UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
DENVER, CO 80202-1129
Phone 800-227-8917
http://www.epa.gov/region08

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Air Quality

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Mr. Terry L. O'Clair, P.E.
Director, Division of Air Quality
Environmental Health Section
Gold Seal Center
918 East Divide Avenue
Bismarck, North Dakota 58501-1947

Dear Mr. O'Clair:

Thank you for submitting the combined 2015 North Dakota Annual Monitoring Network Plan (AMNP) and 5-Year Assessment, which was received by Region 8 on September 18, 2015, as an attachment to your letter. Region 8 has reviewed the submitted AMNP/5-Year Assessment and found that all of the requirements specified in 40 CFR Part 58.10, as well as the 105 grant commitment to conduct a review annually and an assessment every 5 years, have been met with the submission of these documents.

Region 8 appreciates the effort that North Dakota put into its 5-Year Assessment. The Assessment is an important tool for states to (1) re-evaluate the objectives and budget for air monitoring, (2) evaluate a network's effectiveness and efficiency relative to its objectives and costs, and (3) develop recommendations for network reconfigurations and improvements. While this assessment did not propose any immediate changes to the network, it shows the effort that North Dakota has made in future planning of their ambient air monitoring network.

If you have any questions on this issue, please contact me at (303) 312-6416 or Albion Carlson, of my staff, at (303) 312-6207.

Sincerely,

Carl Daly

Carl Daly, Director
Air Program

cc: Chuck Hyatt, DAQ

NORTH DAKOTA
DEPARTMENT *of* HEALTH

ENVIRONMENTAL HEALTH SECTION
Gold Seal Center, 918 E. Divide Ave.
Bismarck, ND 58501-1947
701.328.5200 (fax)
www.ndhealth.gov

September 15, 2015

FILE

Carl Daly, Director
Air Program, Mail Code 8P-AR
1595 Wynkoop Street
Denver, CO 80305

Re: 2014 North Dakota Ambient Air Monitoring Annual Report and 2015 Network Plan

Dear Mr. Daly:

The Code of Federal Regulations Title 40 Part 58 states that "(Agencies) shall adopt and submit to the Regional Administrator an annual monitoring network plan". This plan identifies monitoring stations and monitors that make up an air quality surveillance network under authority of the State. Additionally, the plan outlines any proposed changes or modifications to the network.

CFR 40 Part 58 also states that every five years, "(Agencies) shall perform and submit (to EPA) an assessment of the air quality surveillance system". This expanded review is designed to evaluate the effectiveness of a monitoring network in meeting the objectives of the rule, whether sites should be added or terminated, or if new technology is appropriate for incorporation in the network.

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. North Dakota has chosen to combine the 2015 network review/five year assessment with the 2014 data summary report into one comprehensive Annual Report document. Please find attached the 2015 ambient air monitoring Annual Report for the State of North Dakota. A thirty day public comment period was held which ended on September 13, 2015. No comments were received.

If you have any questions concerning the materials provided or require additional information or clarification, please contact Charles Hyatt of my staff at (701)328-5188.

Sincerely,

Terry O'Clair

Terry L. O'Clair, P.E.
Director
Division of Air Quality

TLO/CRH:saj
Enc:

Annual Report

North Dakota
Ambient Air Quality Monitoring Program

Network Plan and
Five Year
Network Assessment

with
Data Summary

2015

NORTH DAKOTA
DEPARTMENT *of* HEALTH

Annual Report

North Dakota
Ambient Monitoring
Network Plan/5 Year Assessment
With Data Summary
2015

Jack Dalrymple
Governor

Terry L. Dwelle, M.D.
State Health Officer

L. David Glatt
Environmental Health Section Chief

North Dakota Department of Health
Division of Air Quality
Air Quality Monitoring Branch
918 E. Divide Ave.
Bismarck, N.D. 58501-1947

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ACRONYMS AND ABBREVIATIONS

- AAQM – 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
- EPA – United States Environmental Protection Agency
- FEM – Federal Equivalent Method
- FRM – Federal Reference Method
- GIS – Geographic Information System
- H_2S – Hydrogen sulfide
- H_2SO_3 – Sulfurous acid
- H_2SO_4 – 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_3 – Ammonia
- NO – Nitric oxide
- NO_2 – Nitrogen dioxide
- NO_x – Oxides of Nitrogen
- NO_y – Total Reactive Nitrogen
- NPS – National Park Service
- NTN – National Trends Network
- NWR – National Wildlife Refuge
- O_3 – Ozone
- PM – Particulate Matter
- PM_{10} – Particulate Matter less than 10 microns in diameter
- $PM_{2.5}$ – Particulate Matter less than 2.5 microns in diameter (fine particulate matter)
- $PM_{10\text{-}2.5}$ - 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_2 – Sulfur dioxide
- SPM – Special Purpose Monitoring
- STN – Speciation Trends Network
- 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

The North Dakota Department of Health (Department), Division of Air Quality (Division)[1], 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 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)[2] 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 (AAQM) sites throughout the state[3].

The Division conducts an annual review of the network to determine if all federal monitoring requirements as set forth in 40 CFR 58[4] are being met. This document is an account of the review. 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 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 also 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 for the data summary duplicates what was included in the network review. To avoid a doubling-up of effort, beginning in 2015, the data summary for state run AAQM sites will be combined with the network review resulting in one single comprehensive annual report document[5].

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[1] See Appendix A of this document for an organizational chart for the Division.

[2] See Appendix B of this document for a summary table of all applicable federal and state ambient air quality standards.

[3] See Appendix C of this document for a full description for each site, site photographs, and a site map.

[4] The Code of Federal Regulations - 40 CFR 58 was promulgated by the Environmental Protection Agency (EPA) on October 17, 2006

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

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.
- **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:

Criteria Pollutant	Spatial Scales
Inhalable Particulate	micro, middle, neighborhood, urban, regional
Sulfur Dioxide	middle, neighborhood, urban, regional
Ozone	middle, neighborhood, urban, regional
Nitrogen Dioxide	middle, neighborhood, urban

A good understanding of the appropriate monitoring objective and spatial scale allow 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 terminated 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 AAQM network is designed to monitor air quality data for five basic conditions: (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; and (5) regional haze.

