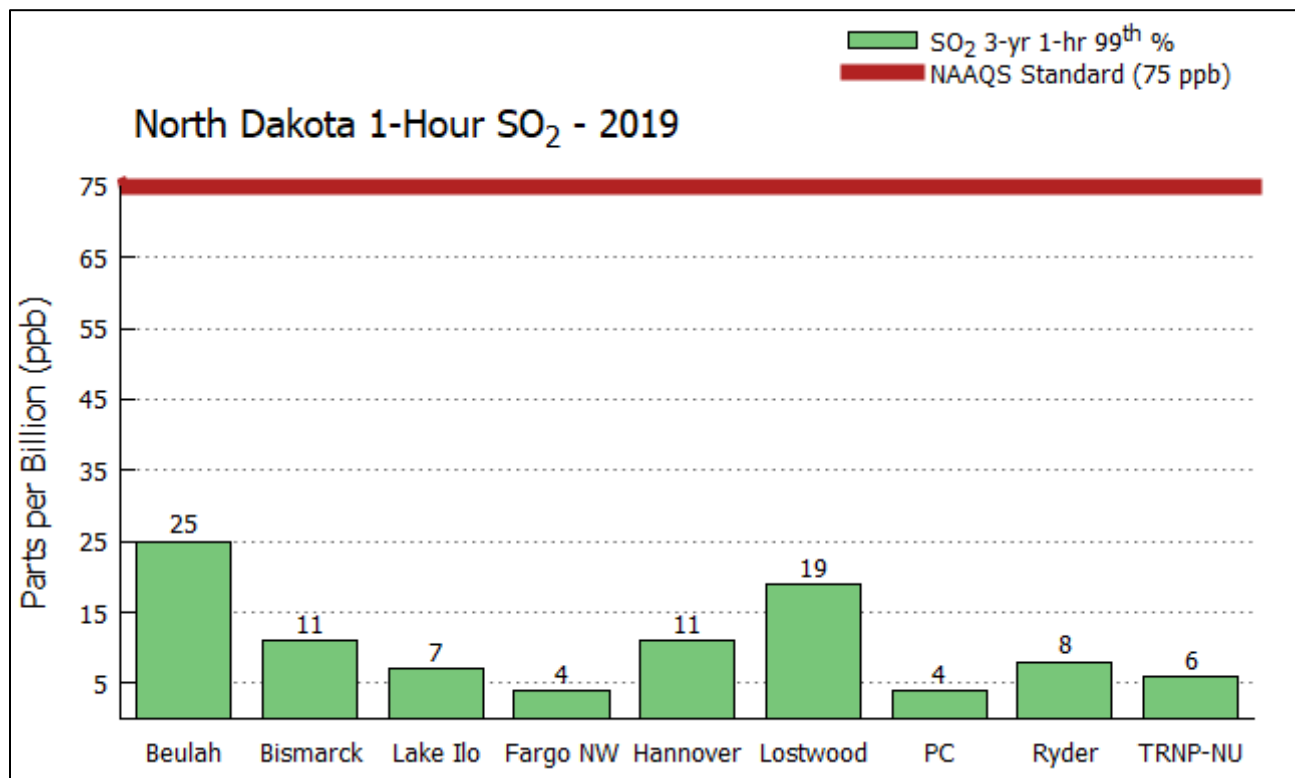


Figure 18. SO<sub>2</sub> Concentrations Compared to the 1-hour Standard

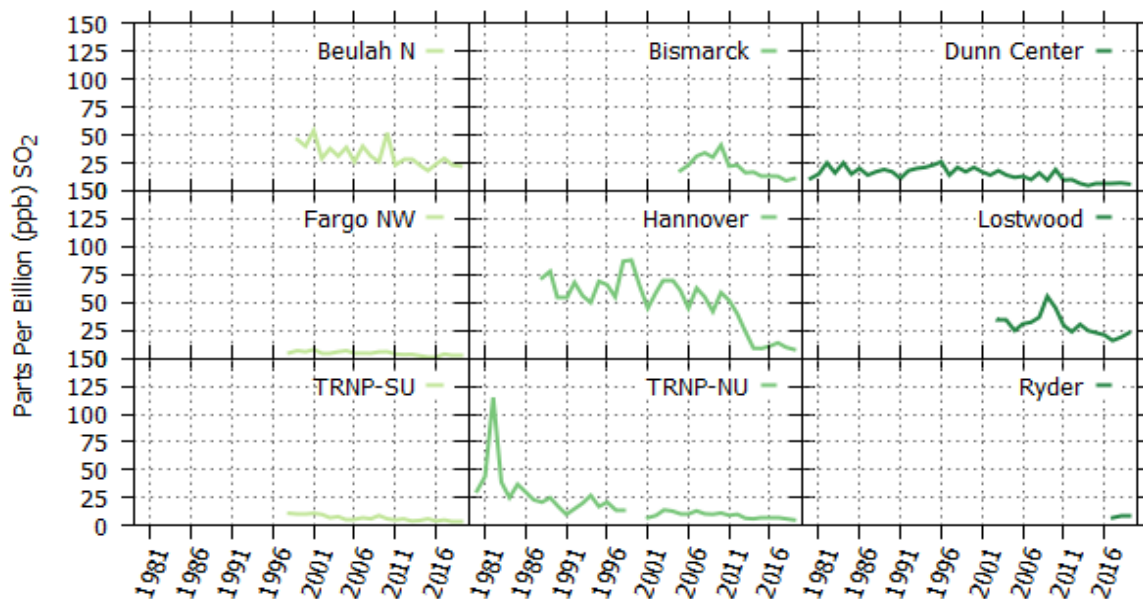


Figure 19 SO<sub>2</sub> 99<sup>th</sup> Percentile 1-Hour Concentrations

Beginning in 1980, major events are traceable. In 1980, the oil industry was expanding and in 1982 the oil industry in western North Dakota hit a peak in activity prior to the most recent increase. Dunn Center/Lake Ilo and TRNP – NU show the influence from the oil field activity as the oil fields expanded and flared the gas. As pipelines were built and wells were tied into the pipelines, the amount of hydrogen sulfide gas flared decreased, reducing the amount of sulfur dioxide emitted. Once the wells were tied into pipelines, the predominant influence at these two sites has been long-range transport from major point sources.

Dunn Center/Lake Ilo and TRNP – NU are indicators of the “oil patch” activity and tracked the activity very well. Since TRNP – NU is more centrally located in the “oil patch,” it is the stronger indicator. Dunn Center/Lake Ilo, which is on the eastern edge of the oil development area, demonstrates influences from both the “oil patch” and the coal conversion facilities to the east.

### 2.6.5 Network Changes

There were no significant changes made to the SO<sub>2</sub> network in 2019. The Department is looking into changing to an alternate EPA approved method of SO<sub>2</sub> analyzers in the foreseeable future.

Additionally, in response to the requirement of 40 CFR 51.1203 (b) concerning characterization of 1-hour SO<sub>2</sub> concentrations for the Tioga area, two new SLAMS-like monitoring sites were established in Williams County for operation in 2017. See Appendix E for more information.

## **2.7 Hydrogen Sulfide**

Hydrogen sulfide (H<sub>2</sub>S) is a colorless gas with a rotten egg odor. It is incompatible with strong oxidizers and reacts violently with metal oxides. It will attack many metals, forming sulfides.

A 5-minute exposure to 800 ppm H<sub>2</sub>S has resulted in death. Inhalation of 1,000 to 2,000 ppm may cause a coma after a single breath. Exposure to lower concentrations may cause headache, dizziness and upset stomach. Low concentrations (20 to 150 ppm) can cause eye irritation which may be delayed in onset. Although the odor is detectable at very low concentrations, it rapidly causes olfactory fatigue at higher levels, and, therefore, is not considered to have adequate warning.

Although no Federal Ambient Air Quality Standard exists for H<sub>2</sub>S, the state of North Dakota has developed H<sub>2</sub>S standards in response to historically high petroleum sulfur content (during the 1980s in particular) and associated high H<sub>2</sub>S. The major source of H<sub>2</sub>S is oil wells. Other sources are natural gas processing plants, lagoons, and sloughs. Emissions have been reduced significantly over time as production from these older sites has declined. The Bakken formation, the focus of the most recent oil and gas activity in the state, has been found to result in very low H<sub>2</sub>S emissions when compared to legacy (non-Bakken) operations.

### **2.7.1 Point Sources**

H<sub>2</sub>S emissions of concern stems almost totally from the legacy oil and gas well operations in the western part of the state. Flares and treater stacks associated with oil/gas wells, oil storage tanks, compressor stations, pipeline risers, and natural gas processing plants are potential H<sub>2</sub>S emission sources.

### **2.7.2 Monitoring Network**

Currently there are no state H<sub>2</sub>S monitoring sites.

### **2.7.3 Network Changes**

There were no significant changes made to the H<sub>2</sub>S network in 2019. There are no changes planned for 2020.

## **2.8 Air Toxics**

The term ‘air toxics’ refers to Hazardous Air Pollutants (HAP) - air contaminants, other than those listed above, that at certain concentrations could be “injurious to human health or well-being or unreasonably interfere with the enjoyment of property or that would injure plant or animal life.”<sup>20</sup> Currently there are no state or federal air toxics monitoring sites in North Dakota.

### **2.8.1 Point Sources**

The major air toxics sources are listed in Table 9 and Figure 22 shows the approximate locations of these facilities (the numbers correspond to the source table).

### **2.8.2 Monitoring Network**

Currently there are no state air toxics monitoring sites. The historic raw data and associated summaries are available in EPA’s AQS system.

### **2.8.3 Network Changes**

There were no significant changes made to the Air Toxics network in 2018. There are no changes planned for 2019.

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<sup>20</sup> NDDoH (2010). Policy for the Control of Hazardous Air Pollutant Emissions in North Dakota (Air Toxics Policy). Available via link at <http://www.ndhealth.gov/AQ/HAPs.aspx>

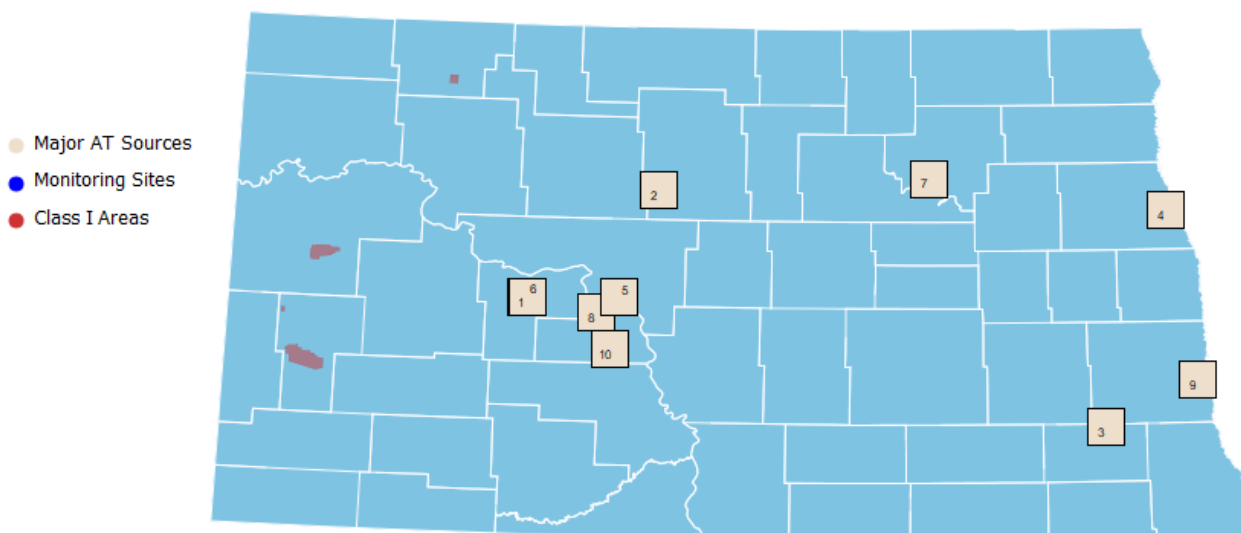


Figure 20. Air Toxics Sources in 2019

Table 8. Air Toxics Sources in 2019  
( $\geq 40$  TPY of a single HAP or  $\geq 40$  TPY aggregate HAPS)

#	COMPANY	SOURCE	EIS Facility ID
1	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
2	ADM Processing	Velva Facility	8085211
3	Northern Sun (Division of ADM)	Enderlin Facility	7923911
4	LM Wind Power Blades	Grand Forks Facility	7293311
5	Great River Energy	Coal Creek Station	8011011
6	Basin Electric Power Cooperative	Antelope Valley Station	8086511
7	Nordic Fiberglass, Inc.	Devils Lake Plant	8203411
8	Basin Electric Power Cooperative	Leland Olds Station	8086311
9	Cargill, Inc.	Cargill Oilseeds Processing	9271111
10	Minnkota Power Cooperative, Inc.	Milton R. Young Station	8087911

## 2.9 NETWORK SITE CHANGES

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### 3.0 No Site Changes During the 2019 monitoring Campaign.

## 4.0 SUMMARY AND CONCLUSIONS

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The North Dakota Ambient Air Quality Monitoring Network is designed to monitor those air pollutants that demonstrate the greatest potential for deteriorating the air quality of North Dakota. Due to a greater number of pollution-producing sources in the western part of the state (primarily associated with the energy producing industries) the greatest percentage of the network is located in the western part of the State.

### 4.1 • Carbon Monoxide (CO)

Neither the state nor federal CO standards of 35,000 ppb (1-hour) or 9,000 ppb (8-hour) were exceeded at the monitoring site. The maximum concentrations are as follows: 1-hour – 1000 ppb; 8-hour – 400 ppb.

### 4.2 • Lead

No lead monitoring was conducted. No changes to the network were identified.

### 4.3 • Nitrogen Dioxide (NO<sub>2</sub>)

Neither the state nor federal NO<sub>2</sub> standards of 100 ppb (1-hour) or 53 ppb (annual) were exceeded at any of the monitoring sites. The maximum concentrations were as follows: Three-year average of the 98<sup>th</sup> percentile 1-hour average concentrations – 36 ppb; annual – 4.72 ppb.

### 4.4 • Ozone (O<sub>3</sub>)

Neither the state nor federal O<sub>3</sub> standard of 70 ppb was exceeded during the year. The maximum fourth-highest 8-hour concentration was 62 ppb.

### 4.5 • Particulate Matter (PM<sub>10</sub>, PM<sub>2.5</sub>)

The federal PM<sub>10</sub> 24-hour standard states that the concentration of PM<sub>10</sub> in the ambient air should not go over 150 µg/m<sup>3</sup> more than once per year on average over a three-year period. Neither the

state nor federal PM<sub>10</sub> standard was exceeded during the year. The 4<sup>th</sup> highest value over three years was 84 µg/m<sup>3</sup>.

Neither the state nor federal PM<sub>2.5</sub> standards of 35 µg/m<sup>3</sup> (24-hour) and 12 µg/m<sup>3</sup> (annual) were exceeded during the year. The maximum concentrations are as follows: 24-hour – 18 µg/m<sup>3</sup>; annual – 6.6 µg/m<sup>3</sup>.

#### **4.6 • Sulfur Dioxide (SO<sub>2</sub>)**

Neither the state nor federal SO<sub>2</sub> standard of 75 ppb (1-hour) was exceeded at any state operated monitoring site. The maximum concentration measured was: 3-year average 1-hour 99<sup>th</sup> percentile – 25 ppb.

#### **4.7 • Hydrogen Sulfide (H<sub>2</sub>S)**

No H<sub>2</sub>S monitoring was conducted. No changes to the network were identified.

#### **4.8 • Air Toxics (HAP)**

No Air Toxics monitoring was conducted. No changes to the network were identified.



## **Appendix A**

## **Air Quality Personnel Organizational Chart**

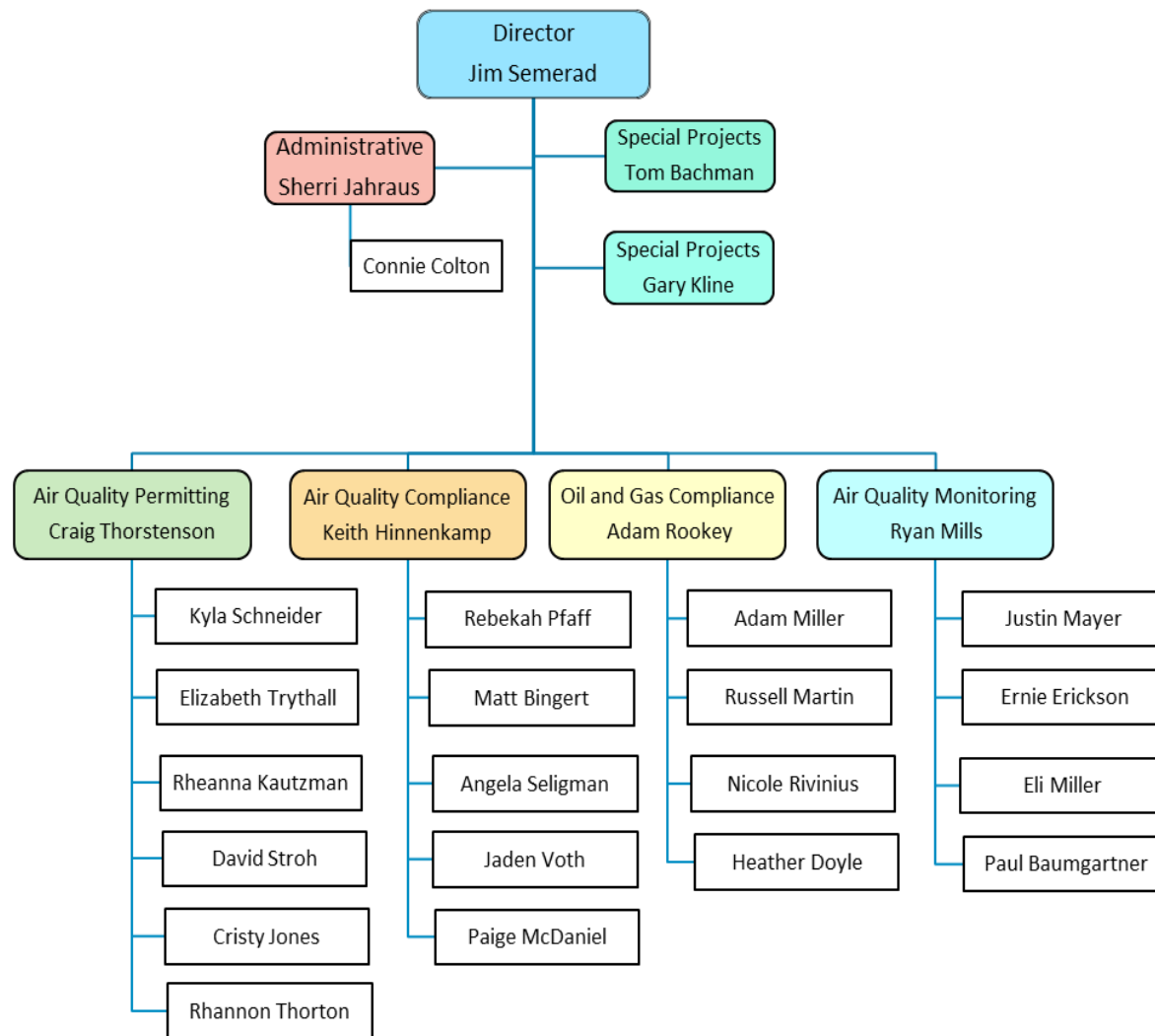


Figure 21. Organizational Chart July 2019

## Appendix B

## Ambient Air Quality Standards

Table 9. National and North Dakota Ambient Air Quality Standards

Ambient Air Quality Standards					
Pollutant	Averaging Period	North Dakota		Federal	
		µg/m <sup>3</sup>	ppb	µg/m <sup>3</sup>	ppb
Carbon Monoxide (CO)	1-hour <sup>a</sup>	40,000	35,000	40,000	35,000
	8-hour <sup>a</sup>	10,000	9,000	10,000	9,000
Lead	3-month <sup>b</sup>	0.15	--	0.15	--
Nitrogen Dioxide (NO <sub>2</sub> )	Annual <sup>c</sup>	100	53	100	53
	1-hour <sup>d</sup>	188	100	188	100
Ozone (O <sub>3</sub> )	8-hour <sup>e</sup>	147	75	147	70
Particulate Matter	PM <sub>10</sub>	24-hour <sup>f</sup>	150	--	150
	PM <sub>2.5</sub>	24-hour <sup>g</sup>	35	--	35
		Annual <sup>h</sup>	12	--	12
Sulfur Dioxide (SO <sub>2</sub> )		1-hour <sup>i</sup>	196	75	196
		3-hour <sup>a</sup>	1309	500	1309
		24-hour <sup>a*</sup>	--	--	365
		Annual <sup>c*</sup>	--	--	80
Hydrogen Sulfide (H <sub>2</sub> S)		Instantaneous	14,000	10,000	--
		1-hour <sup>j</sup>	280	200	--
		24-hour <sup>a</sup>	140	100	--
		Quarter	28	20	--

<sup>a</sup> Not to be exceeded more than once per calendar year.