The 2008 National Ambient Air Monitoring Strategy (NAAMS[6]) establishes a monitoring site classification system for the national AAQM network. State and Local Monitoring Stations (SLAMS) make up the primary component for determining criteria pollutant NAAQS compliance. The Department operates eight ambient air quality monitoring sites in North Dakota (Figure 1). Additionally a ninth 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.

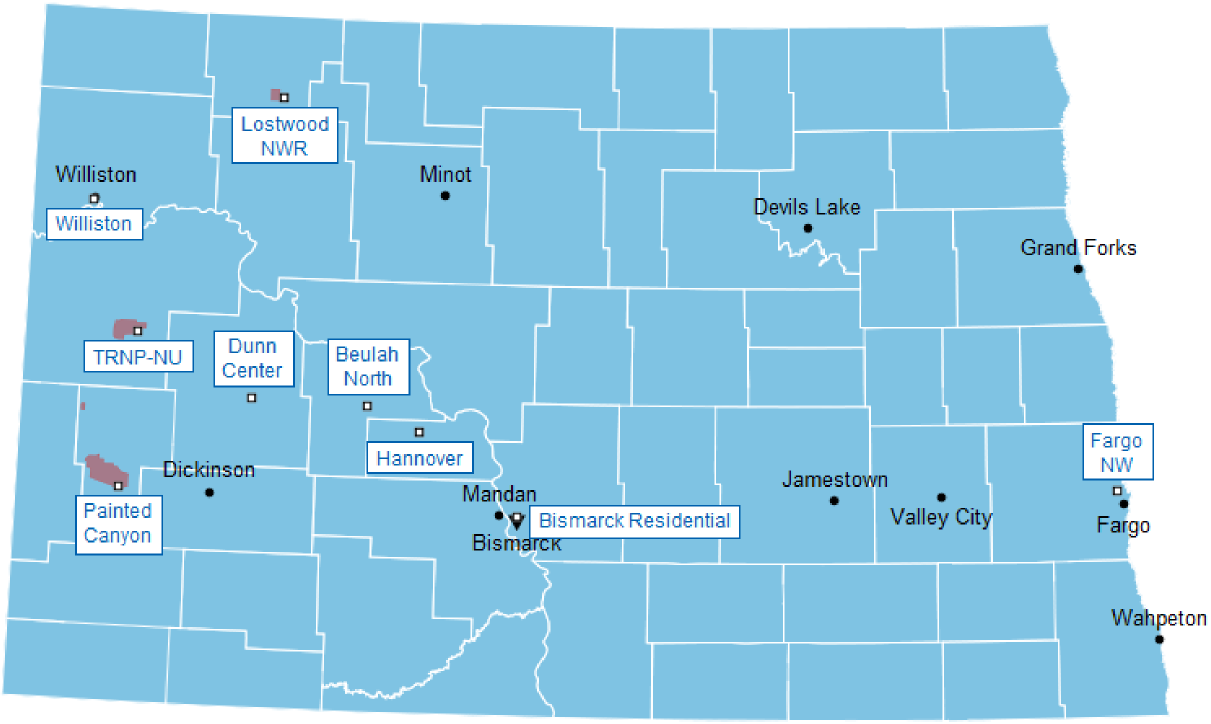

Figure 1. North Dakota Ambient Air Quality Monitoring Sites

A National Core (NCore) site is a one in a network of approximately 80 multi-pollutant

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[6] 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

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, Fargo NW has been designated the required NCore site in North Dakota.

The Fargo 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.

Table 1. AAQM Network Description

Site Name AQS* Site Number	**Parameter Monitored**											**Monitoring Objective**
	SO_2	**NO_2**	**O_3**	**CO**	**cont. $PM_{2.5}$**	**cont. PM_{10}**	**Manual $PM_{2.5}$**	**PM_{fine} Speciation**	**NH_3**	**NO_y**	**Wind Speed & Direction**	
1 Beulah North 380570004	★	★	★		★	★	★		★		★	Population Exposure & Significant Source
2 Bismarck Residential 380150003	★	★	★		★	★	★				★	Population Exposure
3 Dunn Center 380250003	★	★	★		★	★					★	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 TRNP – NU 380530002	★	★	★		★	★					★	General Background, Long-range Transport, & Welfare-related
9 Williston 381050003			★		★	★					★	Population Exposure
* Air Quality System – EPA's computer database and information system of ambient air quality data.												

The monitoring sites in the state fall into two categories: 40 CFR 58 required (3 sites) and supplemental (6 sites). The primary function of the Department's three required sites is to satisfy five monitoring objectives (Table 1). The Beulah monitoring site, which lies between the city of

Beulah and two major air pollutant emissions sources (and in the vicinity to a third), has been designated a significant source and population-oriented site. The Fargo NW site has been designated a population orientated site because the city of Fargo is a major population center in North Dakota with five major emissions sources 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.

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. The remaining six sites are used to support air dispersion model calibration and/or validation and to supplement data collected at the required sites. For the national fine Particulate Matter program, the Department is required to operate three “non-Core required” sites (these being Fargo, Bismarck and Beulah).

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.

1.3 Monitoring Objectives

The Department operates SLAMS sites at selected locations around the state to track those pollutants that are judged to have the potential for violating the NAAQS. Figure 1 shows the approximate site locations, Table 1 lists basic site information, and Appendix C contains a full description for each site, site photographs, and a site map.