<sup>b</sup> Not to be exceeded by a rolling three-month arithmetic mean.

<sup>c</sup> Annual arithmetic mean.

<sup>d</sup> Three-year average of 98<sup>th</sup> percentile of 1-hour daily maximum concentrations.

<sup>e</sup> Three-year average of the annual fourth-highest daily maximum 8-hour concentrations.

<sup>f</sup> Not to be exceeded more than once per year on average over a 3-year period.

<sup>g</sup> Three-year average of the annual 98<sup>th</sup> percentile values.

<sup>h</sup> Three-year average of annual concentrations.

<sup>i</sup> Three-year average of 99<sup>th</sup> percentile of 1-hour daily maximum concentrations.

<sup>j</sup> Not to be exceeded more than once per month.

\* The 24-hour and Annual SO<sub>2</sub> standards were revoked per the 2010 rulemaking. However, these standards will remain in effect until one year after attainment status designations for the 2010 1-hour SO<sub>2</sub> standard are complete for a given area.

\*\* On October 26, 2015 EPA revised the primary ozone standard level to from 75 to 70 ppb with an effective date of December 28, 2015. North Dakota ambient air quality standards will be revised to concur with federal standards in a future rulemaking.

## **Appendix C**

## **AAQM Site Descriptions**

This appendix includes site descriptions and information relating to State operated analyzers and samplers onsite. Please note that all sites meet the siting criteria specified in 40 CFR 58, Appendices A, C, D, and E. When selecting a site, five factors are considered: modeling results, landowner permission, power availability, year-round access to the site, and prevailing wind direction.

The sites addressed in this report are only the current active sites. A complete list of sites and all monitoring that has been conducted at each site can be found in the AQS system at [www.epa.gov/air/data/aqsdb.html](http://www.epa.gov/air/data/aqsdb.html). Also available at this site are air quality summary data and emissions data.

Map images in this appendix are from the North Dakota Geographic Information Systems (GIS) Hub site at <http://www.nd.gov/gis>.

## Site Name: Beulah – North

**Station Type:** SLAMS (required)

**AQS#:** 38-057-0004

**MSA:** 0000

**Address:** 6024 Highway 200

Beulah, ND

**Latitude:** +47.298611

**Longitude:** -101.766944

**Site Description:** This is one of three key sites in the Department's ambient monitoring network to meet the six required monitoring objectives. When this site was established, it was decided to enhance the site to include ammonia, solar radiation and delta temperature to support air quality dispersion modeling. This site is one of the required PM<sub>2.5</sub> monitoring sites for North Dakota. This site also acts as a collocated PM<sub>2.5</sub> site for meeting EPA Collocation requirements.

### Gas/Particulate parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	Population Exposure	Urban
Nitrogen Dioxide	Instrumental Chemiluminescence	Continuous	Population Exposure	Urban
Ozone	Instrumental Ultraviolet	Continuous	Population Exposure	Urban
PM <sub>2.5</sub>	PM <sub>2.5</sub> Beta Attenuation Collocated	Continuous	Population Exposure	Urban
	PM <sub>2.5</sub> scattered light spectrometry	Continuous	Population Exposure	Urban
PM <sub>10</sub>	PM <sub>10</sub> Local Condition scattered light spectrometry	Continuous	Population Exposure	Urban

### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Wind Speed	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Wind Direction	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Ambient Temperature	Elec. or Mach Avg.	Continuous	10 meters	Urban
Delta Temperature	Elec. or Mach Avg.	Continuous	10 - 2 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	6 meters	Urban
Solar Radiation	Pyranometer	Continuous	2 meters	Urban

There are no plans to move or remove this site.

Site Pictures: **Beulah North**



North



South



East



West



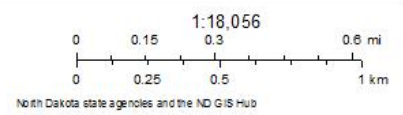
Looking Northeast



Looking Northwest



## Beulah - North



## Site Name: Bismarck Residential

**Station Type:** SLAMS, NCore

**AQS#:** 38-015-0003

**MSA:** 1010

**Address:** 1810 N 16<sup>th</sup> Street  
Bismarck, ND

**Latitude:** +46.825425

**Longitude:** -100.768210

**Site Description:** This site is located in the second largest metropolitan area in the state and is the designated NCore site in North Dakota. This site also serves as a field test location for new types of equipment and procedures.

### Gas/Particulate parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	Population Exposure	Urban
Nitrogen Dioxide	Instrumental Chemiluminescence	Continuous	Population Exposure	Urban
Carbon Monoxide	Instrumental Gas Filter Correlation	Continuous	Population Exposure	Urban
NO <sub>y</sub>	Instrumental Chemiluminescence	Continuous	Population Exposure	Urban
Ozone	Instrumental Ultraviolet	Continuous	Population Exposure	Urban
PM <sub>2.5</sub>	24-hour Gravimetric	1/3	Population Exposure	Urban
PM <sub>2.5</sub>	PM <sub>2.5</sub> Beta Attenuation	Continuous	Population Exposure	Urban
PM <sub>2.5</sub>	PM <sub>2.5</sub> scattered light spectrometry	Continuous	Population Exposure	Urban
PM <sub>10</sub> STP	PM <sub>10</sub> scattered light spectrometry	Continuous	Population Exposure	Urban
PM <sub>2.5</sub> Speciation	24-hour Gravimetric	1/3	Population Exposure	Urban

### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Wind Speed	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Wind Direction	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Ambient Temperature	Elec. or Mach Avg.	Continuous	10 meters	Urban
Delta Temperature	Elec. or Mach Avg.	Continuous	10 - 2 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	6 meters	Urban
Relative Humidity	Hygroscopic Plastic Film	Continuous	10 meters	Urban
Solar Radiation	Pyranometer	Continuous	2 meters	Urban

There are no plans to move or remove this site.



Site Pictures: **Bismarck Residential**



North



South



East

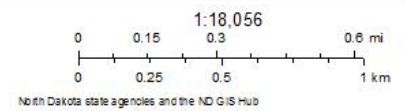


West



Southeast

## Bismarck Residential



## Site Name: Lake Ilo

**Station Type:** SLAMS

**AQS#:** 38-025-0004

**MSA:** 0000

**Address:** 101<sup>st</sup> Avenue SW

Dunn Center, ND

**Latitude:** +47.342442

**Longitude:** -102.645839

**Site Description:** This site is located about midway between the oil development all along the North Dakota – Montana border and the seven coal conversion facilities to the east. The importance lies in the ability to monitor the transport of sulfur dioxide, nitrogen dioxide, and PM<sub>2.5</sub> between these two areas. Also, this is a key site used in dispersion model calibration and validation.

### Gas/Particulate parameters

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	General/Background	Urban
Nitrogen Dioxide	Instrumental Chemiluminescence	Continuous	General/Background	Urban
Ozone	Instrumental Ultraviolet	Continuous	General/Background	Urban
PM <sub>2.5</sub>	PM <sub>2.5</sub> Beta Attenuation	Continuous	General/Background	Urban
PM <sub>10</sub>	PM <sub>10</sub> TEOM Gravimetric 50° Celsius	Continuous	General/Background	Urban

### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Wind Speed	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Wind Direction	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Ambient Temperature	Elec. or Mach Avg.	Continuous	10 meters	Urban
Delta Temperature	Elec. or Mach Avg.	Continuous	10 - 2 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	6 meters	Urban
Solar Radiation	Pyranometer	Continuous	2 meters	Urban



Site Pictures: **Lake Ilo**



North



West



East



South

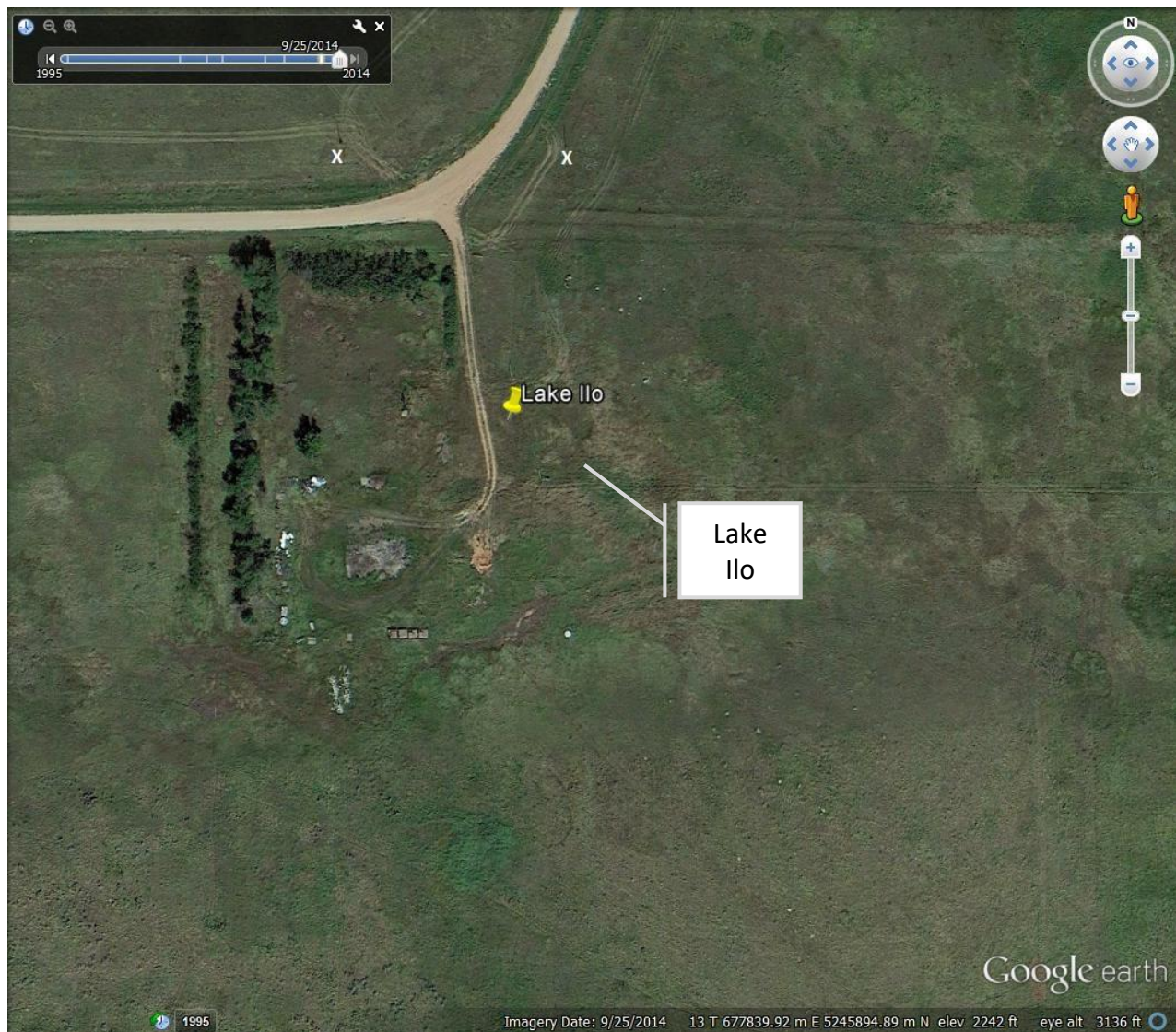


Looking Southeast



Looking Northeast





## Site Name: Fargo NW

**Station Type:** SLAMS (required)

**AQS#:** 38-017-1004

**MSA:** 2520

**Address:** 4266 40<sup>th</sup> Avenue North  
Fargo, ND

**Latitude:** +46.933754

**Longitude:** -96.855350

**Site Description:** This site is located in the largest metropolitan area in North Dakota. The data collected at this site are used in dispersion modeling for input, calibration and validation.

### Gas/Particulate parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	Population Exposure	Urban
Nitrogen Dioxide	Instrumental Chemiluminescence	Continuous	Population Exposure	Urban
Ozone	Instrumental Ultraviolet	Continuous	Population Exposure	Urban
PM <sub>2.5</sub>	PM <sub>2.5</sub> Beta Attenuation	Continuous	Population Exposure	Urban
PM <sub>10</sub>	PM <sub>10</sub> Beta Attenuation	Continuous	Population Exposure	Urban

### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Wind Speed	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Wind Direction	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Ambient Temperature	Elec. or Mach Avg.	Continuous	10 meters	Urban
Delta Temperature	Elec. or Mach Avg.	Continuous	10 - 2 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	6 meters	Urban
Relative Humidity	Hygroscopic Plastic Film	Continuous	10 meters	Urban
Solar Radiation	Pyranometer	Continuous	2 meters	Urban

There are no plans to move or remove this site. Fargo was upgraded to a Teledyne T640 during 2020, providing PM<sub>2.5</sub> and PM<sub>10</sub> Local Condition data.



Site Pictures: **Fargo NW**



North



West



East



South

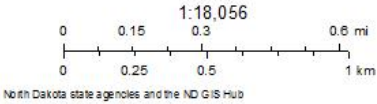


Looking Northeast



Looking West

Fargo NW





## Site Name: Hannover

**Station Type:** SLAMS

**AQS#:** 38-065-0002

**MSA:** 0000

**Address:** 1575 Highway 31  
Stanton, ND

**Latitude:** +47.185833

**Longitude:** -101.428056

**Site Description:** This site is centrally located to the power plants in the Oliver-Mercer-McLean county area. The data collected here are used to supplement ambient data collected at Beulah – North and TRNP – NU.

### Gas/Particulate parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	Source Oriented	Urban
Nitrogen Dioxide	Instrumental Chemiluminescence	Continuous	Source Oriented	Urban
Ozone	Instrumental Ultraviolet	Continuous	Source Oriented	Urban
PM <sub>2.5</sub>	PM <sub>2.5</sub> Beta Attenuation	Continuous	Source Oriented	Urban
PM <sub>10</sub>	PM <sub>10</sub> TEOM Gravimetric 50° Celsius	Continuous	Source Oriented	Urban

### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Wind Speed	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Wind Direction	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Ambient Temperature	Elec. or Mach Avg.	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	6 meters	Urban

There are no plans to move or remove this site. Hannover was upgraded to a Teledyne T640 during 2020, providing PM<sub>2.5</sub> and PM<sub>10</sub> Local Condition data.

Site Pictures: **Hannover**



North



East



South



West

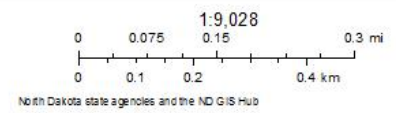


Looking Southwest



Looking Northeast

# Hannover





## Site Name: Lostwood NWR

**Station Type:** SLAMS

**AQS#:** 38-013-0004

**MSA:** 0000

**Address:** 8315 Highway 8  
Kenmare, ND

**Latitude:** +48.641930

**Longitude:** -102.401800

**Site Description:** This site is located in a PSD Class I area. This site is downwind of two power plants near Estevan, SK, and located in the Souris River Airshed.

The site has an IMPROVE sampler operated by the US Fish and Wildlife Service. These data will be used with the other ambient data collected here to evaluate long-range transport of aerosols affecting regional haze/visibility.

### Gas/Particulate parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	Regional Transport	Regional
Nitrogen Dioxide	Instrumental Chemiluminescence	Continuous	Regional Transport	Regional
Ozone	Instrumental Ultraviolet	Continuous	Regional Transport	Regional
Ozone	Instrumental Chemiluminescence	Continuous	Regional Transport	Regional
PM <sub>2.5</sub>	PM <sub>2.5</sub> Beta Attenuation	Continuous	Regional Transport	Regional
PM <sub>10</sub>	PM <sub>10</sub> TEOM Gravimetric 50° Celsius	Continuous	Regional Transport	Regional

### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Wind Speed	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Wind Direction	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Ambient Temperature	Elec. or Mach Avg.	Continuous	10 meters	Urban
Delta Temperature	Elec. or Mach Avg.	Continuous	10 - 2 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	6 meters	Urban
Solar Radiation	Pyranometer	Continuous	2 meters	Urban
Relative Humidity	Hygroscopic Plastic Film	Continuous	10 meters	Urban

There are no plans to move or remove this site. Lostwood was upgraded to a Teledyne T640 during 2020, providing PM<sub>2.5</sub> and PM<sub>10</sub> Local Condition data.

Site Pictures: **Lostwood NWR**



North



South



East



West

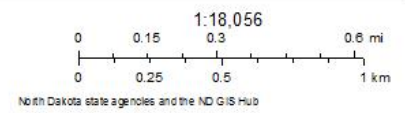


Looking Northwest



Looking North

## Lostwood NWR



## Site Name: Painted Canyon (TRNP – SU)

**Station Type:** SLAMS

**AQS#:** 38-007-0002

**MSA:** 0000

**Address:** Theodore Roosevelt National Park – South Unit  
13881 I94 East

**Latitude:** +46.894300

**Longitude:** -103.378530

**Site Description:** Located in the South Unit of Theodore Roosevelt National Park, this Class I area site is operated in partnership with the National Park Service. As it is positioned south of the majority of oil and gas activity in the state, this station plays a key role in monitoring general background conditions and providing data for dispersion modeling input, calibration and validation.

The site has an IMPROVE sampler operated by the National Park Service. These data will be used with the other ambient data collected here to evaluate long-range transport of aerosols affecting regional haze/visibility.

### Gas/Particulate parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	General/Background	Urban
Ozone	Instrumental Ultraviolet	Continuous	General/Background	Urban
PM <sub>2.5</sub>	PM <sub>2.5</sub> Beta Attenuation	Continuous	General/Background	Urban

### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
*	*	*	*	*

\* All meteorological parameters are monitored as part of the NPS network.

There are no plans to move or remove this site.



Site Pictures: **Painted Canyon**



North



East



South



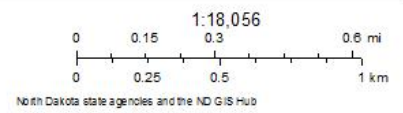
West



Looking Southwest



## Painted Canyon



## Site Name: Ryder

**Station Type:** SLAMS

**AQS#:** 38-101-0003

**MSA:** 0000

**Address:** 184<sup>th</sup> St. SW

Ryder, ND

**Latitude:** +47.940861

**Longitude:** -101.571583

**Site Description:** This site is located at the eastern edge of the major oil and gas production area of the state. Located in Ward County, it is approximately 20 miles southwest of the city of Minot. This station is intended to provide data on regional pollutant transport and population impacts.

### Gas/Particulate parameters:

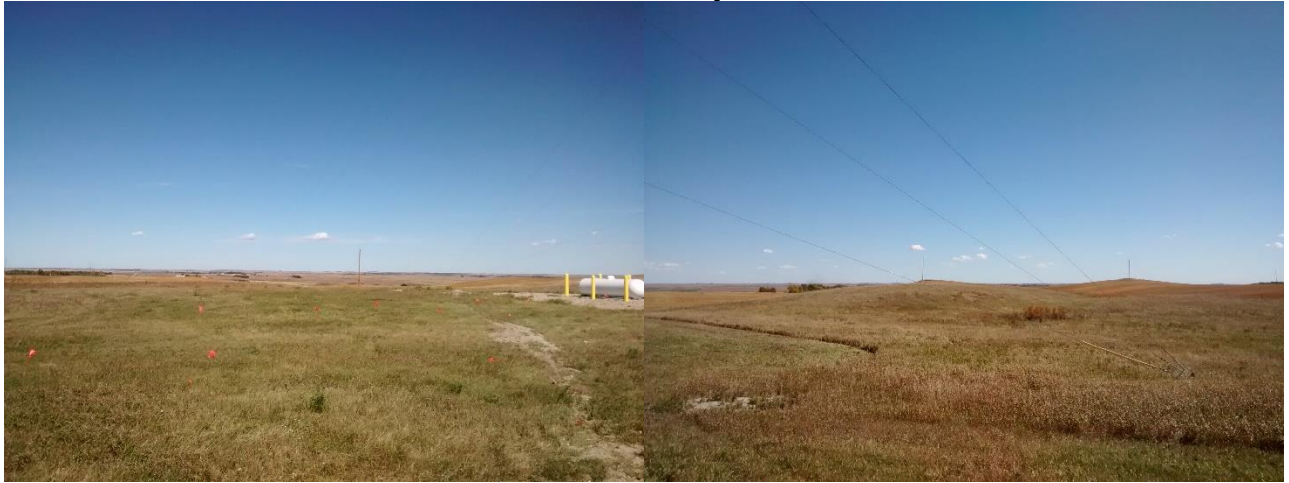
Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	Regional Transport / Population Exposure	Regional
Nitrogen Dioxide	Instrumental Chemiluminescence	Continuous	Regional Transport / Population Exposure	Regional
Ozone	Instrumental Ultraviolet	Continuous	Regional Transport / Population Exposure	Regional
PM <sub>2.5</sub>	PM <sub>2.5</sub> Beta Attenuation	Continuous	Regional Transport / Population Exposure	Regional
PM <sub>10</sub>	PM <sub>10</sub> TEOM Gravimetric 50° Celsius	Continuous	Regional Transport / Population Exposure	Regional

### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Wind Speed	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Wind Direction	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Ambient Temperature	Elec. or Mach Avg.	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	6 meters	Urban

There are no plans to move or remove this site.