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

2.0 AMBIENT AIR MONITORING NETWORK COVERAGE

The State of North Dakota is in attainment for all ambient standards for criteria pollutants. The nine ambient air quality monitoring sites in the state are positioned to satisfy the five monitoring objectives described in Section 1.3, above, and to collect data to compare to the State and Federal ambient air quality standards and support dispersion modeling activities relating to visibility/regional haze and source permit evaluation. The following sections describe 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 an improperly sized, blocked, disconnected, or leaking flue, 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 emission problems. 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.

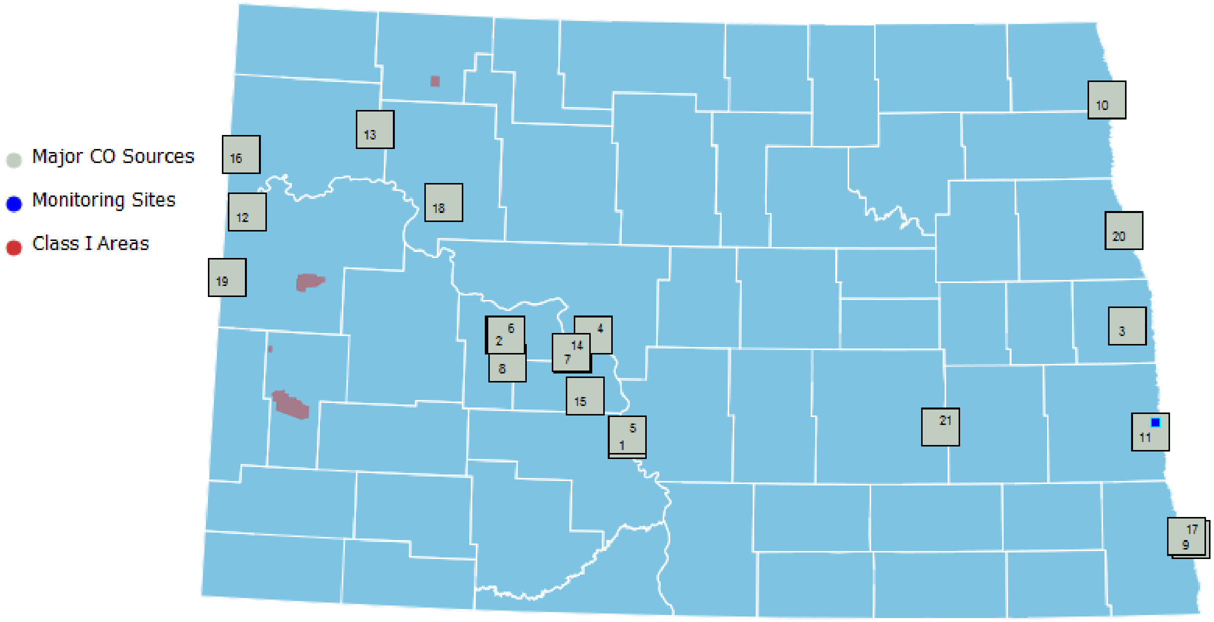

Figure 2. Major CO Sources in 2014

Table 2. Major CO Sources (> 100 TPY) in 2014

#	COMPANY	SOURCE	EIS Facility ID
1	Tesoro Refining and Marketing Company	Mandan Refinery	7923611
2	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
3	American Crystal Sugar Company	Hillsboro Plant	7939011
4	Great River Energy	Coal Creek Station	8011011
5	Montana Dakota Utilities Company	RM Heskett Station	8087011
6	Basin Electric Power Cooperative	Antelope Valley Station	8086511
7	Basin Electric Power Cooperative	Leland Olds Station	8086311
8	Otter Tail Power Company	Coyote Station	8086611
9	Minn-Dak Farmers Cooperative	Wahpeton Plant	7924011
10	American Crystal Sugar Company	Drayton Plant	7923811
11	Cargill, Inc.	Cargill Oilseeds Processing	9271111
12	ONEOK Rockies Midstream, L.L.C.	Fort Buford Compressor Station	10612511
13	Hess Corporation	Tioga Gas Plant	8013911
14	Great River Energy	Stanton Station	8086411
15	Minnkota Power Cooperative, Inc.	Milton R. Young Station	8087911
16	ONEOK Rockies Midstream, L.L.C.	Stateline Gas Plant	*
17	Cargill Corn Milling	Wahpeton Facility	10612711
18	Whiting Oil and Gas Corporation	Robinson Lake Gas Plant	*
19	ONEOK Rockies Midstream, LLC	Grasslands Gas Plant	8085511
20	University of North Dakota	UND Heating Plant	7292911
21	Great River Energy	Spiritwood Station	*

* ID not yet assigned

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.

2.1.2 Monitoring Network

Carbon monoxide monitoring in North Dakota ended in 1994, after operating five years. The conclusion drawn from the data was that CO concentrations in North Dakota were well below the NAAQS and exceedances were unlikely. A summary report of the data collected at the West Acres Shopping Mall was drafted for the Fargo-Moorhead Council of Governments for use in its traffic planning program. Since 2009, the Department has operated a Trace Level CO analyzer at the Fargo NW site in order to comply with the NCore requirements. Figure 3 shows CO concentrations at Fargo in comparison to the 1- and 8-hour NAAQS.

2.1.3 Network Changes

There were no significant changes made to the CO network in 2014. Concentrations measured by the trace level CO monitor at Fargo have consistently been lower than the NAAQS. No changes to the CO emissions inventory that would result in significant changes in ambient concentrations of this pollutant are foreseen.

The Department is currently evaluating the possibility of relocating the NCore site from Fargo to Bismarck. If the Department does commit to this move within 2015-2016, the trace level CO monitor would move as well. See section 3.0 – Network Site Changes for the possibility of the addition of a new ambient monitoring station to the network.

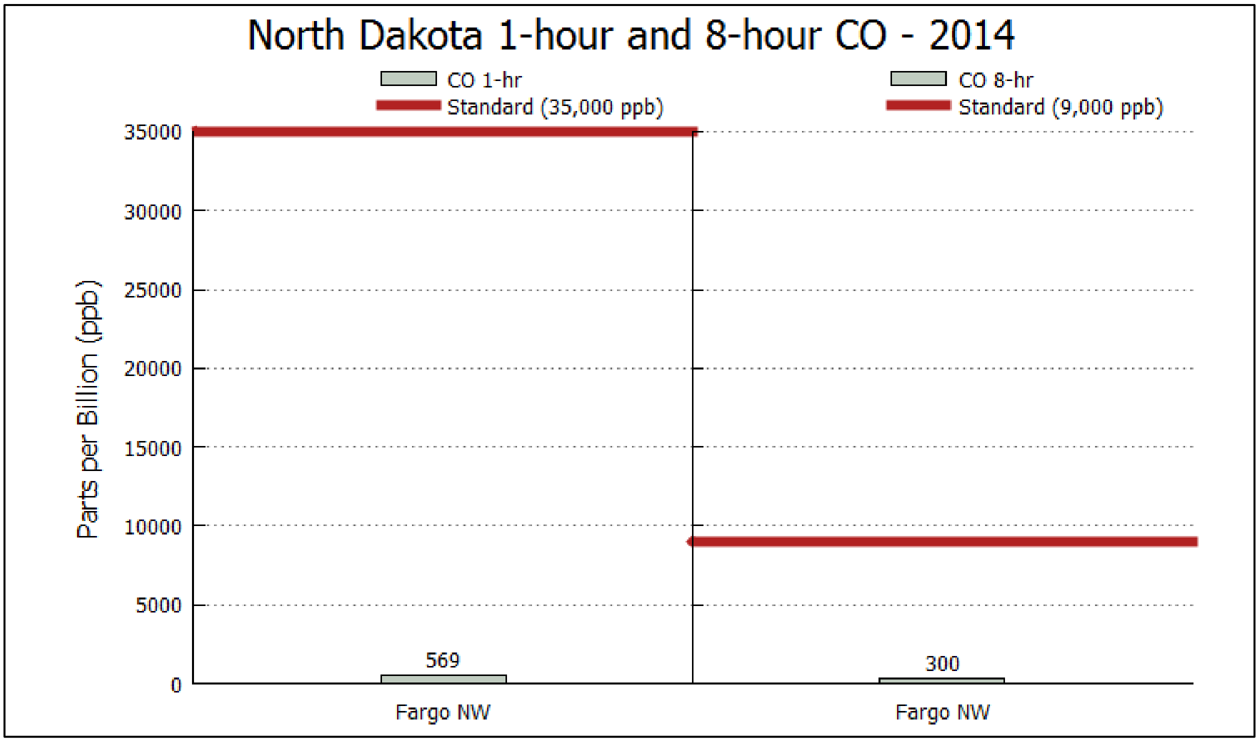

Figure 3. CO Concentrations Compared to the 1-hour and 8-hour Standards

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 2014. There are no changes planned for 2015.

A review of the network as part of the five year assessment did not identify any significant foreseen changes to lead emissions. Because of this, there are no anticipated changes to the lead monitoring network.

2.3 Nitrogen Oxide

Nitrogen Oxide (NO_x) is the term used to represent nitric oxide (NO) plus nitrogen dioxide (NO_2). NO and NO_2 are formed when the nitrogen and oxygen in the air are combined in high-temperature combustion. Major NO_x sources in North Dakota are coal conversion processes, natural gas processing plants, and natural gas compressor stations.

In its pure state, NO_2 is a reddish-orangish-brown gas with a characteristic pungent odor. As a pollutant in ambient air, however, NO_2 is virtually odorless – although it may be an irritant to the eyes and throat. 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 NO_2 or the conversion of NO to 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 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.

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 NO_x and volatile organic compounds with heat and sunlight. In the form of the corrosive species nitrous and nitric acid, NO_x can result in impacts on vegetation and materials. In combination with ammonia and water vapor, NO_x can form small particulates, impairing visibility and impacting health.

NO_y, or “total reactive nitrogen”, consists of oxidized compounds of nitrogen (i.e. NO_x + nitric acid and organic nitrates). A NO_y monitor works by converting all reactive species to NO. Non-NO_x species concentrations can be determined by subtracting monitored ambient NO and NO_2 concentrations from the resultant total concentration of converted NO. There is no ambient air quality standard for NO_y.

2.3.1 Point Sources

The major NO_x stationary point sources (>100 TPY) are listed in Table 3, along with their emissions as calculated from the most recent emission inventories reported to the Department.