Site Pictures: **Ryder**



North

East



South

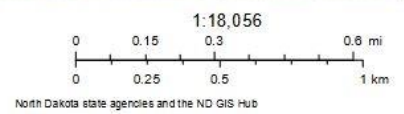
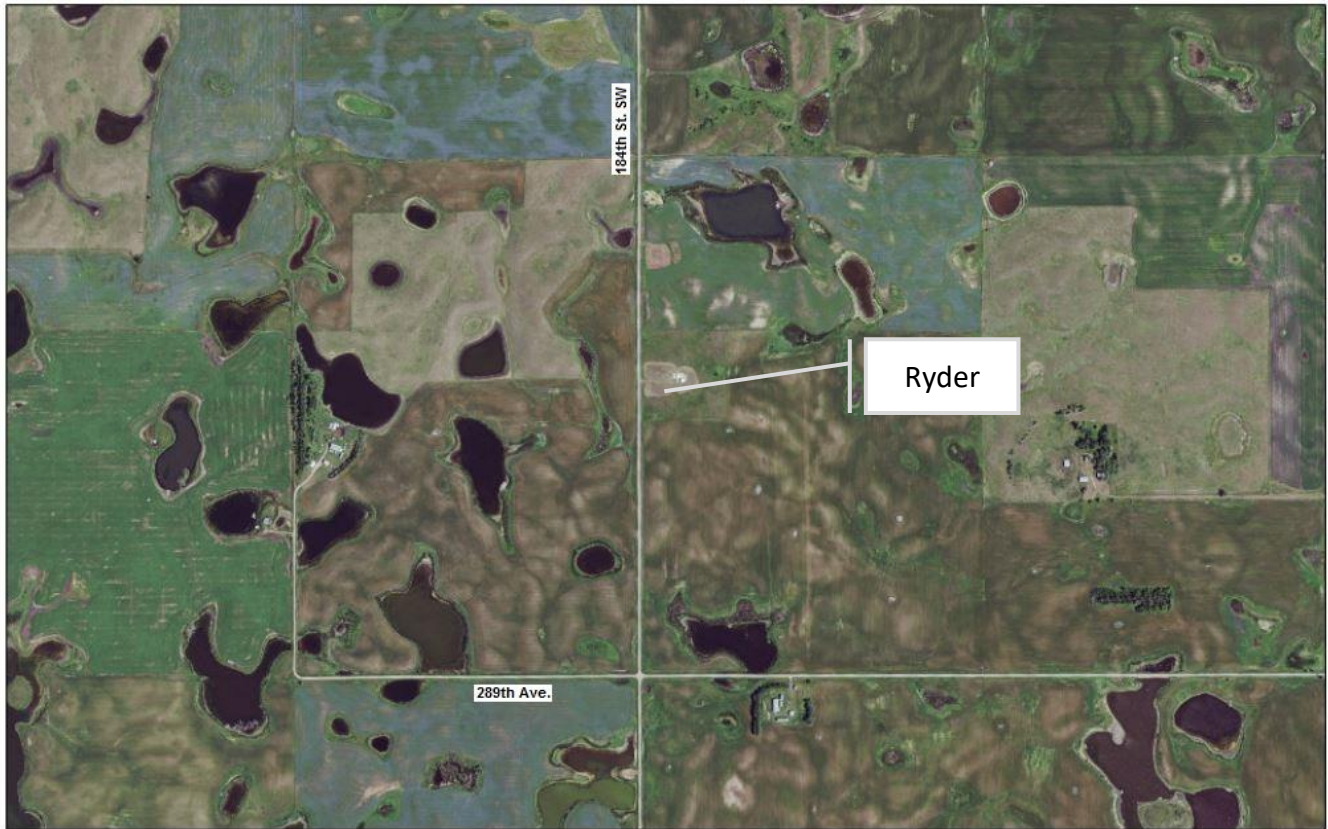
West



Looking Northeast



# Ryder



## Site Name: TRNP-NU

Station Type: SLAMS (required)

AQS#: 38-053-0002

MSA: 0000

Address: 229 Service Road  
Watford City, ND

Latitude: +47.581200

Longitude: -103.299500

**Site Description:** This site is located in Theodore Roosevelt National Park – North Unit, a Class I area, and is one of three key sites in the Department’s ambient monitoring network to meet the six required monitoring objectives. The data collected are used for model calibration/validation.

### Gas/Particulate parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	General/Background	Regional
Nitrogen Dioxide	Instrumental Chemiluminescence	Continuous	General/Background	Regional
Ozone	Instrumental Ultraviolet	Continuous	General/Background	Regional
PM <sub>2.5</sub>	PM <sub>2.5</sub> Beta Attenuation	Continuous	General/Background Regional Transport	Regional
PM <sub>10</sub>	PM <sub>10</sub> TEOM Gravimetric 50° Celsius	Continuous	General/Background Regional Transport	Regional

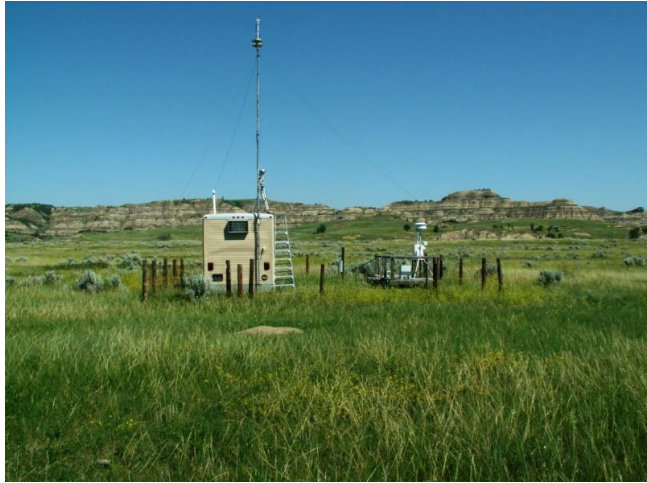
### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Wind Speed	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Wind Direction	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Ambient Temperature	Elec. or Mach Avg.	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	6 meters	Urban
Relative Humidity	Hygroscopic Plastic Film	Continuous	10 meters	Urban

There are no plans to move or remove this site.



Site Pictures: **TRNP-NU**



North



South



East



West



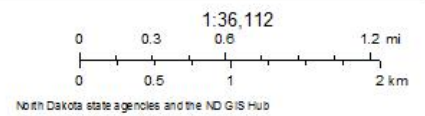
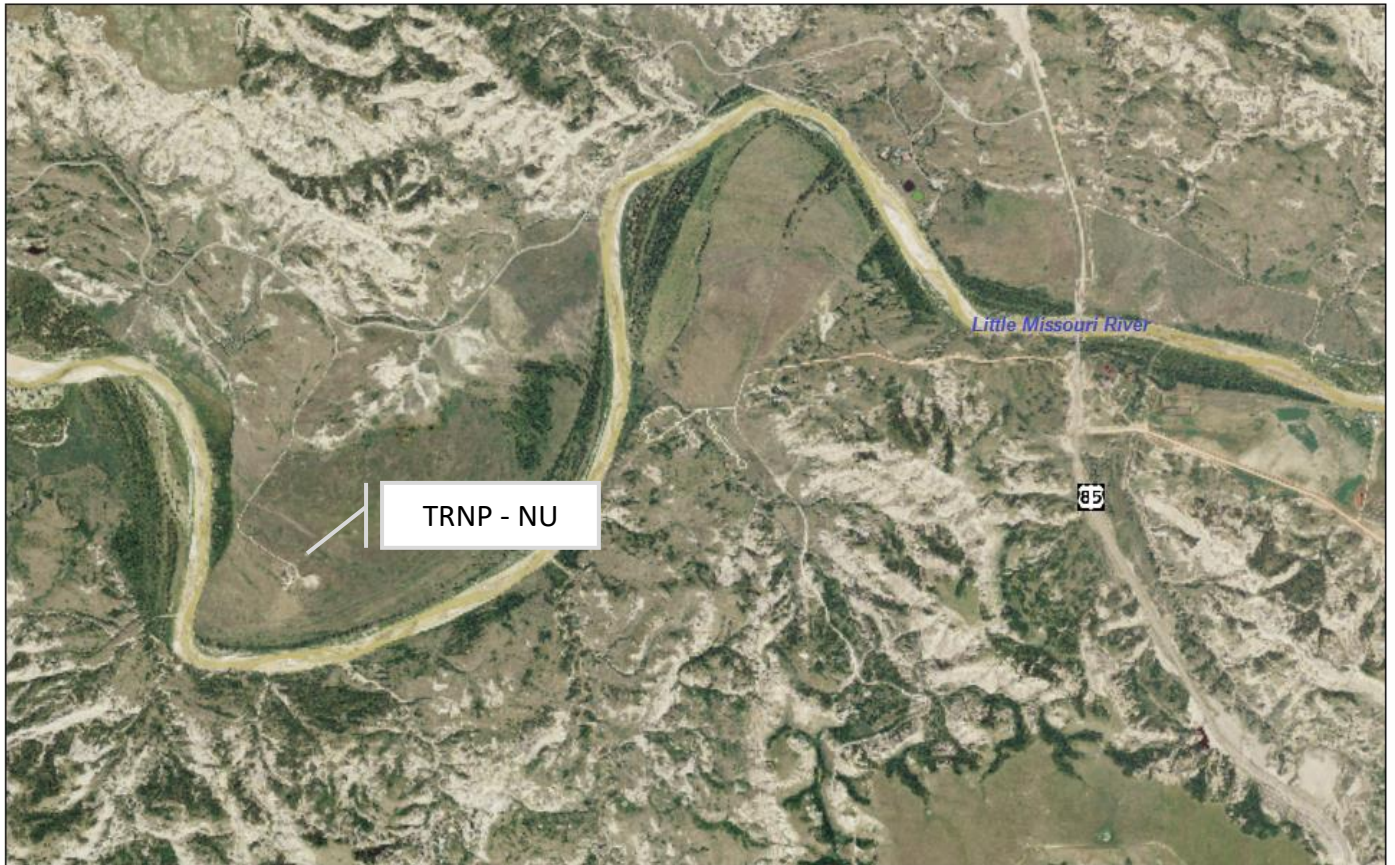
Looking Northwest



Looking Northeast



## Theodore Roosevelt National Park - North Unit



## Site Name: Williston

Station Type: SLAMS

AQS#: 38-105-0003

MSA: 0000

Address: 10<sup>th</sup> Street West

Williston, ND

Latitude: +48.152780

Longitude: -103.639510

**Site Description:** This site is located in the Williston Riverview Cemetery in downtown Williston. It is in the heart of the oil and gas development activity area and serves to meet the objective of monitoring population exposure to particulate matter and ozone.

### Gas/Particulate parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Ozone	Instrumental Ultraviolet	Continuous	Population Exposure	Urban
PM <sub>2.5</sub>	PM <sub>2.5</sub> Beta Attenuation	Continuous	Population Exposure	Urban
PM <sub>10</sub>	PM <sub>10</sub> TEOM Gravimetric 50° Celsius	Continuous	Population Exposure	Urban

### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Wind Speed	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Wind Direction	Elec. or Mach Avg. Level 1	Continuous	10 meters	Urban
Ambient Temperature	Elec. or Mach Avg.	Continuous	10 meters	Urban
Ambient Pressure	Barometric Pressure Transducer	Continuous	6 meters	Urban

The Williston site was constructed to provide data primarily to cover the influx of truck traffic and impacts from the rapid development of Oil and Gas activity in the area. The focus for the Williston site was to provide Particulate Matter produced from haul road and truck activity in the area. PM levels have significantly dropped over the life of the site. With the call for reductions in the Departments budgets, mainly due to the reduction in oil field activity in the area, and the fact that the Williston site is only a PM site; the department is looking into suspending monitoring at the Williston site.



Site Pictures: **Williston**



North



South

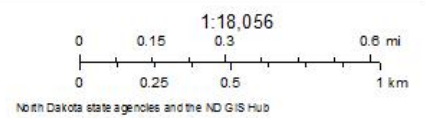
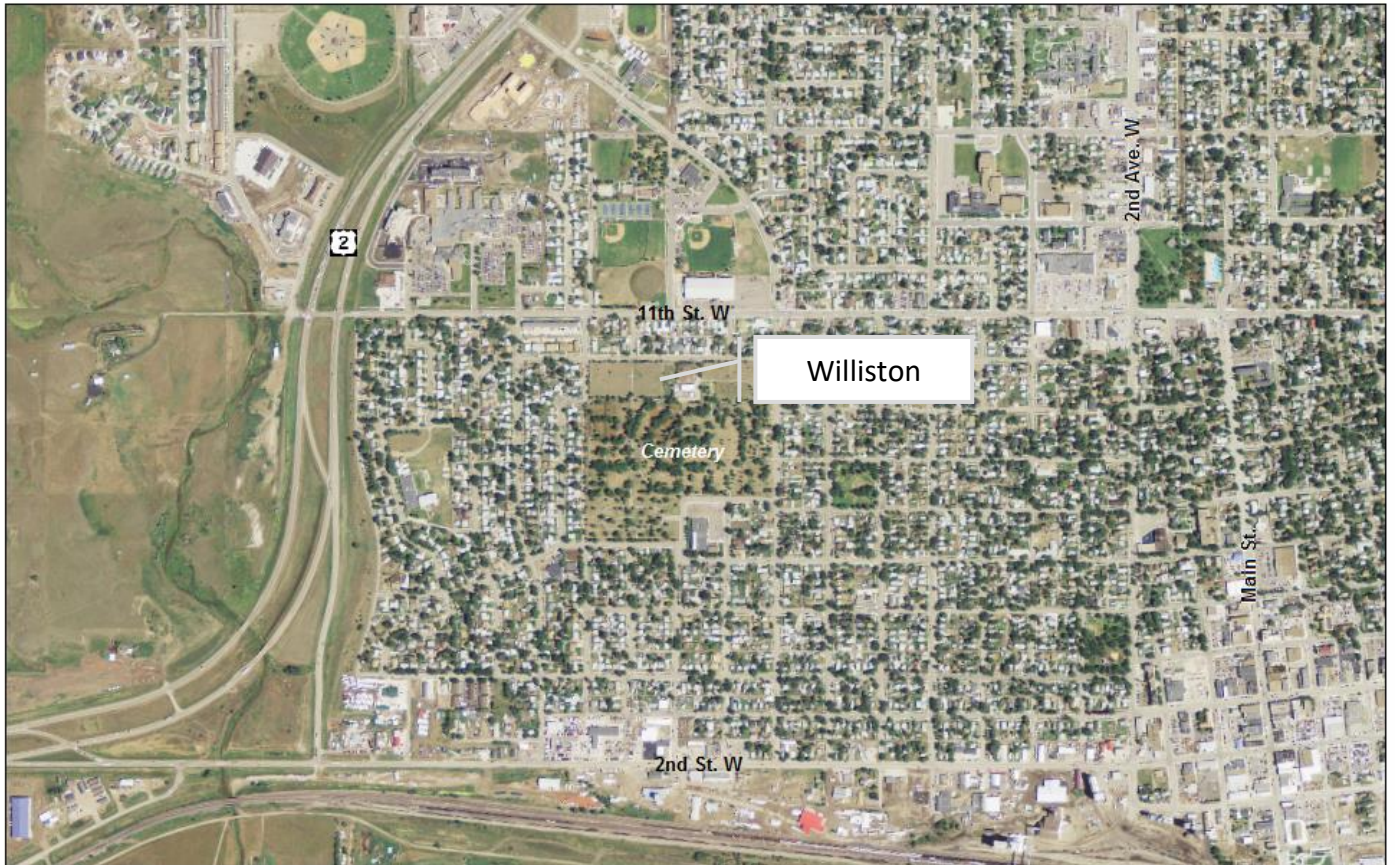


East



West

## Williston



## **Appendix D**

### **Wind and Pollution Roses**

The figures in this appendix are organized with the site's wind rose presented at top, criteria pollutant roses follow in alphabetical order, monitored pollutant roses.

The pollution roses show the percentage of time a pollutant is detected when the wind is from a given direction and provide a total summary of detected concentrations in the legend.