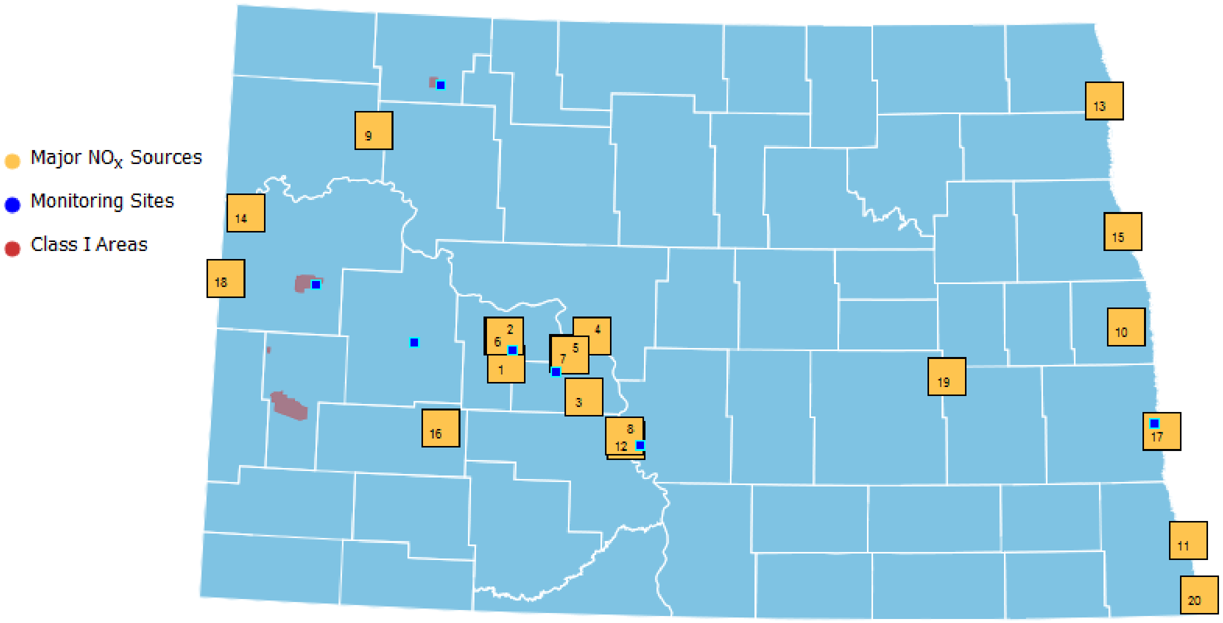

Figure 4. Major Nitrogen Oxides Sources in 2014

Table 3. Major NO_x Sources (> 100 TPY) in 2014

#	Company	Source	EIS Facility ID
1	Otter Tail Power Company	Coyote Station	8086611
2	Basin Electric Power Cooperative	Antelope Valley Station	8086511
3	Minnkota Power Cooperative, Inc.	Milton R. Young Station	8087911
4	Great River Energy	Coal Creek Station	8011011
5	Basin Electric Power Cooperative	Leland Olds Station	8086311
6	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
7	Great River Energy	Stanton Station	8086411
8	Montana Dakota Utilities Company	RM Heskett Station	8087011

9	Hess Corporation	Tioga Gas Plant	8013911
10	American Crystal Sugar Company	Hillsboro Plant	7939011
11	Minn-Dak Farmers Cooperative	Wahpeton Plant	7924011
12	Tesoro Refining and Marketing Company	Mandan Refinery	7923611
13	American Crystal Sugar Company	Drayton Plant	7923811
14	ONEOK Rockies Midstream, LLC	Fort Buford Compressor Station	10612511
15	University of North Dakota	UND Heating Plant	7292911
16	Red Trail Energy, LLC	Richardton Ethanol Plant	10613611
17	North Dakota State University	NDSU Heating Plant	8448211
18	ONEOK Rockies Midstream, LLC	Grasslands Gas Plant	8085511
19	Alliance Pipeline, LP	Wimbledon Compressor Station	10612411
20	Guardian Hankinson, LLC	Hankinson Renewable Energy, LLC	16663511

Figure 4 shows the approximate locations of these facilities (the numbers correspond to the site and source tables). The larger 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 NO_x emissions. The "Point Sources" category consists of utility boilers (power plant boilers) and oil and gas wells.

2.3.2 Area Sources

Another source of NO_x 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 228,291 (2014 estimate[7]). Figure 5 shows the contribution of "Other Point Sources" and "Utility Boilers." The "Other Point Sources" category consists of coal gasification, oil refineries, natural gas processing plants and agricultural processing plants.

2.3.3 Monitoring Network

The Department currently operates seven $NO/NO_2/NO_x$ analyzers. From Figure 4 it can be seen that $NO/NO_2/NO_x$ analyzers, except for Dunn Center and TRNP - NU, are well placed with respect to the major NO_x sources: TRNP - NU is defined as a background and long-range transport/welfare-related site. Additionally, as part of the NCore network site at Fargo, the Department operates a NO_y monitor.

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[7] US Census Bureau. Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2014 – United States – Metropolitan and Micropolitan Statistical Area; and for Puerto Rico 2013 Population Estimates. http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Retrieved 7/27/2015