## Site Name: Beulah – North

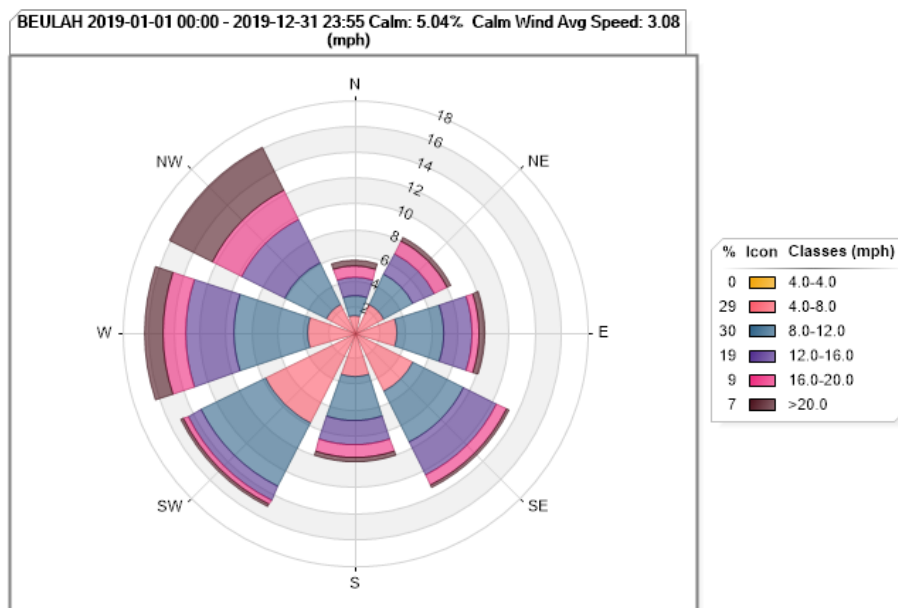


Figure 22. Beulah Wind Rose for 2019

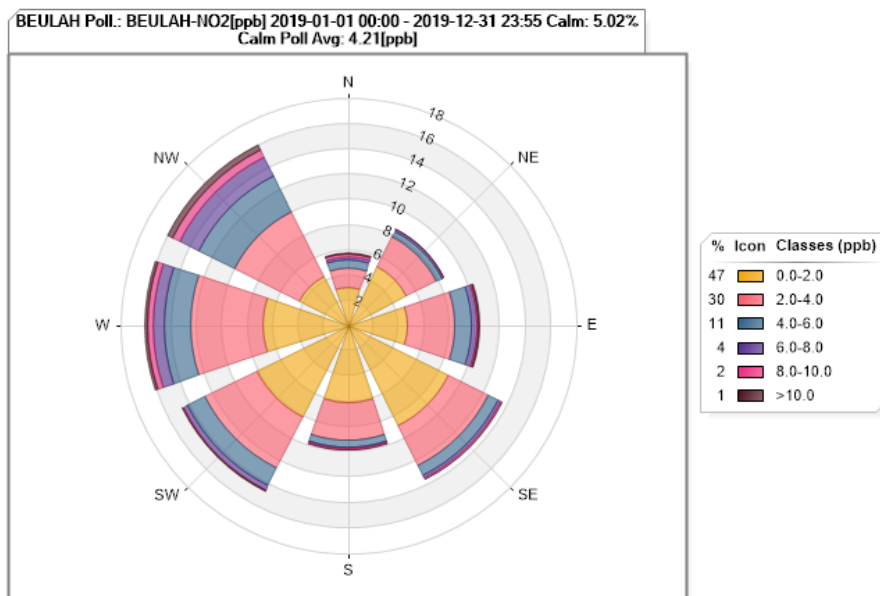


Figure 23. Beulah NO<sub>2</sub> Pollution Rose for 2019

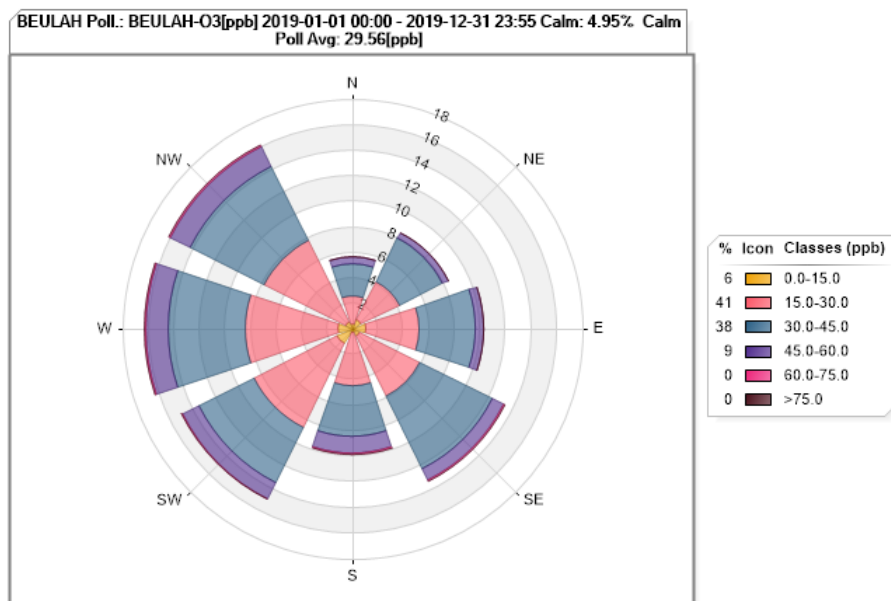


Figure 24. Beulah O<sub>3</sub> Pollution Rose for 2019

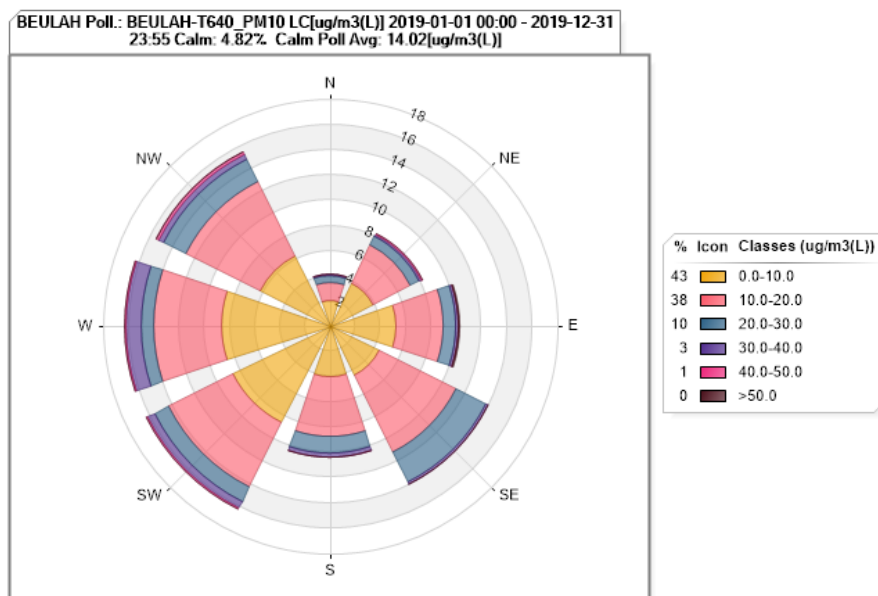


Figure 25. Beulah PM<sub>10</sub> Pollution Rose for 2019

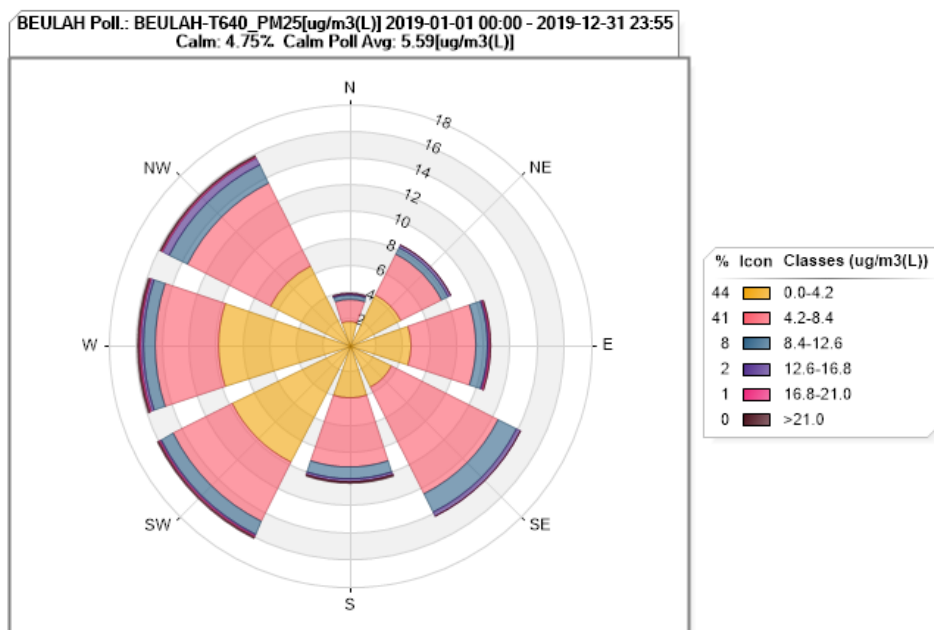


Figure 26. Beulah PM<sub>2.5</sub> Pollution Rose for 2019

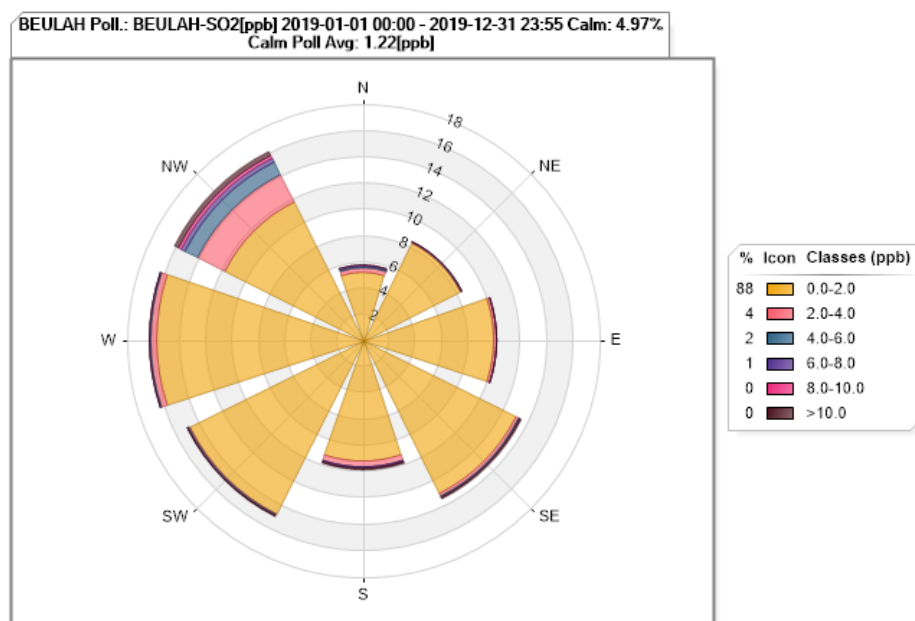


Figure 27. Beulah SO<sub>2</sub> Pollution Rose for 2019

## Site Name: Bismarck Residential

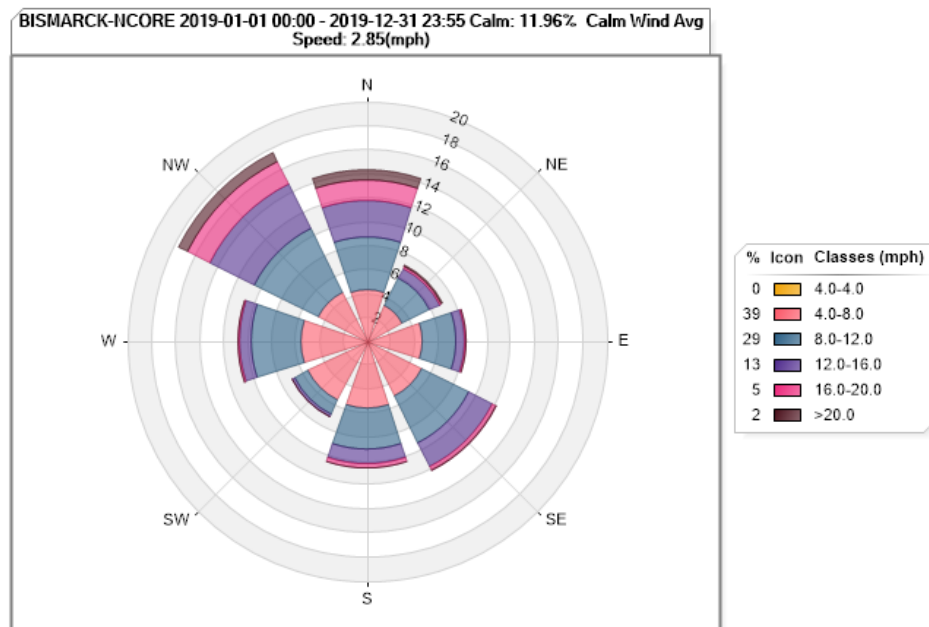


Figure 28. Bismarck Wind Rose for 2019

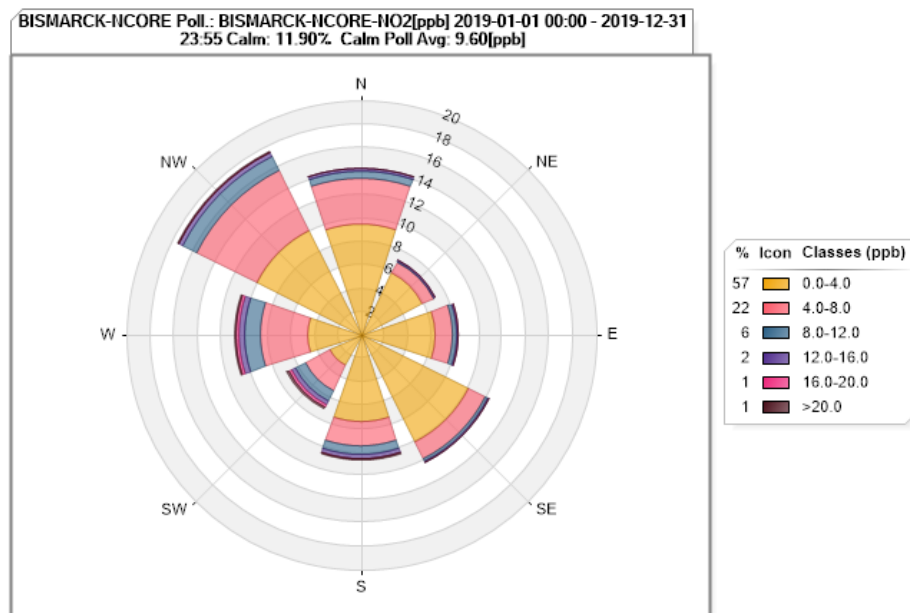


Figure 29. Bismarck NO<sub>2</sub> Pollution Rose for 2019



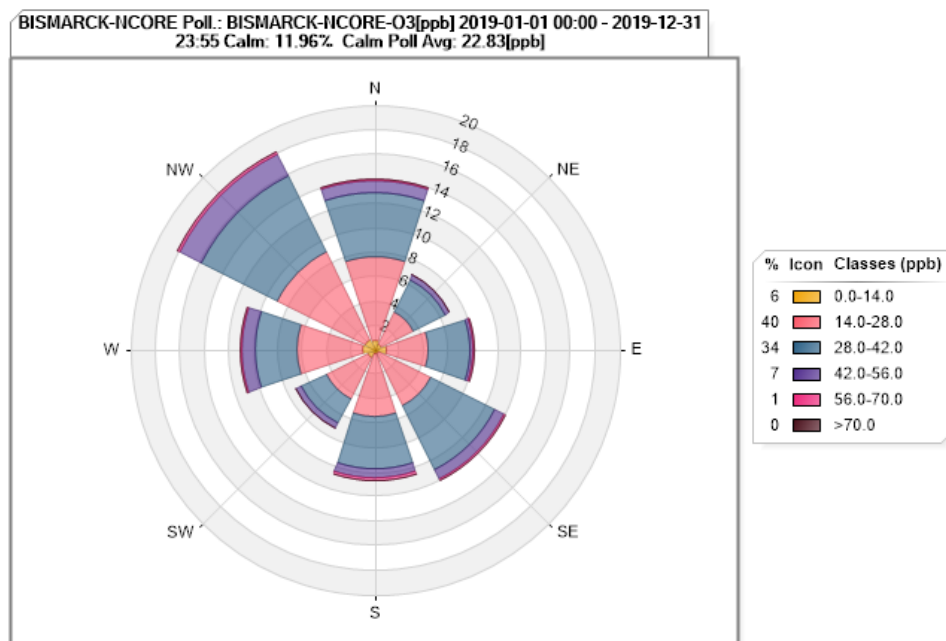


Figure 29. Bismarck O<sub>3</sub> Pollution Rose for 2019

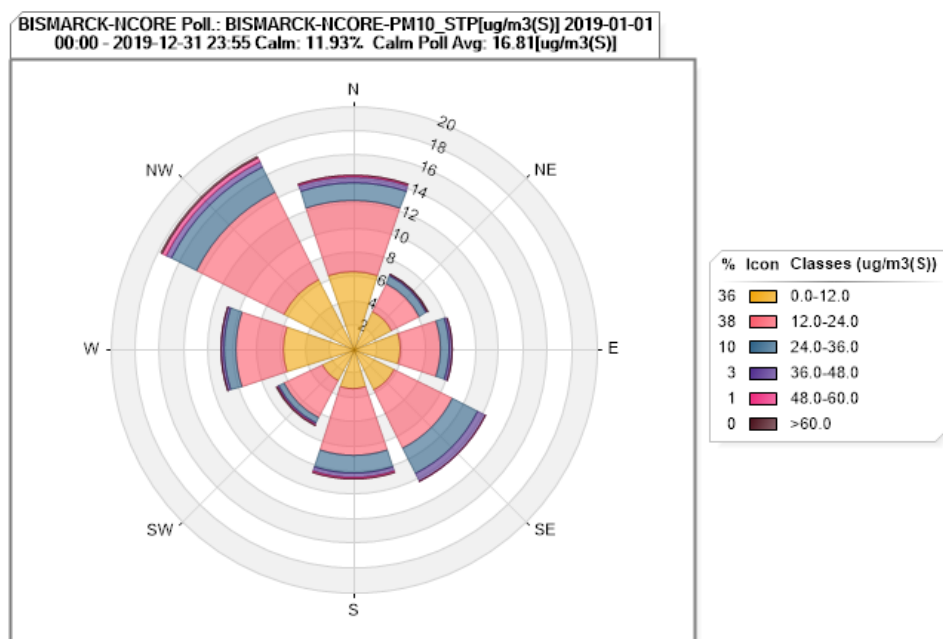


Figure 30. Bismarck PM<sub>10</sub> Pollution Rose for 2019

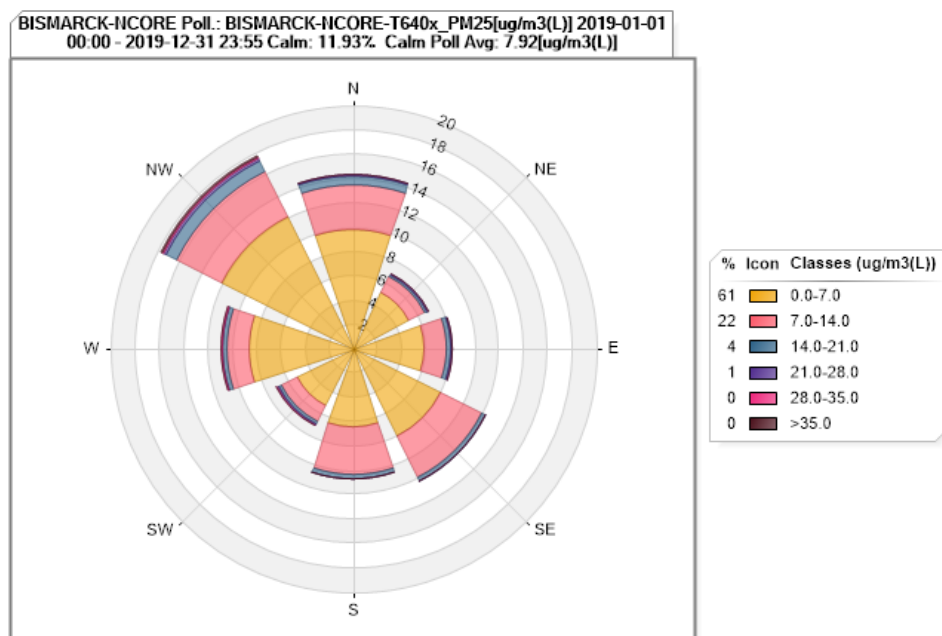


Figure 31. Bismarck PM<sub>2.5</sub> Pollution Rose for 2019

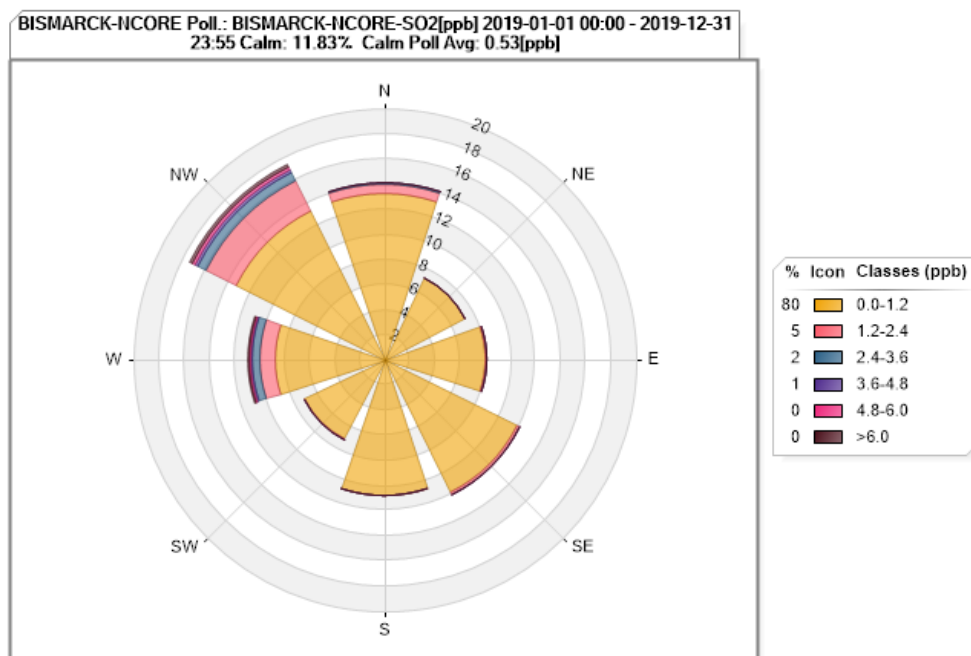


Figure 32. Bismarck SO<sub>2</sub> Pollution Rose for 2018

## Site Name: Lake Ilo

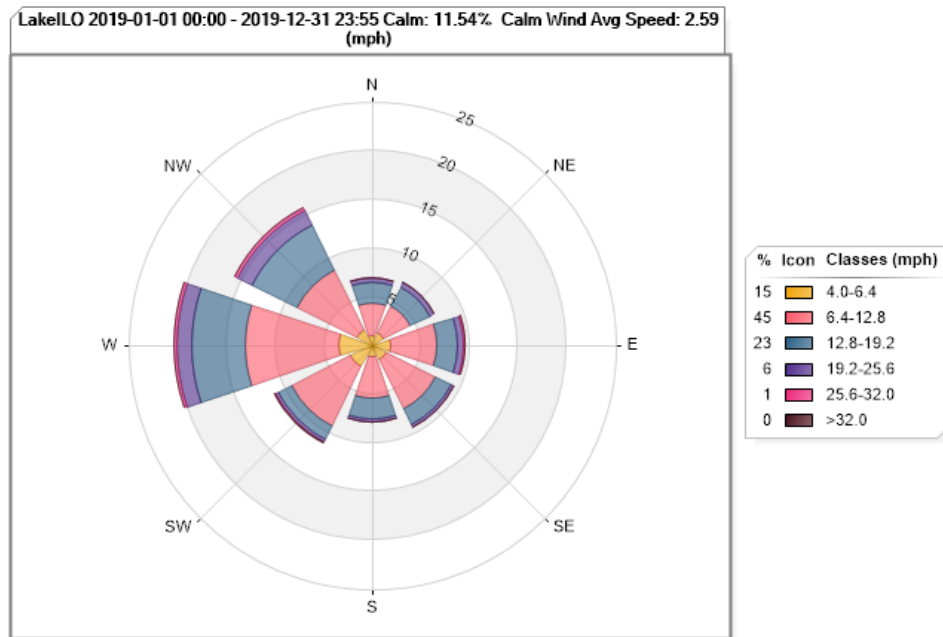


Figure 33. Lake Ilo Wind Rose for 2019

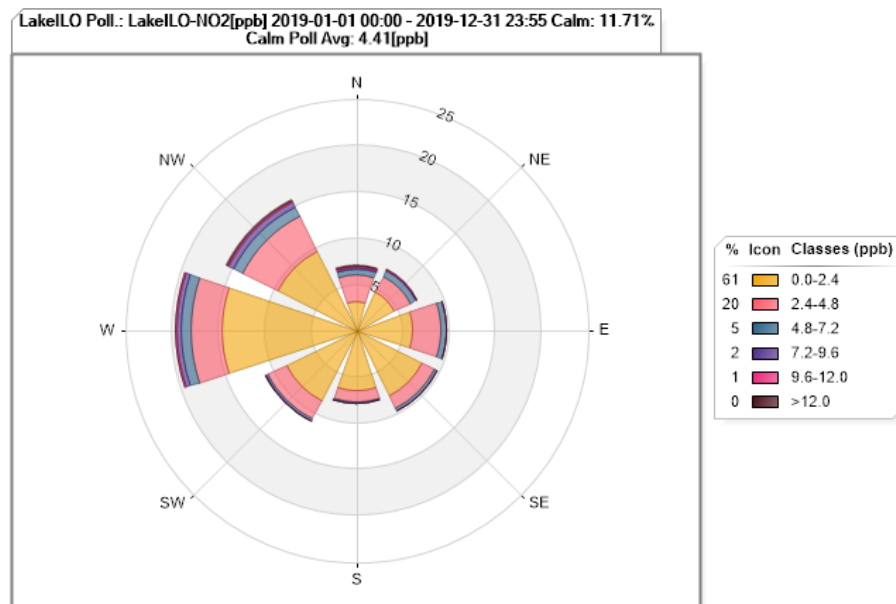


Figure 34. Lake Ilo NO<sub>2</sub> Pollution Rose for 2019

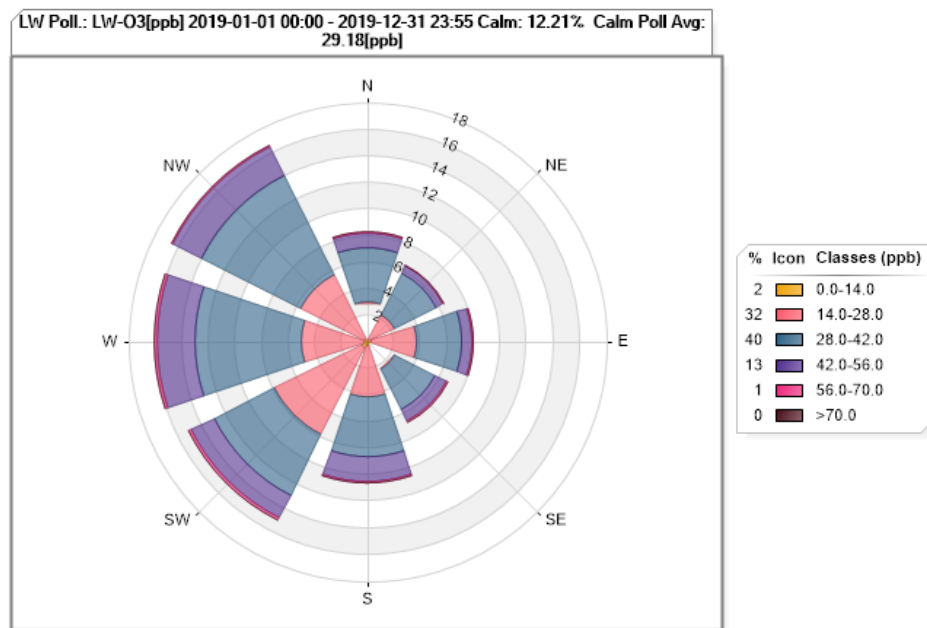


Figure 35. Lake Ilo O<sub>3</sub> Pollution Rose for 2019

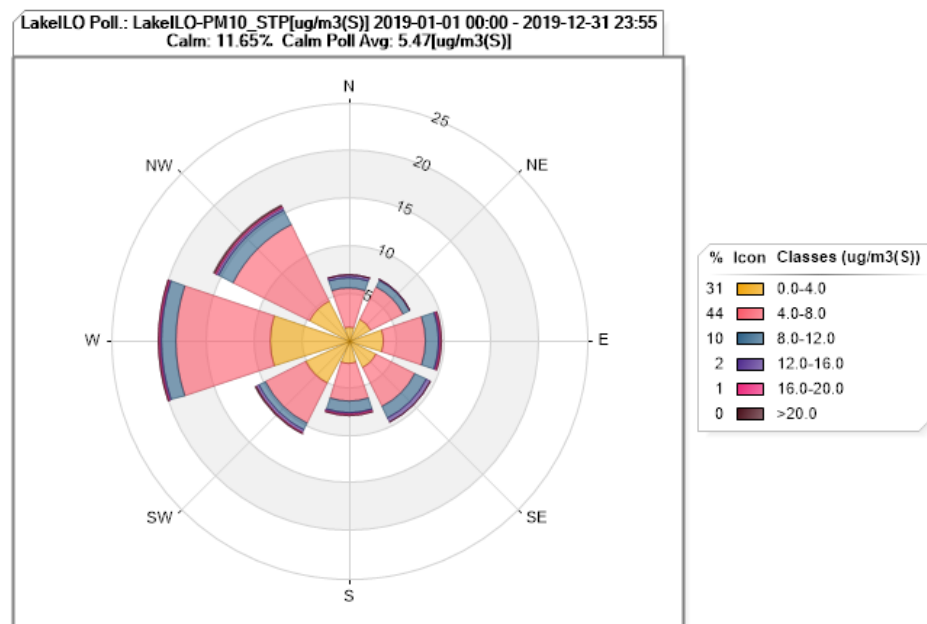


Figure 37. Lake Ilo PM<sub>10</sub> Pollution Rose for 2019

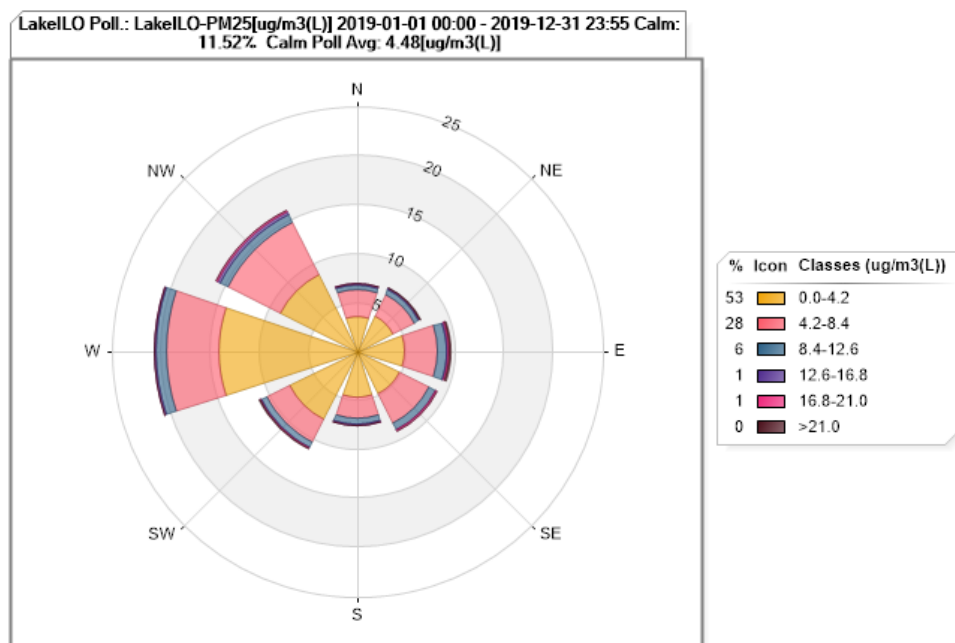


Figure 36. Lake Ilo PM<sub>2.5</sub> Pollution Rose for 2019

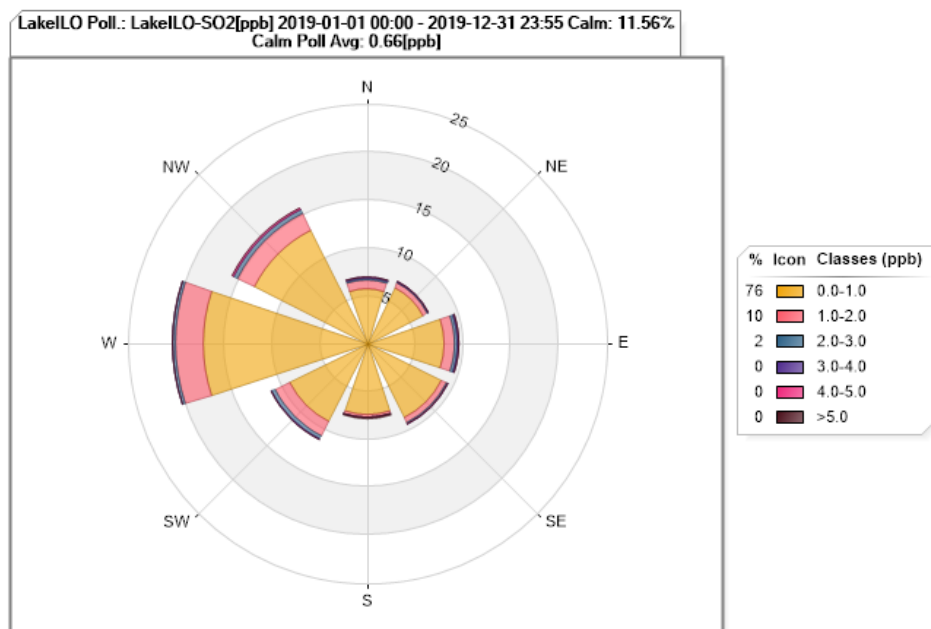


Figure 37. Lake Ilo SO<sub>2</sub> Pollution Rose for 2019

## Site Name: Fargo NW

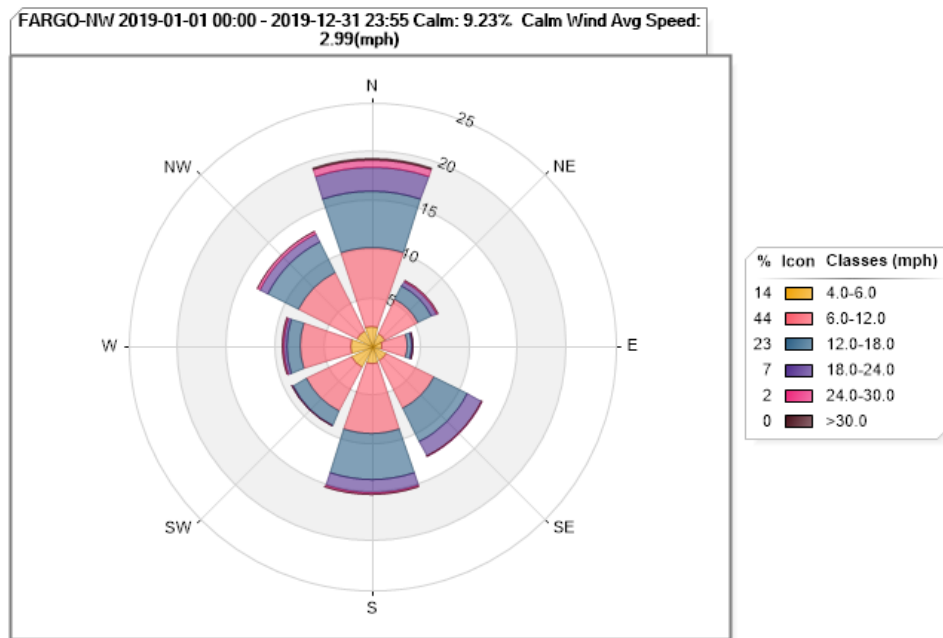


Figure 38. Fargo Wind Rose for 2019

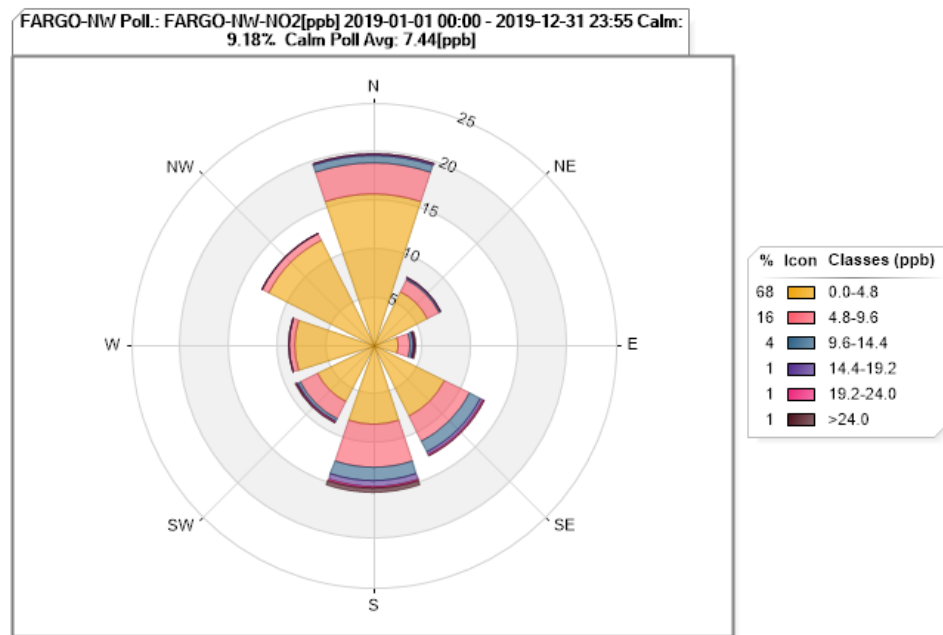


Figure 39. Fargo NO<sub>2</sub> Pollution Rose for 2019

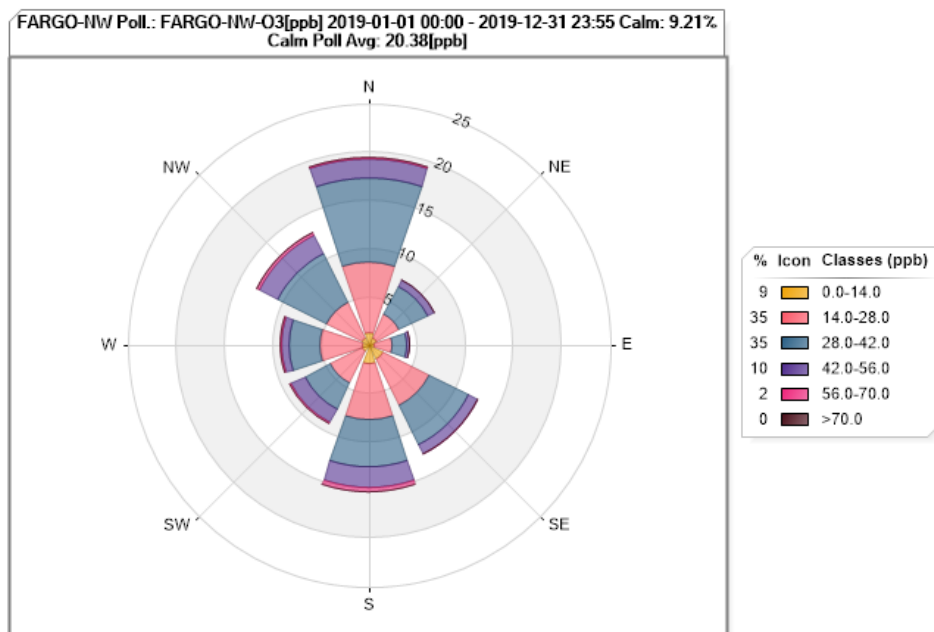


Figure 40. Fargo O<sub>3</sub> Pollution Rose for 2019

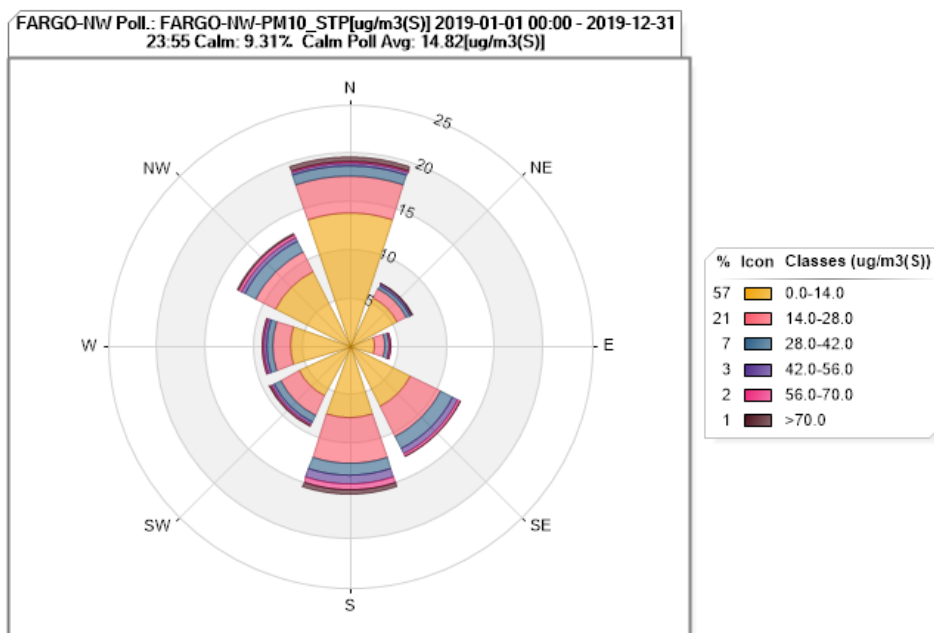


Figure 41. Fargo PM<sub>10</sub> Pollution Rose for 2019



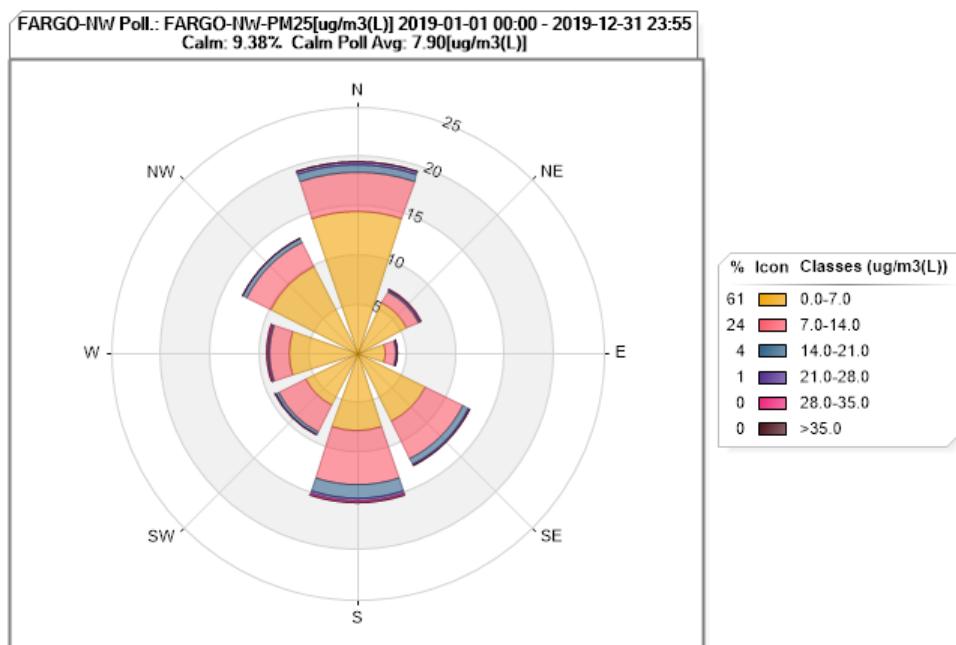


Figure 42. Fargo PM<sub>2.5</sub> Pollution Rose for 2019

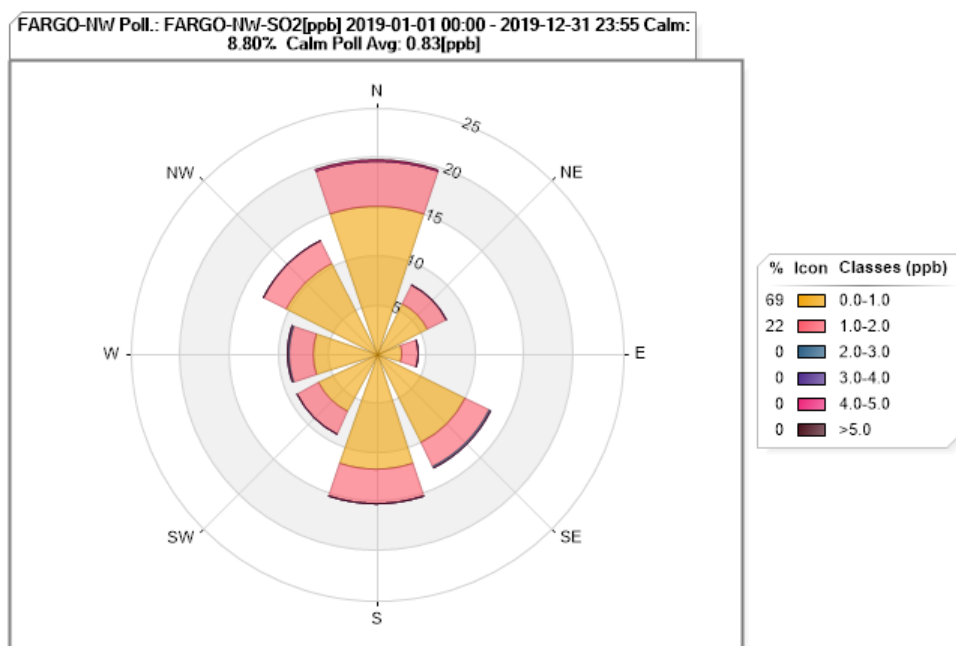


Figure 43. Fargo SO<sub>2</sub> Pollution Rose for 2019

## Site Name: Hannover

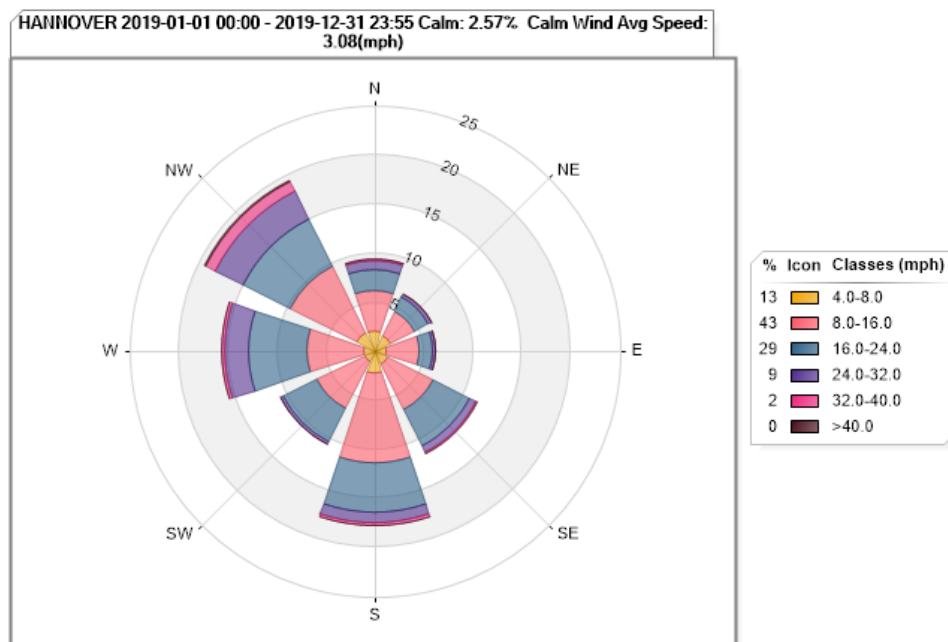


Figure 44. Hannover Wind Rose for 2019

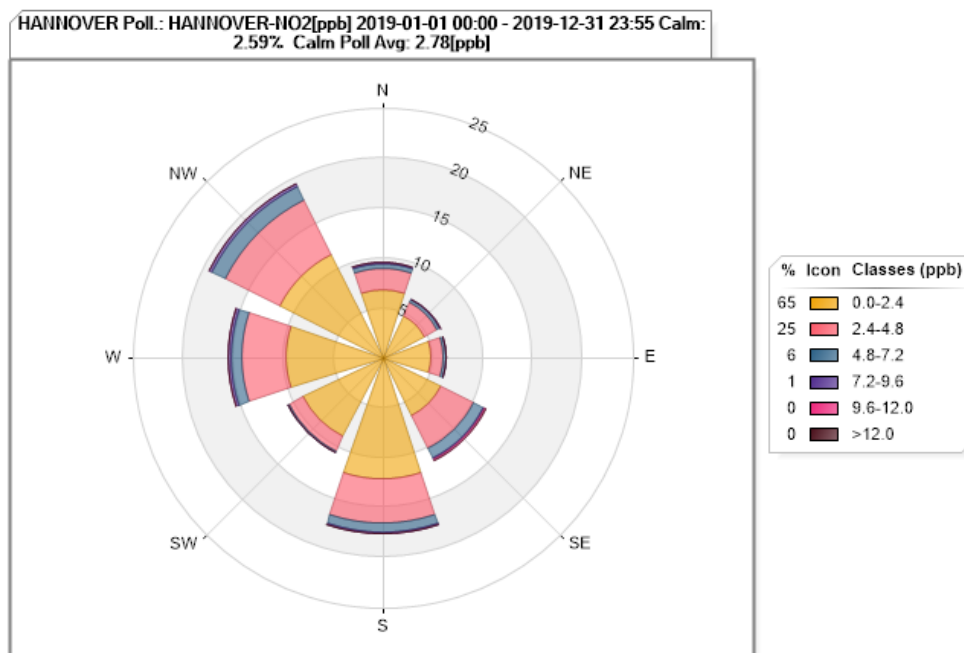


Figure 47. Hannover NO<sub>2</sub> Pollution Rose for 2019

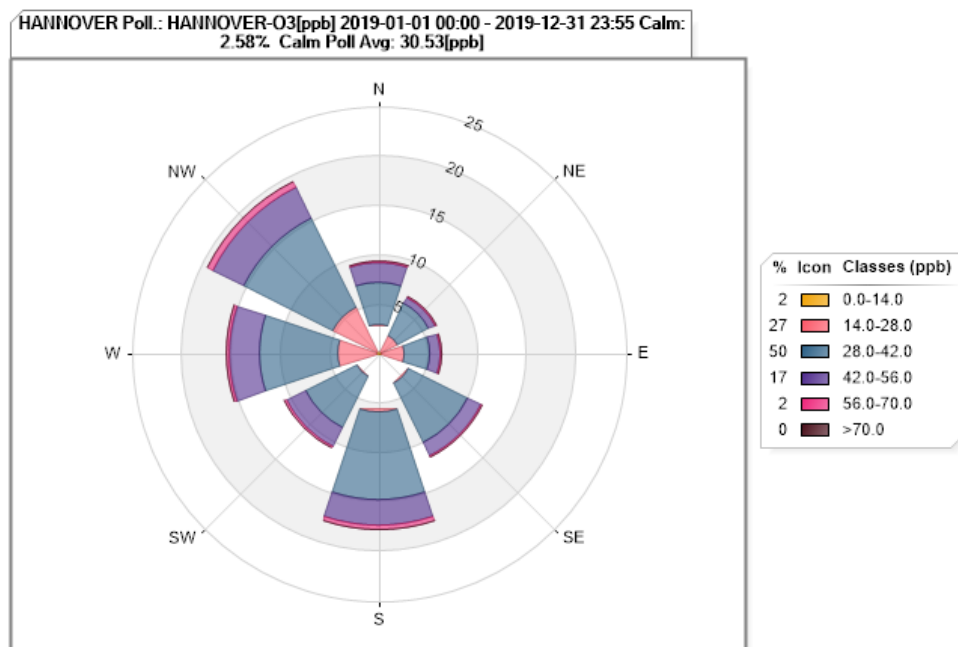


Figure 45. Hannover O<sub>3</sub> Pollution Rose for 2019

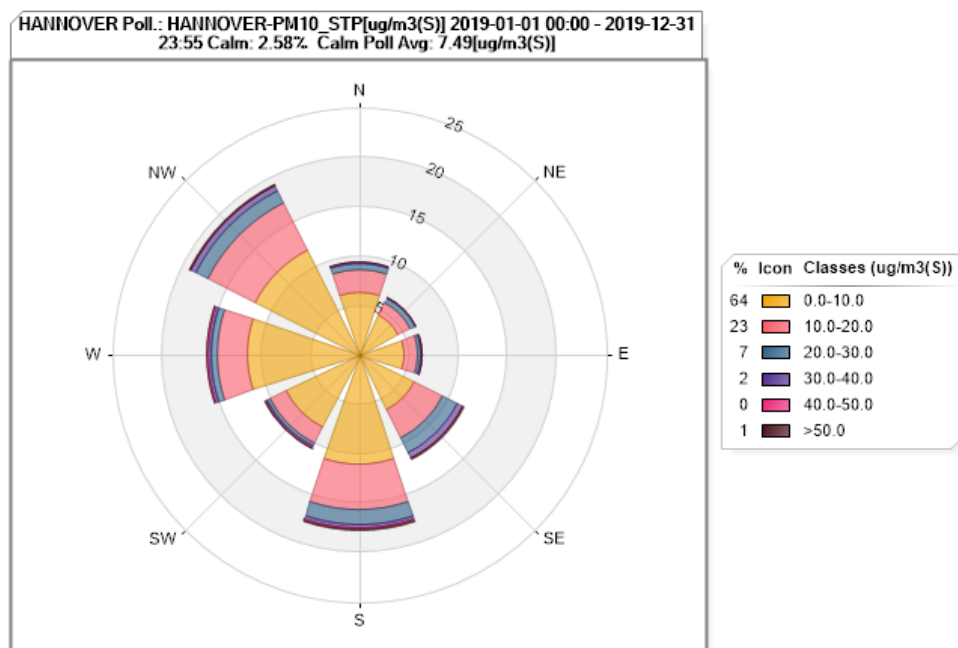


Figure 46. Hannover PM<sub>10</sub> Pollution Rose for 2019

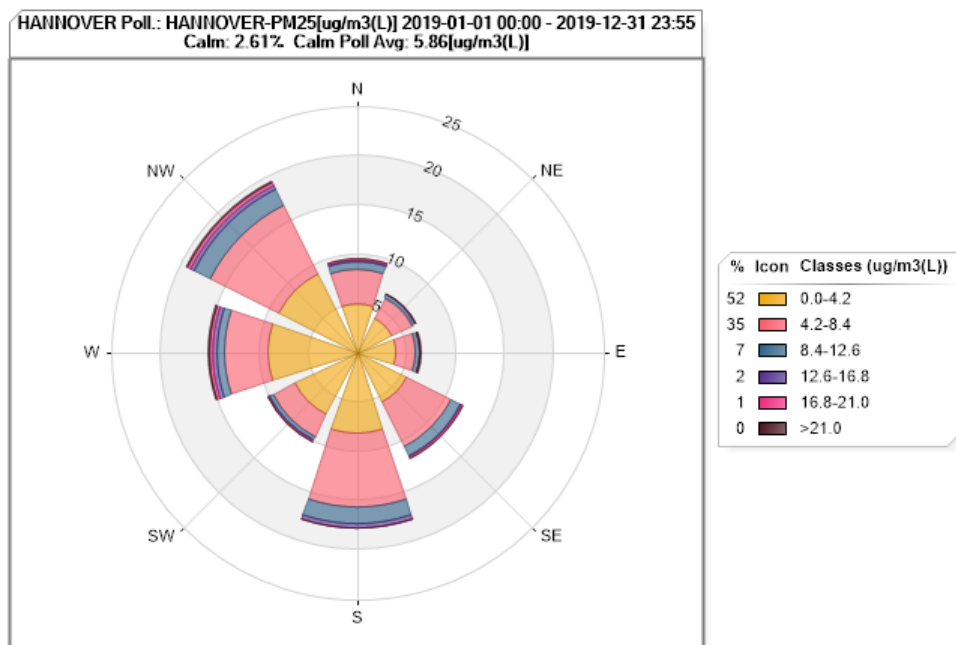


Figure 50. Hannover PM<sub>2.5</sub> Pollution Rose for 2019

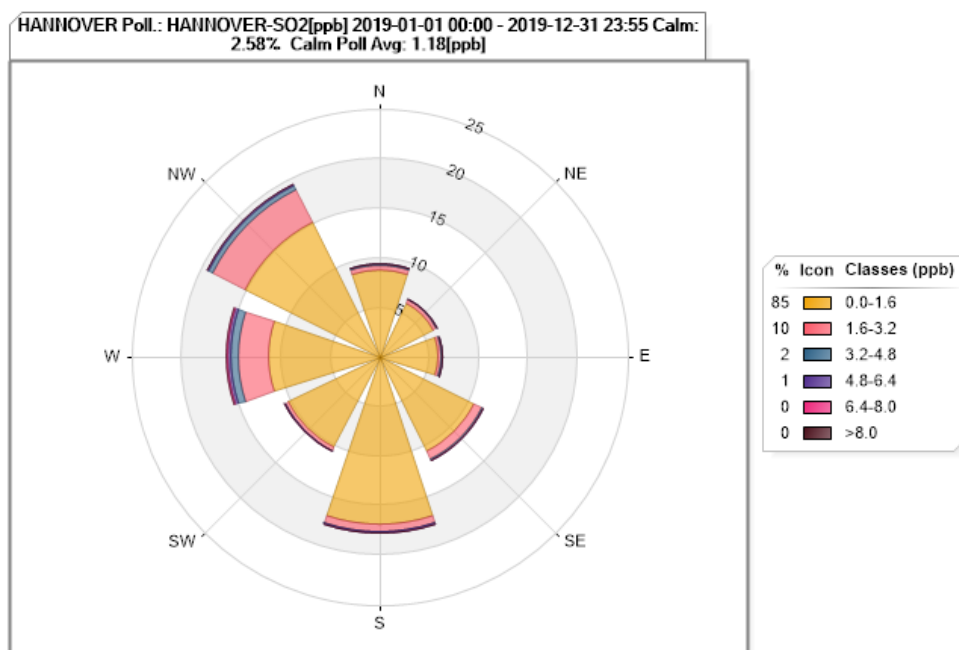


Figure 47. Hannover SO<sub>2</sub> Pollution Rose for 2019

## Site Name: Lostwood NWR

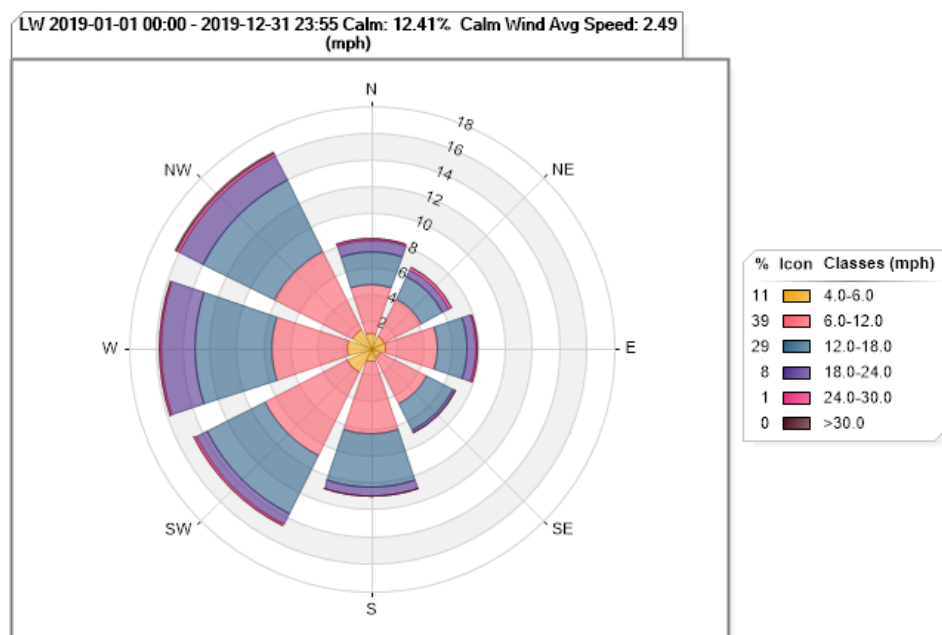


Figure 48. Lostwood Wind Rose for 2019

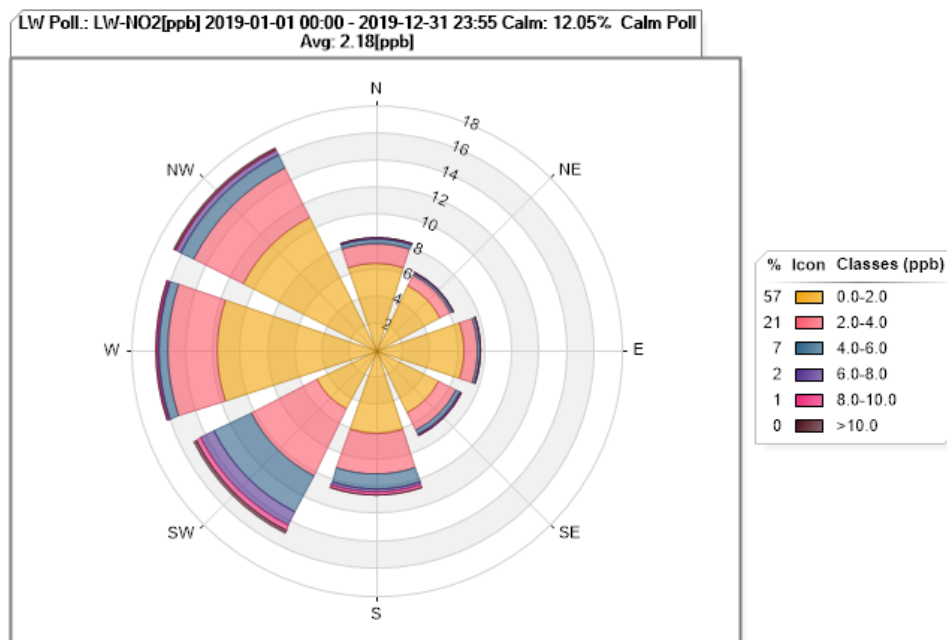


Figure 49. Lostwood NO<sub>2</sub> Pollution Rose for 2019



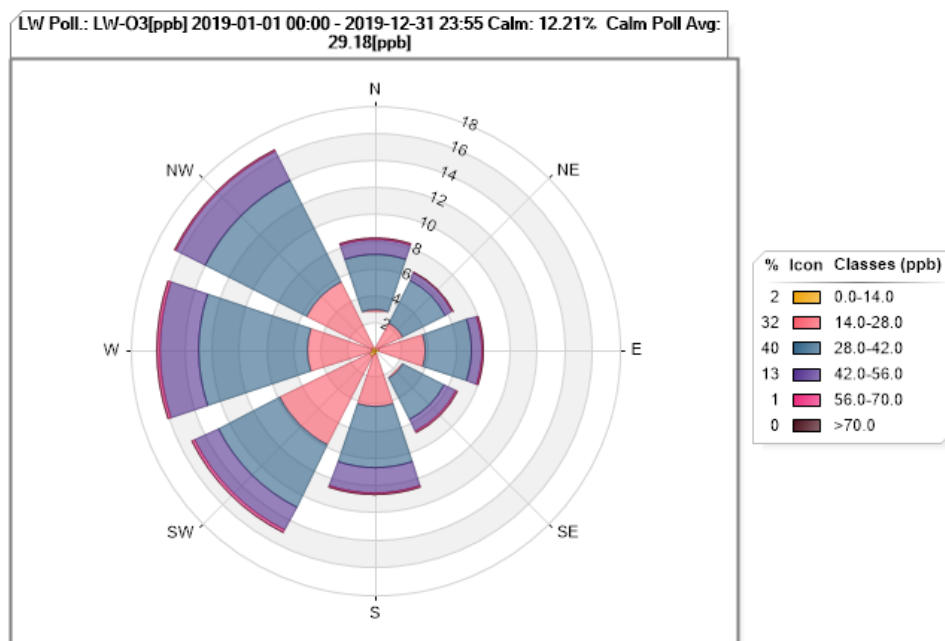


Figure 50. Lostwood O<sub>3</sub> Pollution Rose for 2019

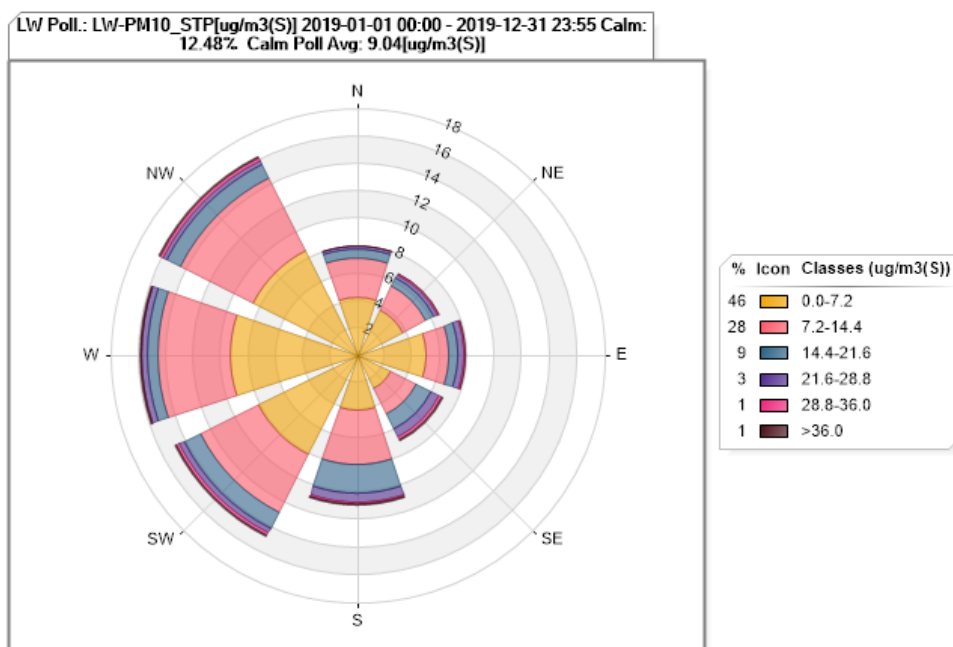


Figure 51. Lostwood PM<sub>10</sub> Pollution Rose for 2019

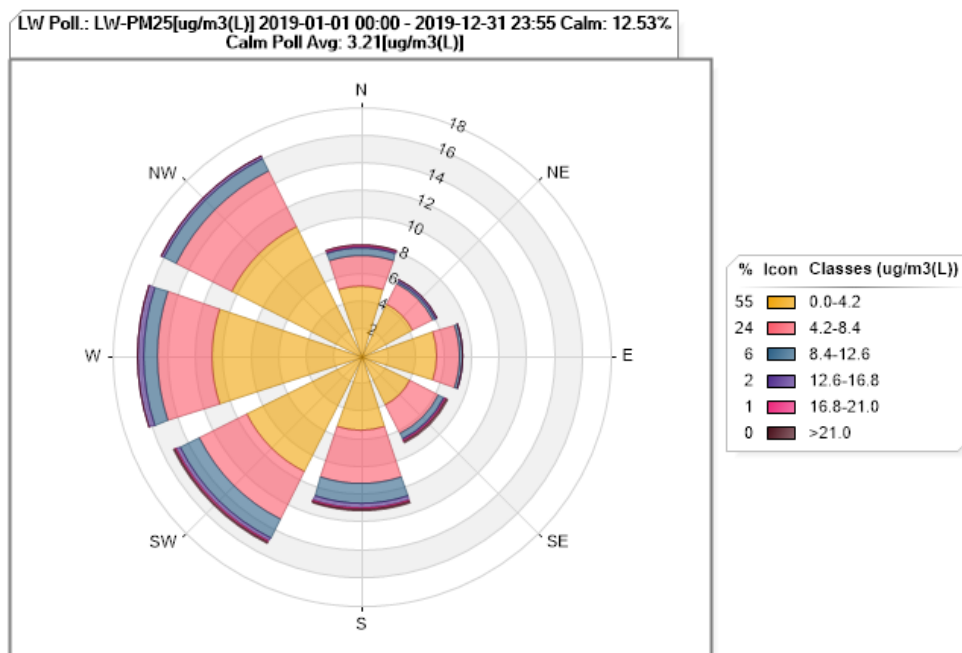


Figure 52. Lostwood PM<sub>2.5</sub> Pollution Rose for 2019

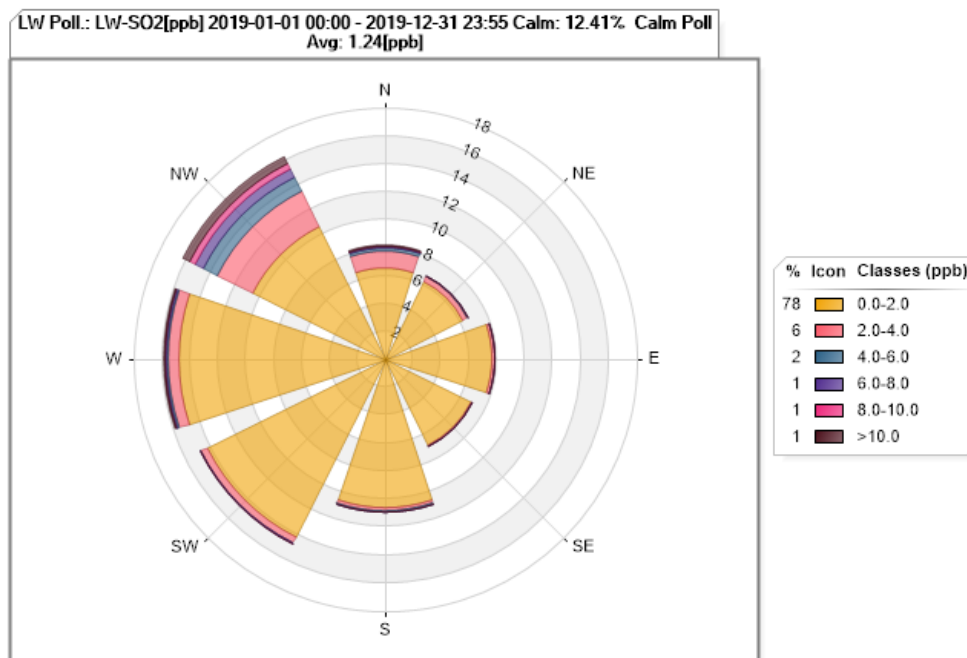


Figure 57. Lostwood SO<sub>2</sub> Pollution Rose for 2019

## Site Name: Painted Canyon (TRNP - SU)

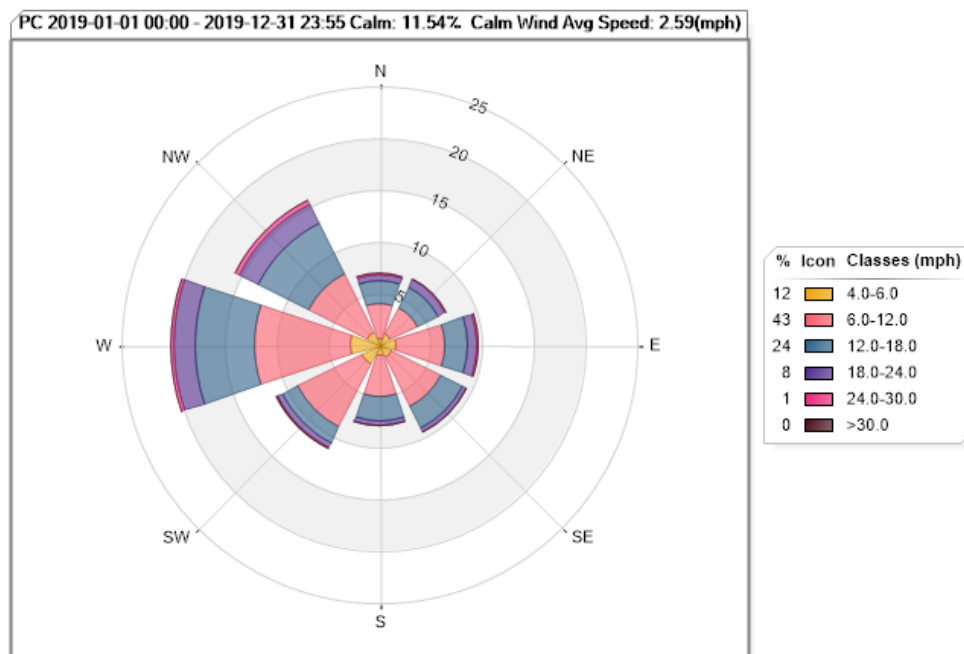


Figure 53. Painted Canyon Wind Rose for 2019

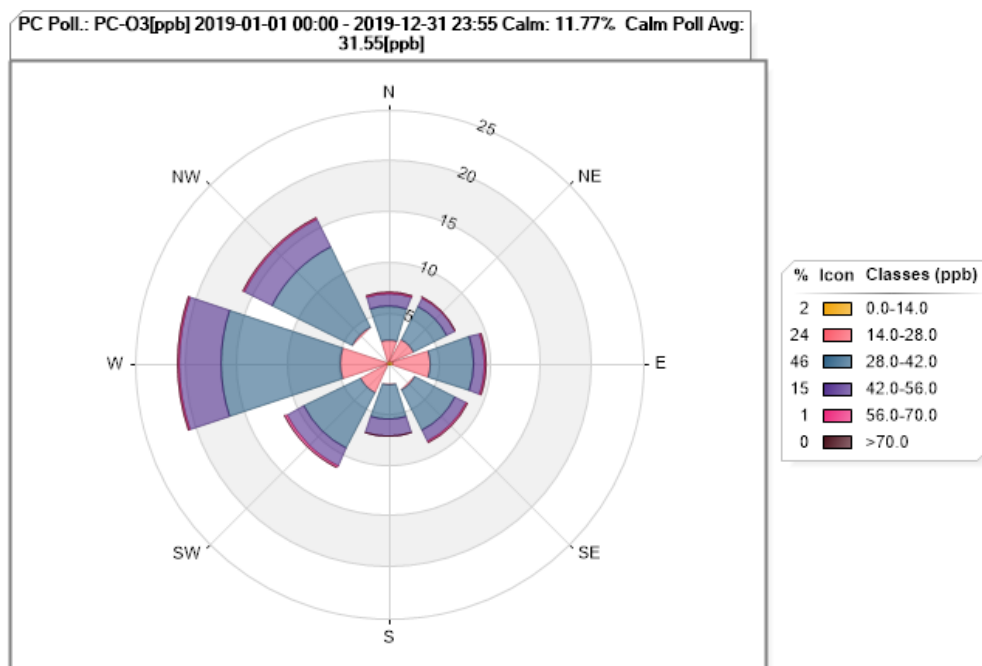


Figure 54. Painted Canyon O<sub>3</sub> Pollution Rose for 2019

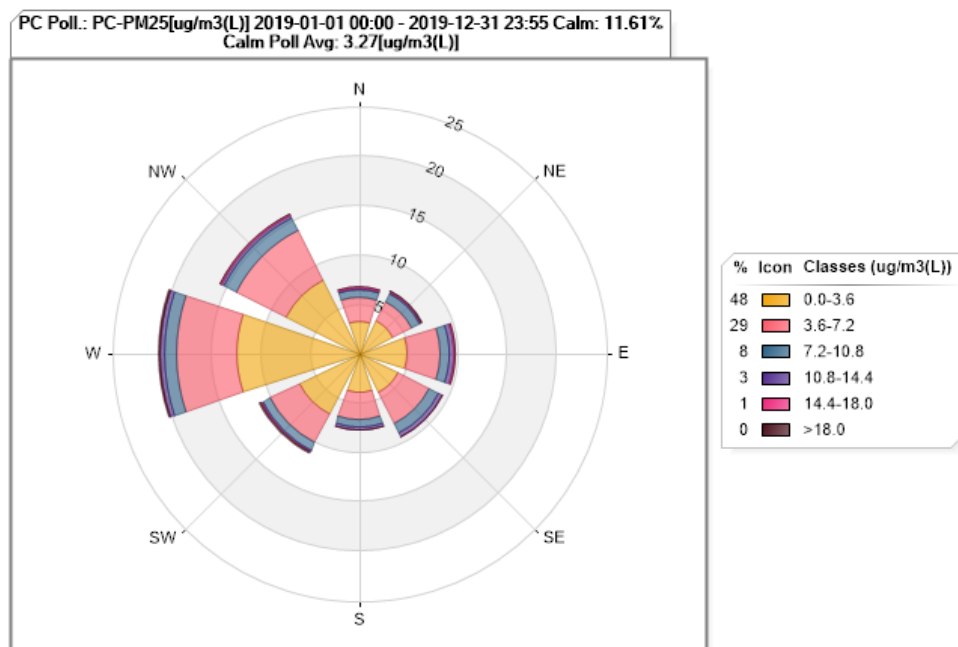