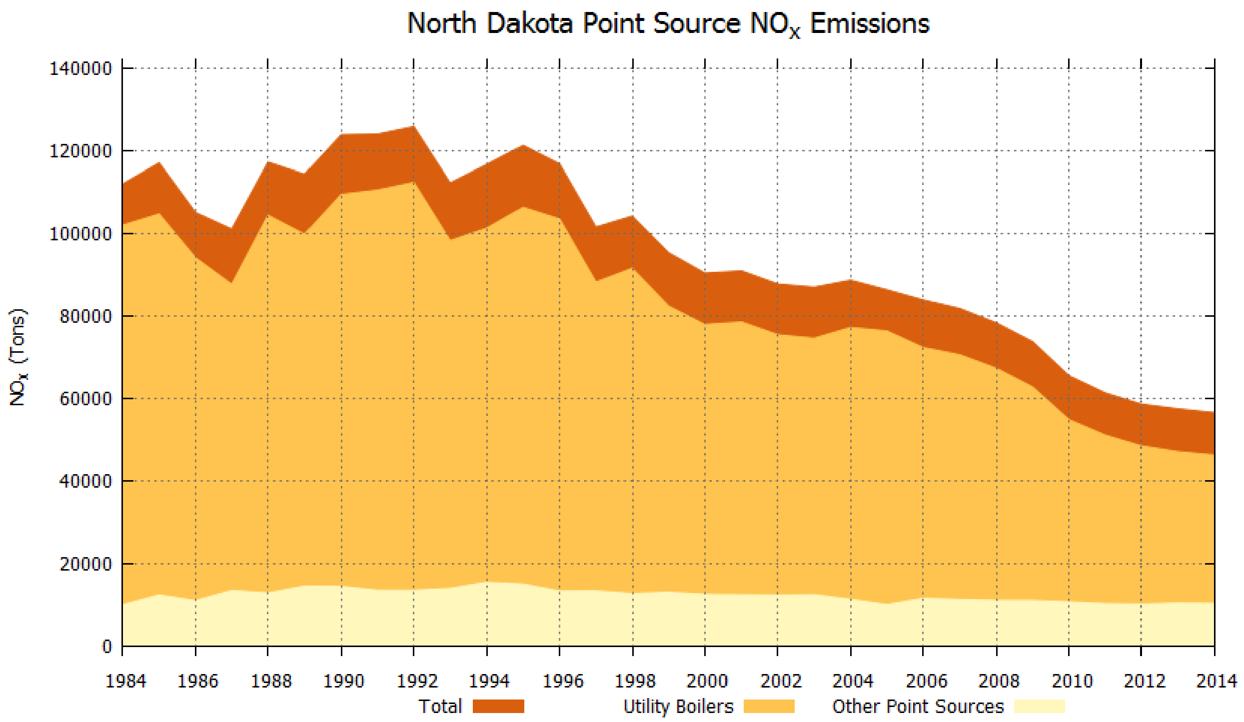

Figure 5. Annual Oxides of Nitrogen Emissions

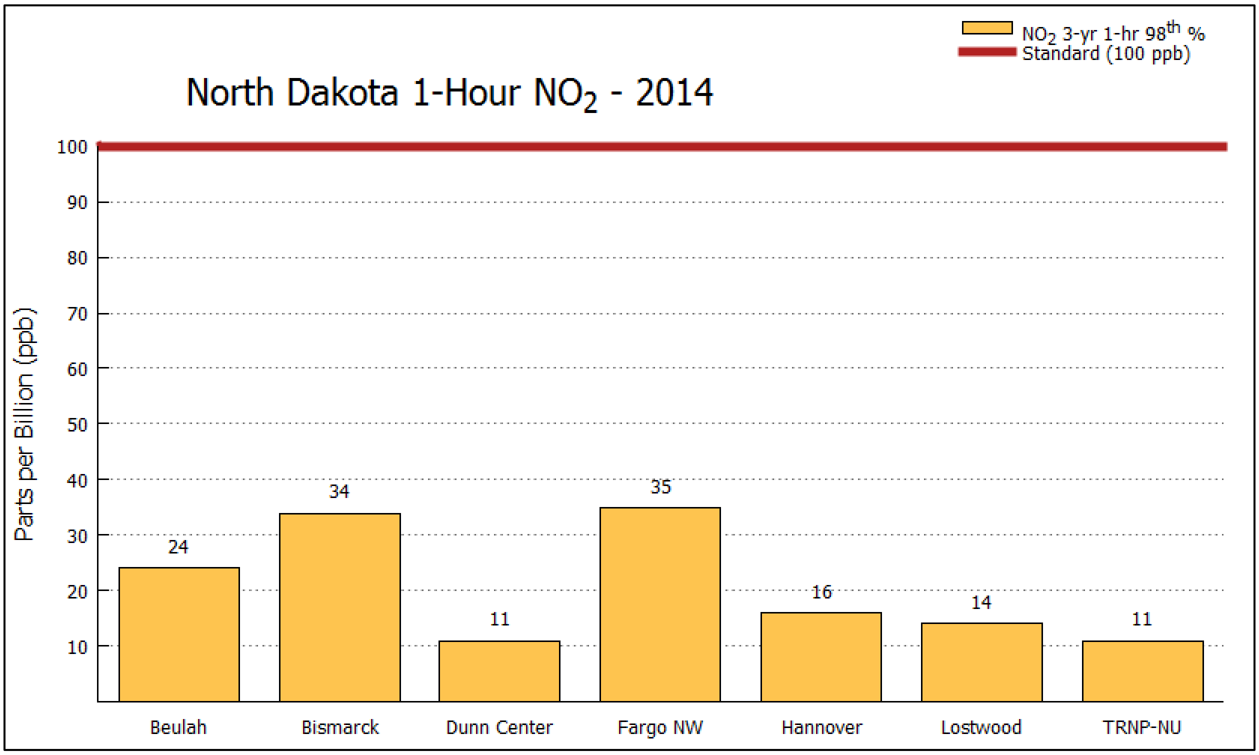

Figure 6. NO_2 Concentrations Compared to the 1-hour Standard

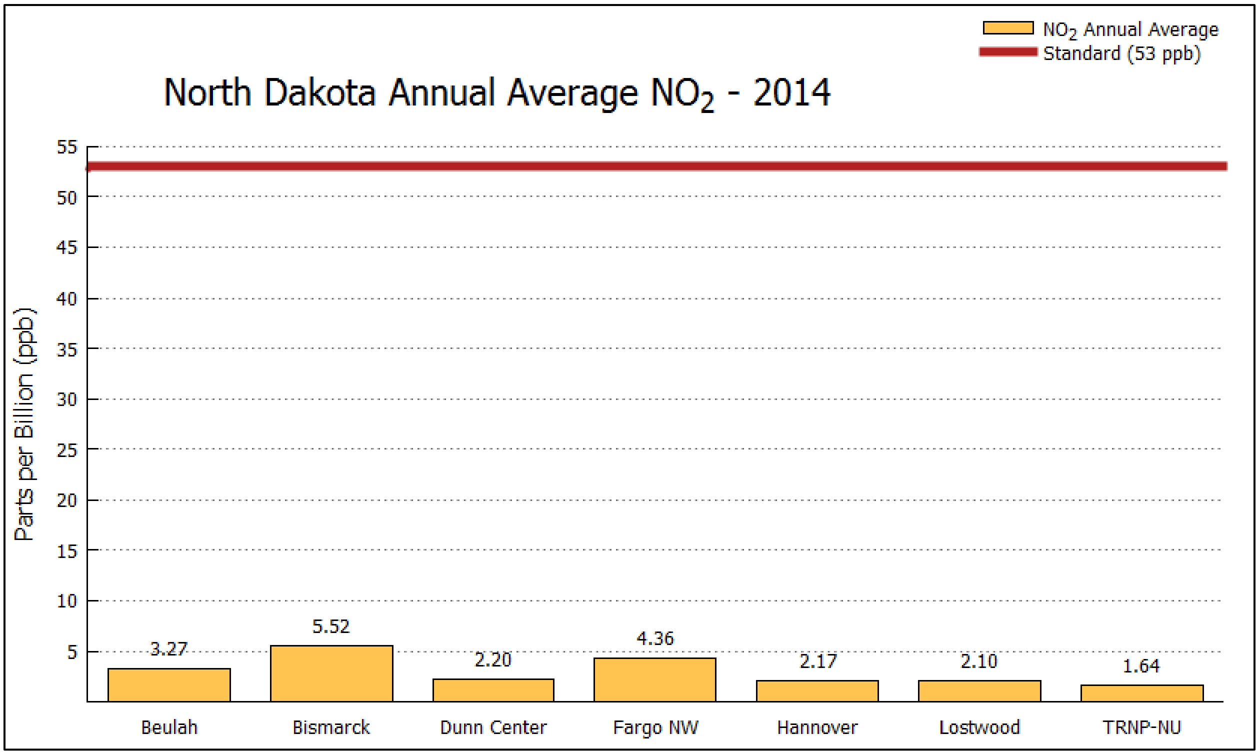

Figure 7. NO_2 Concentrations Compared to the Annual Standard

2.3.4 Network Analysis

Figures 6 and 7 show the 2014 NO_2 monitoring results in comparison to the 1-hour and annual NO_2 NAAQS, respectively. Numbers above the bars indicate monitored concentrations.

Nine of the ten largest NO_x sources in the state are within 45 miles of the Beulah and Hannover monitoring sites. Figures 8 and 9 show the 1-hour and annual average concentrations for the Department-operated sites for 1980 - 2014.