Figure 60. Painted Canyon PM<sub>2.5</sub> Pollution Rose for 2019

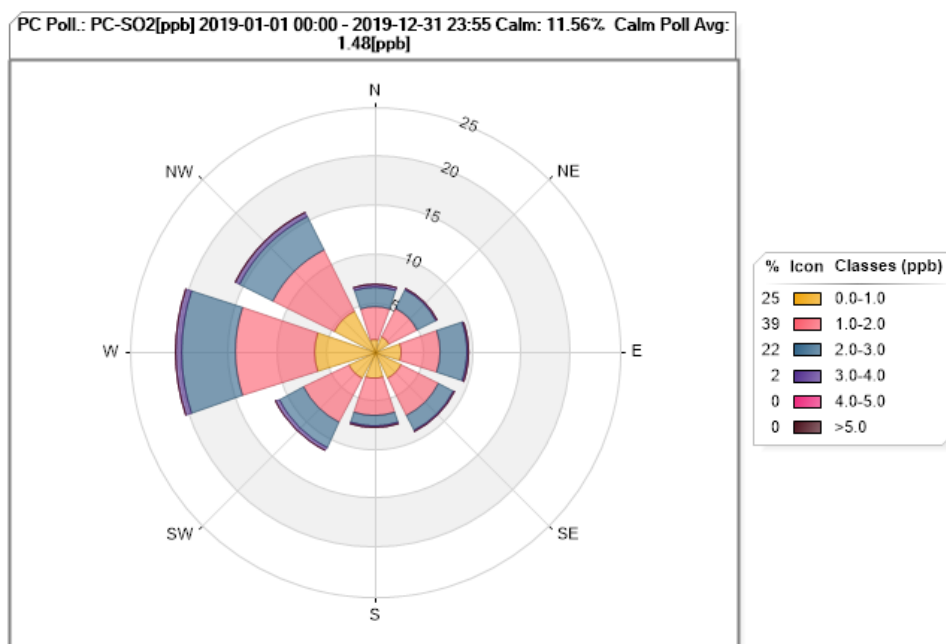


Figure 55. Painted Canyon SO<sub>2</sub> Pollution Rose for 2019

## Site Name: TRNP-NU

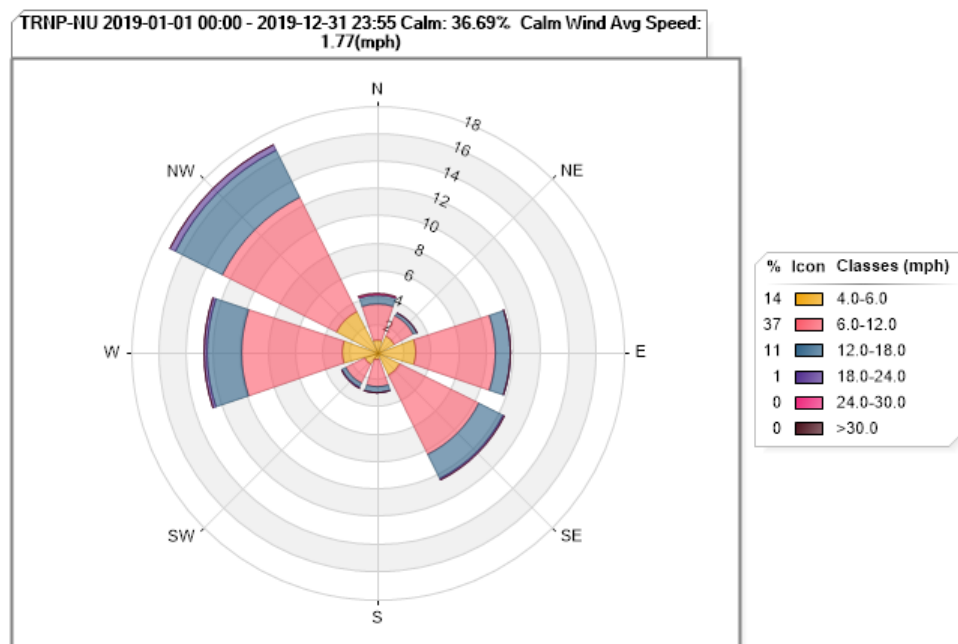


Figure 56. TRNP – North Unit Wind Rose for 2019

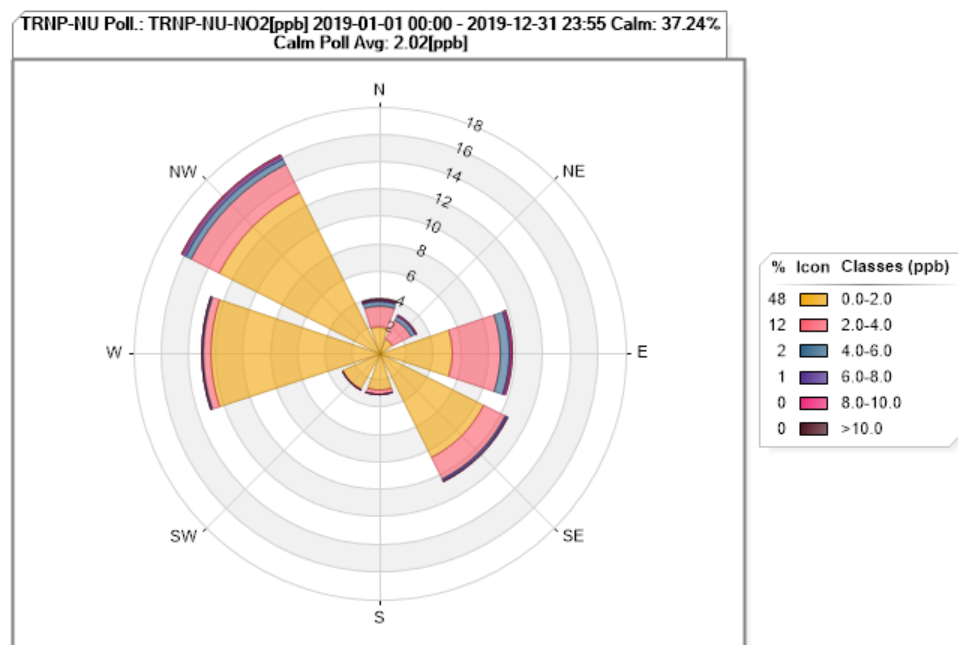


Figure 57. TRNP – North Unit NO<sub>2</sub> Pollution Rose for 2019



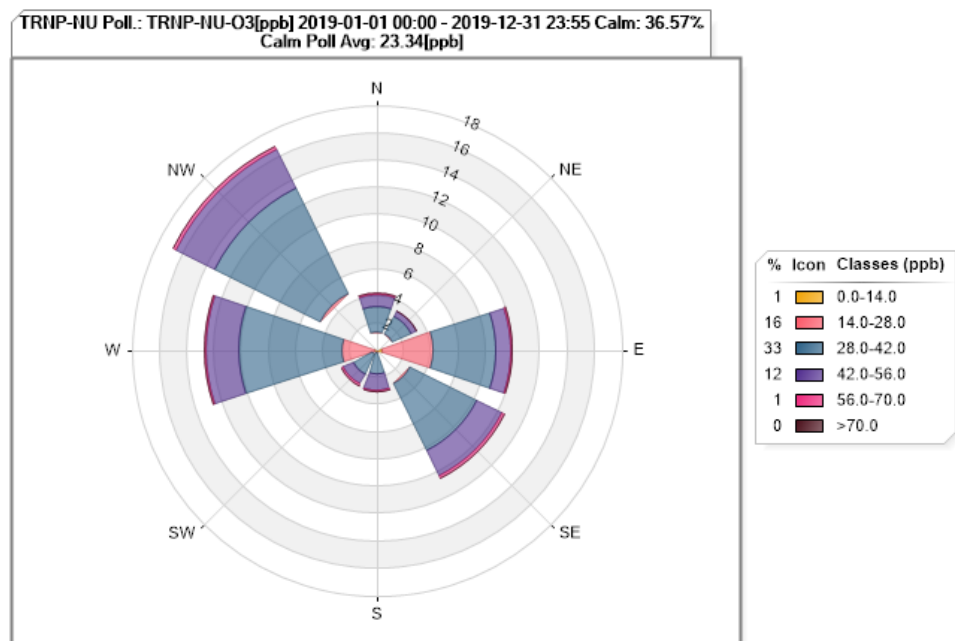


Figure 58. TRNP – North Unit O<sub>3</sub> Pollution Rose for 2019

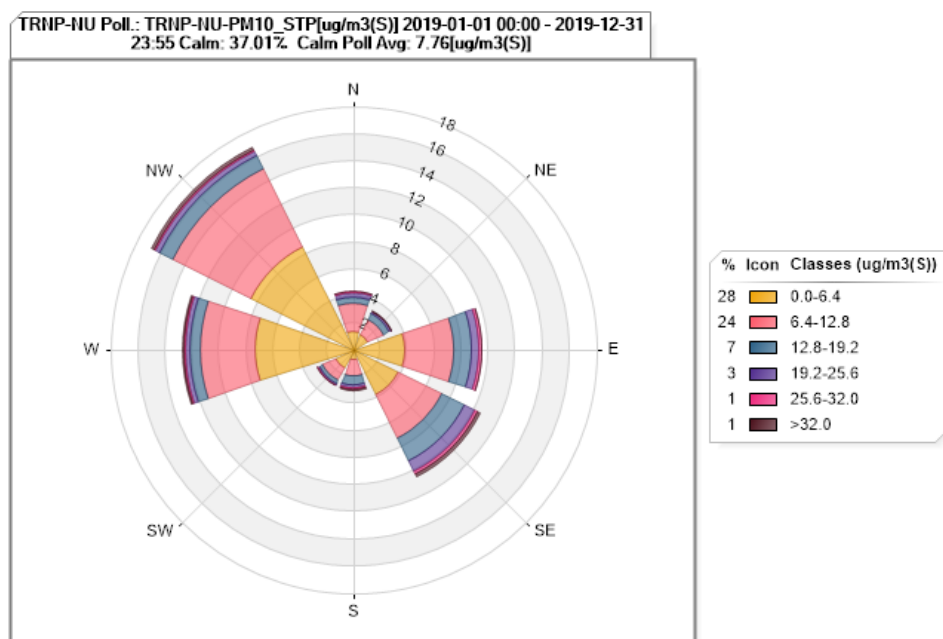


Figure 59. TRNP – North Unit PM<sub>10</sub> Pollution Rose for 2019

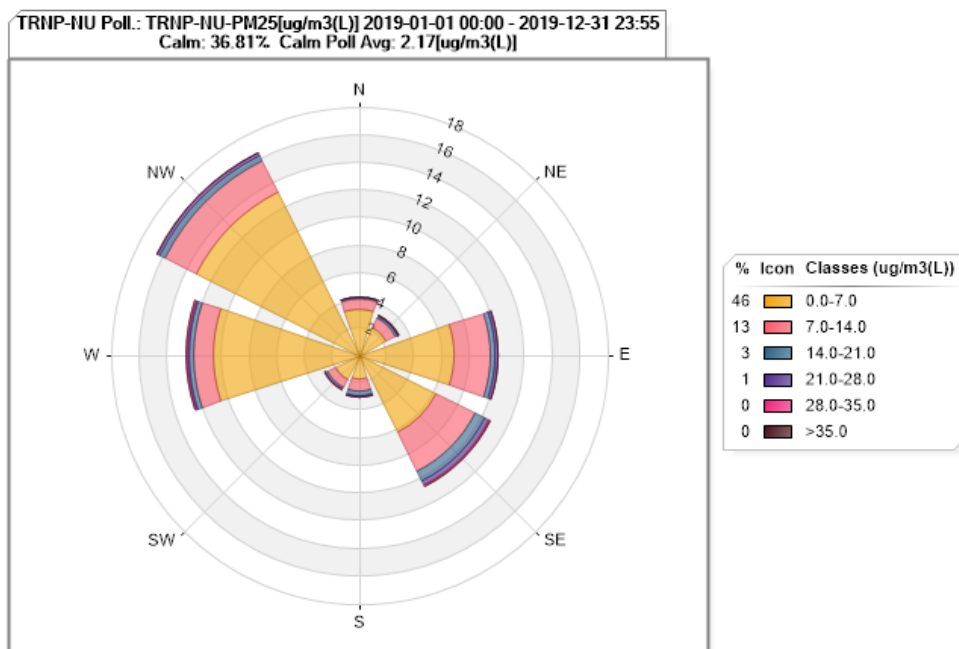


Figure 66. TRNP – North Unit PM<sub>2.5</sub> Pollution Rose for 2019

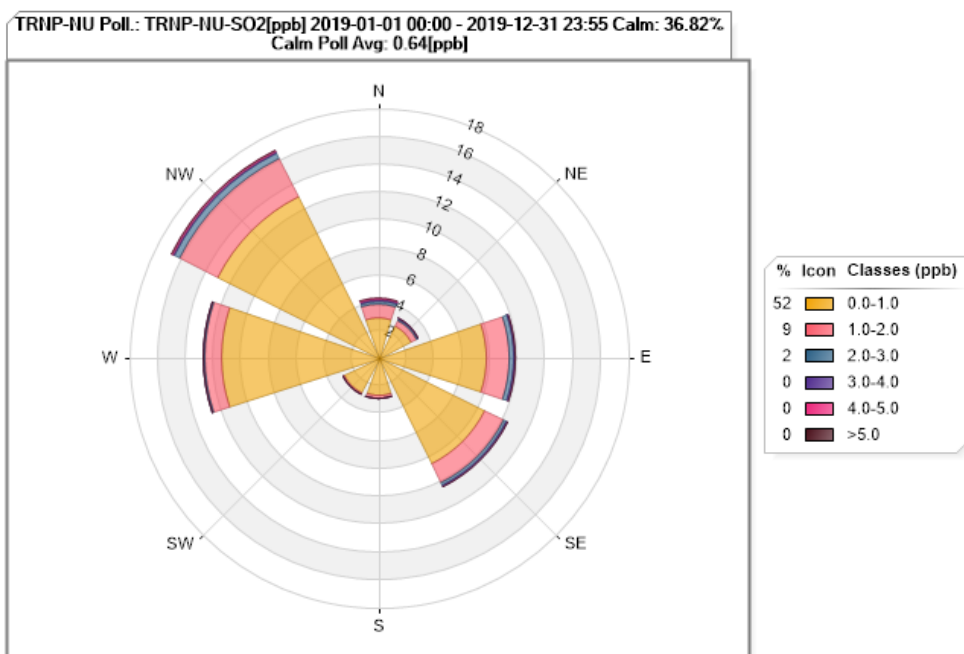


Figure 60. TRNP – North Unit SO<sub>2</sub> Pollution Rose for 2019

## Site Name: Williston

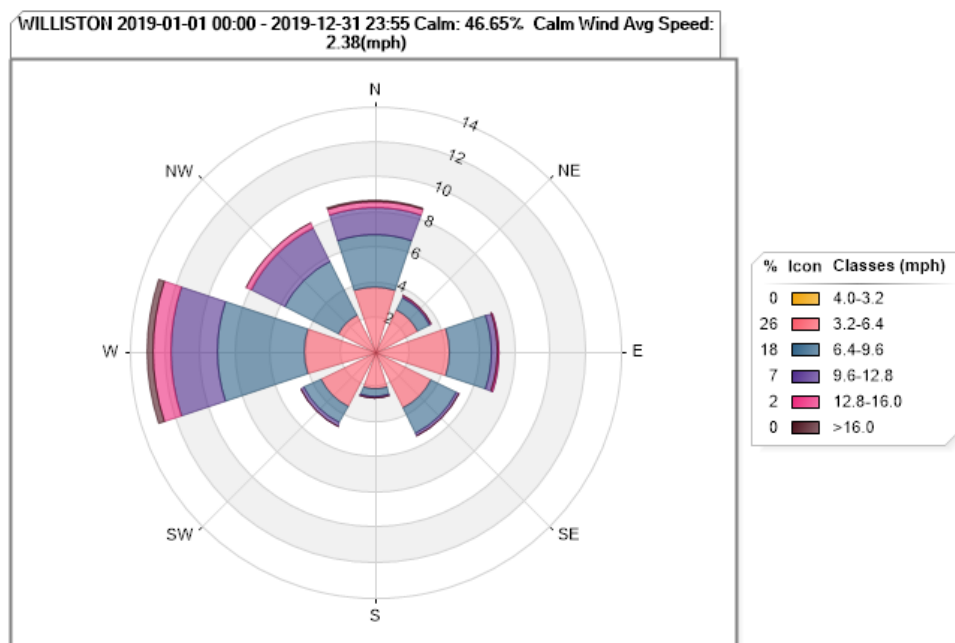


Figure 61. Williston Wind Rose for 2019

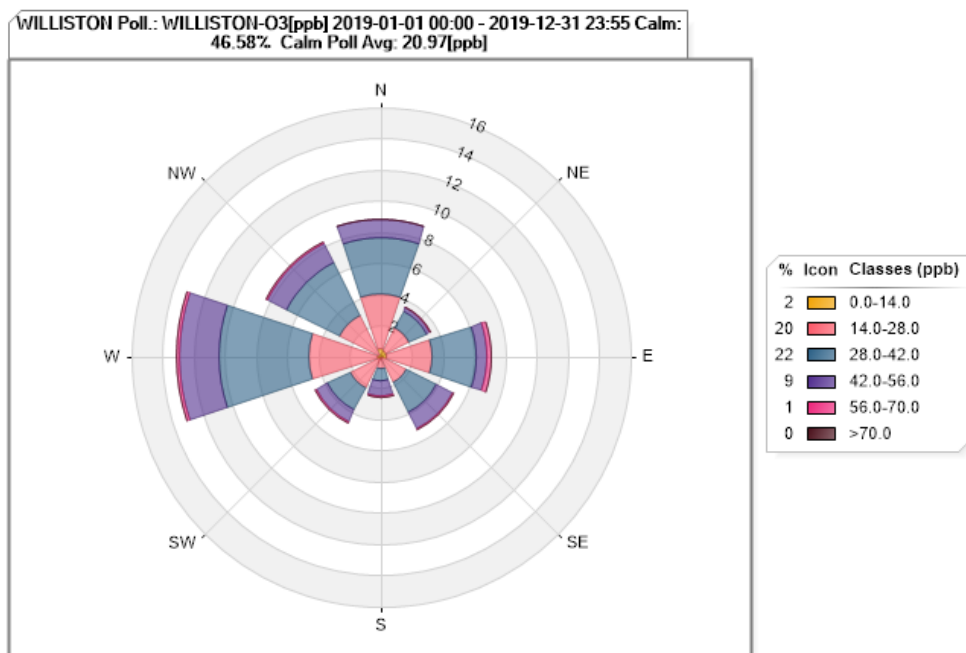


Figure 62. Williston O<sub>3</sub> Pollution Rose for 2019

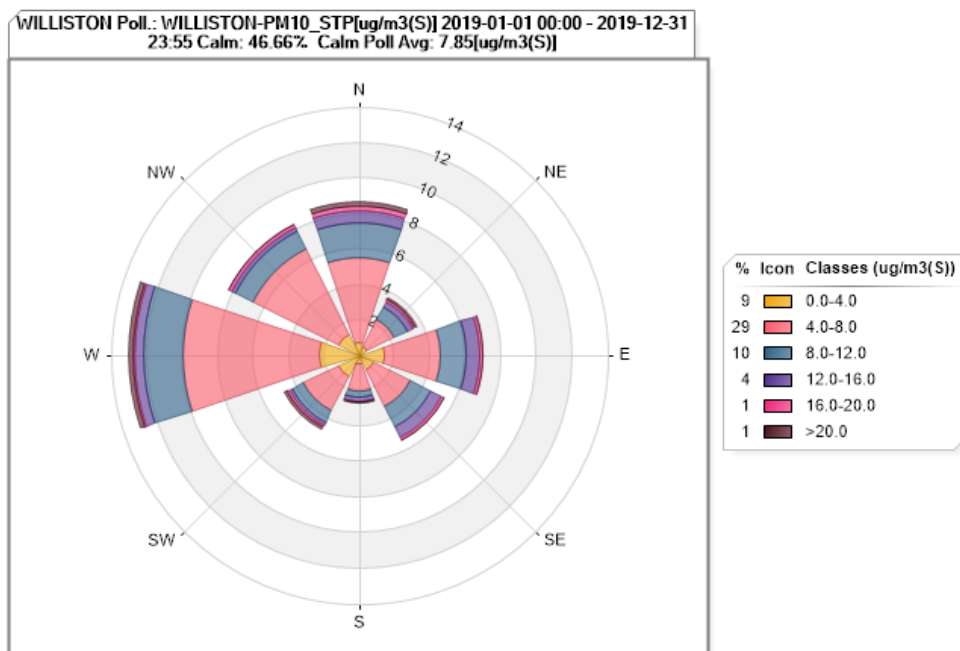


Figure 70. Williston PM<sub>10</sub> Pollution Rose for 2019

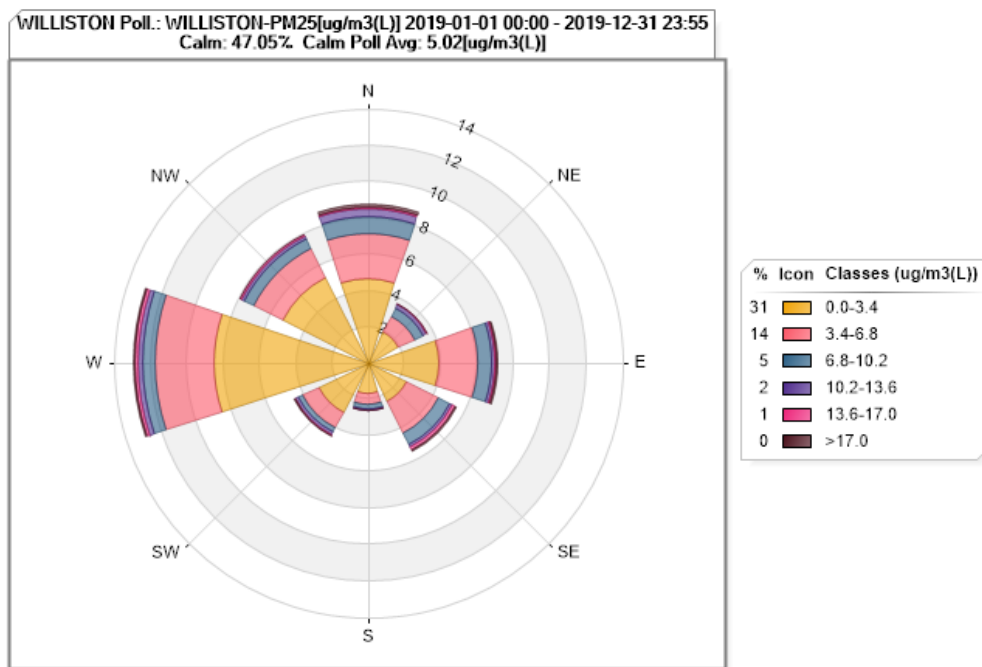


Figure 71. Williston PM<sub>2.5</sub> Pollution Rose for 2019

## Appendix E SO<sub>2</sub> Monitors for the Data Requirements Rule

Effective September 21, 2015, EPA promulgated the Data Requirements Rule (DRR) for the 2010 1-hour SO<sub>2</sub> standard which requires state air agencies to characterize air quality in areas with large sources of SO<sub>2</sub> emissions. The Hess Corporation's Tioga Gas Plant in Williams County is subject to this rule as an applicable source due to a non-regulatory monitor in the area suggesting excessive ambient concentrations of SO<sub>2</sub>. This applicability is outlined in the March 18, 2016 DRR Response letter from EPA<sup>21</sup>.