2.3.5 Network Changes

There were no significant changes made to the NO_2 network in 2014.

The Department is currently evaluating the possibility of relocating the NCore site from Fargo to Bismarck. If the Department does commit to this move within 2015-2016, the NO_y monitor would move as well. See section 3.0 – Network Site Changes for the possibility of the addition of a new ambient monitoring station to the network.

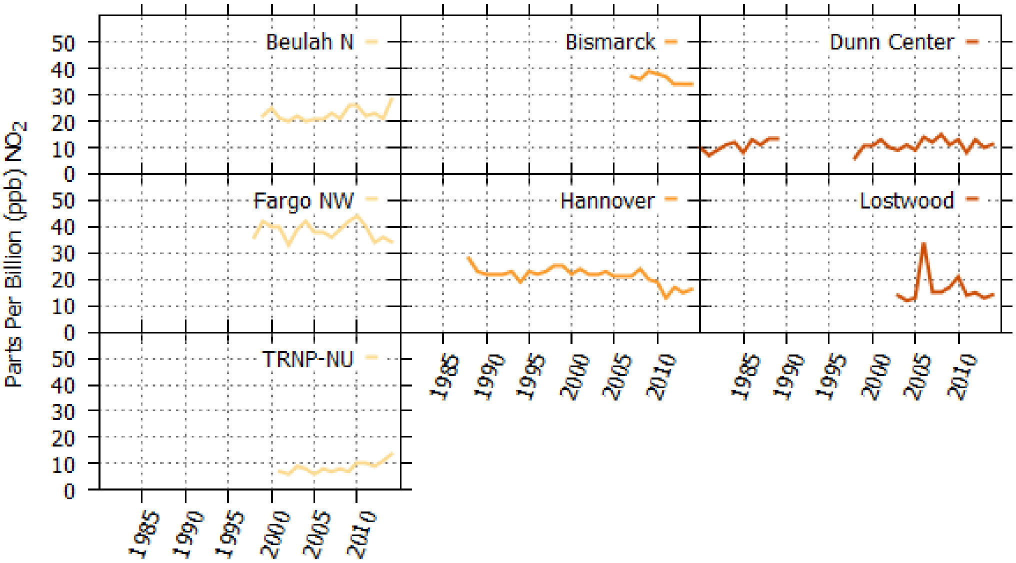

Figure 8. NO_2 98th Percentile 1-Hour Concentrations

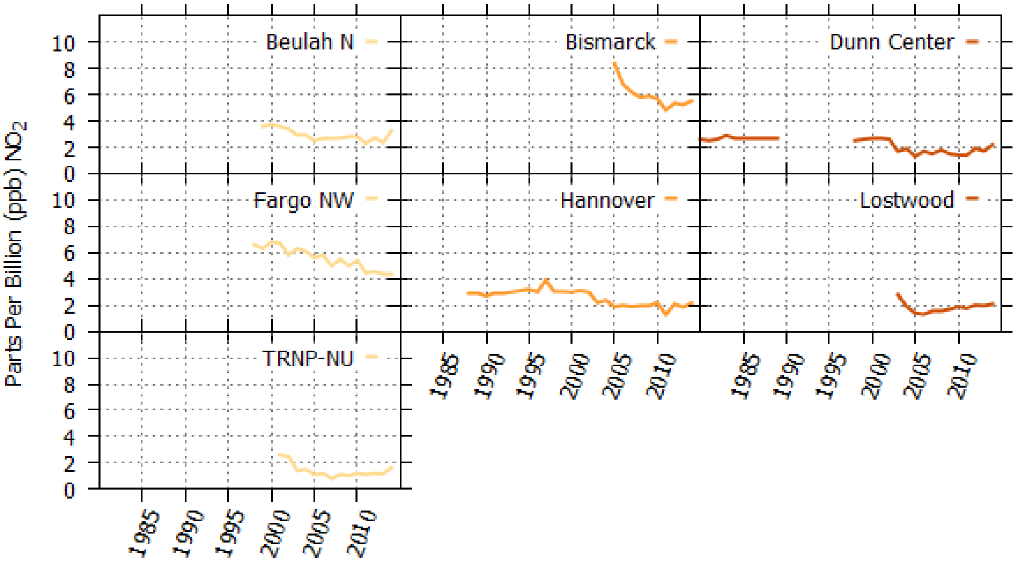

Figure 9. NO_2 Annual Average Concentrations

2.4 Ozone

Ozone (O_3) 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_3 is colorless and odorless.