One of the pathways for a state agency to characterize air quality is to use ambient air quality monitoring by use of SLAMS or SLAMS-like monitors. The Department chose to use SLAMS-like monitors to meet this requirement. In this case a SLAMS-like monitor is operated by the regulated entity but is audited by the Department and must meet all the requirements of a SLAMS monitor as specified in 40 CFR 58<sup>22</sup>.

After a comprehensive computer air dispersion modeling analysis, the Department determined that two monitors will be used to characterize ambient air quality around the Hess Tioga Gas Plant: one in the general area identified via the modeling analysis as the location of peak SO<sub>2</sub> concentration (Station B – North), and one at the current location of the non-regulatory monitor that collected data that resulted in the facility being subject to the DRR (Station A - South). The following pages provide information on these sites.

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<sup>21</sup> Available at <https://www3.epa.gov/airquality/sulfurdioxide/drr/nd-response.pdf>

<sup>22</sup> Monitors operated in a manner equivalent to SLAMS as to meet all applicable requirements of 40 CFR 58, appendices A, C, and E, and subject to the data certification and reporting requirements of 40 CFR 58.15 and 58.16.

## Site Name: Hess Tioga Gas Plant - Station A South

Station Type: SLAMS – Like

AQS#: 38-105-0105

MSA: 0000

Address: Tioga, ND

Latitude: +48.392666

Longitude: -102.910693

**Site Description:** This site was previously named Hess #3 – South Site. It was the non-regulatory monitor site that recorded readings suggesting excessive ambient concentrations of SO<sub>2</sub>.

### Gas/Particulate parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	Data Requirements Rule SO <sub>2</sub> Characterization	Source Specific

### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
None	N/A	N/A	N/A	N/A

There are no plans to move or remove this site.



Site Pictures: **Hess Tioga Gas Plant – Station A South**



North

## Hess Tioga Gas Plant - Station A South



## Site Name: Hess Tioga Gas Plant - Station B Northeast

Station Type: SLAMS – Like

AQS#: 38-105-0106

MSA: 0000

Address: Tioga, ND

Latitude: +48.465253

Longitude: -102.894086

**Site Description:** This site is located in the area where maximum modeled SO<sub>2</sub> concentrations were seen. The modeling was conducted in response to the requirements of the Data Requirements Rule for the 2010 1-hour SO<sub>2</sub> Standard.

### Gas/Particulate parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	Data Requirements Rule SO <sub>2</sub> Characterization	Source Specific

### Meteorological parameters:

Parameter	Sampling & Analysis Method	Operating Schedule	Tower Height	Spatial Scale
Wind Speed	Elec. or Mach Avg. Level 1	Continuous	10 meters	Source Specific
Wind Direction	Elec. or Mach Avg. Level 1	Continuous	10 meters	Source Specific
Ambient Temperature	Elec. or Mach Avg.	Continuous	4 meters	Source Specific

There are no plans to move or remove this site.

Site Pictures: **Hess Tioga Gas Plant – Station B North**



North



South



East



West



## Hess Tioga Gas Plant - Station B North



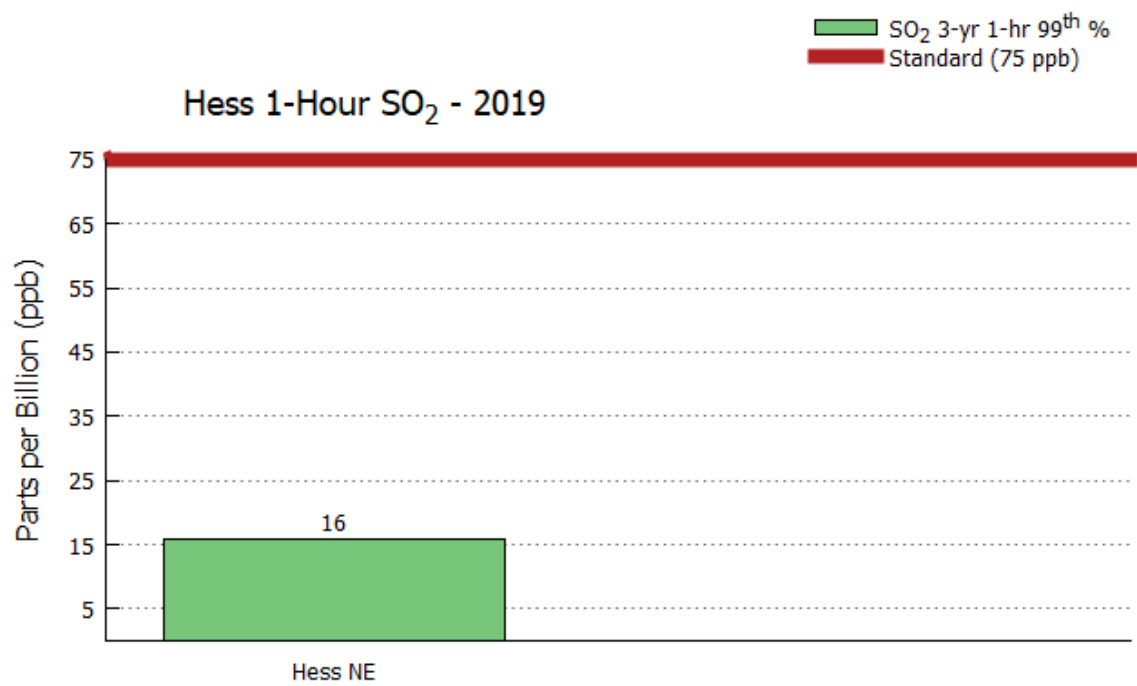


Figure 63. Tioga Gas Plant SO<sub>2</sub> Concentrations Compared to the 1-hour Standard



## **Appendix F**

## **Public Comments**

A 30-day public comment period for a draft of this document was held from August 5, 2020 through September 5, 2020. No comments were received.

Notice for the comment period and a link to an electronic version of the document was placed on the North Dakota Department of Environmental Quality, Air Quality Monitoring web page at: <http://deq.nd.gov/AQ/monitoring>, on the Division of Air Quality Public Comments & Notices web page at: <http://deq.nd.gov/AQ/PublicCom.aspx#AMRNP>, and the Calendar & Events page at: <http://deq.nd.gov/AQ/Calendar.aspx>; as well as on the ND Department of Environmental Quality Public Notices/Public Comment system which includes the webpage at <http://deq.nd.gov/PublicNotice.aspx>, an e-mail notification, and an RSS feed.