Unlike most other pollutants, O_3 is not emitted directly into the atmosphere, but results from a complex photochemical reaction between volatile organic compounds (VOC), NO_x, and solar radiation. Both VOC and NO_x 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_3 is a year-round phenomenon. However, the highest O_3 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_3 monitoring season for North Dakota as May 1 through September 30.

At ground level where it can be breathed, O_3 is a pollutant. However, ground-level O_3 should not be confused with the stratospheric O_3 located between 12 and 20 miles above the earth's surface. The stratospheric O_3 layer shields the earth from intense cancer-causing ultraviolet radiation. Concentrations of O_3 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_3 being brought to ground level. This can increase ambient air concentrations by 50 to 100 ppb.

Short-term exposure to O_3 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_3 exposure are more readily induced in people who are exercising.

O_3 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_3. Many plants, such as soybeans and alfalfa, are sensitive to O_3 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.

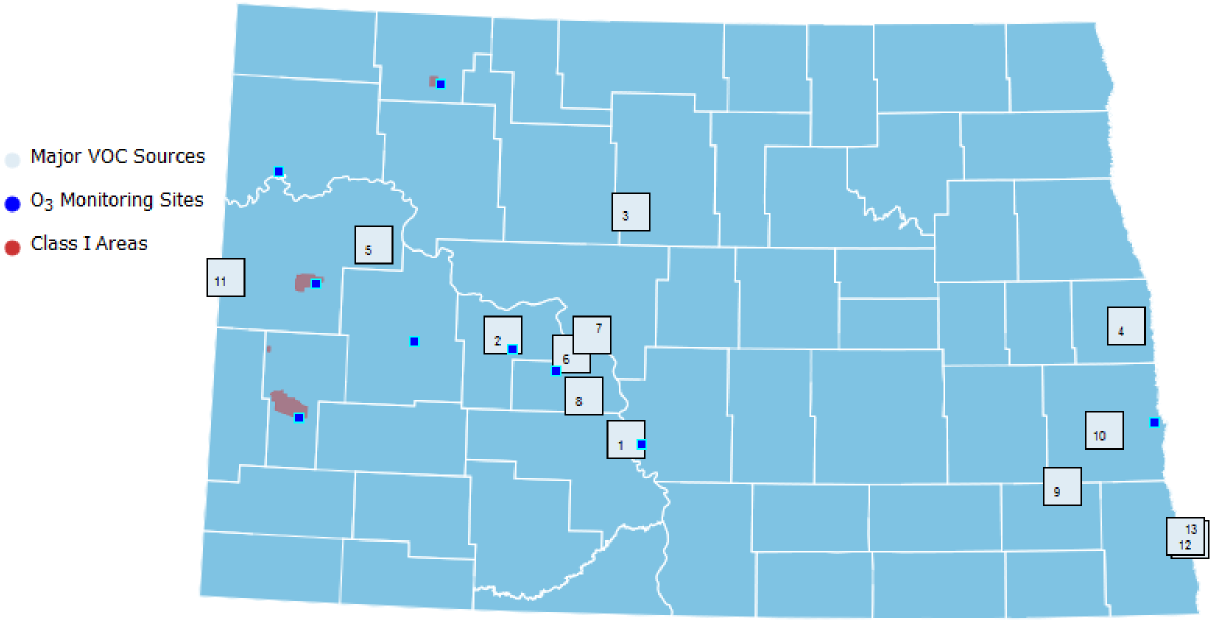

Figure 10. Major VOC Sources in 2014

Table 4. Major VOC Sources (> 100 TPY) in 2014

#	Company	Source	EIS Facility ID
1	Tesoro Refining and Marketing Company	Mandan Refinery	7923611
2	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
3	ADM Processing	Velva Facility	8085211
4	American Crystal Sugar Company	Hillsboro Plant	7939011
5	Arrow Midstream Holdings, LLC	Central Delivery Facility	*
6	Basin Electric Power Cooperative	Leland Olds Station	8086311
7	Great River Energy	Coal Creek Station	8011011
8	Minnkota Power Cooperative, Inc.	Milton R. Young Station	8087911
9	Northern Sun (Division of ADM)	Enderlin Facility	7923911
10	Tharaldson Ethanol Plant I, LLC	Tharaldson Ethanol Plant I, LLC	12682411
11	ONEOK Rockies Midstream, LLC	Grasslands Gas Plant	8085511
12	Minn-Dak Farmers Cooperative	Wahpeton Plant	7924011
13	Cargill Corn Milling	Wahpeton Facility	10612711

* ID not yet assigned

2.4.2 Area Sources

Point sources contribute only part of the total VOC and NO_x 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_3 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 4th highest 8-hour average concentration must be at least 68 parts per billion. As can be seen from Figure 11 (numbers above the bars indicate concentration), none of the O_3 monitors at SLAMS sites reach this threshold.

2.4.3 Monitoring Network

The Department currently has nine continuous ultraviolet (UV) photometric ozone analyzers in operation (Figure 10), two of which are co-located with chemiluminescence ozone analyzers (Lostwood and Beulah). Figure 11 presents the 2014 8-hour data summaries. Co-location was implemented in order to determine the cause(s) of elevated readings occurring at select UV photometric analyzers. The readings are suspected to be the result of UV photometric method-specific interference as they do not appear to register in the chemiluminescence based machine. For the time being, the Department will continue to operate collocated UV and chemiluminescence based analyzers to observe and resolve any differences in method results.

2.4.4 Network Analysis

Only three of the nine monitoring sites are in an area not significantly influenced by VOC sources (see Figure 10). 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[8] 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. Dunn Center 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 11 shows a striking similarity among the 4th 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 4th highest average is 4 ppb (see Figure 11). Figure 12 shows the annual average concentrations for the Department-operated sites for 1980 - 2014.

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[8] 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.

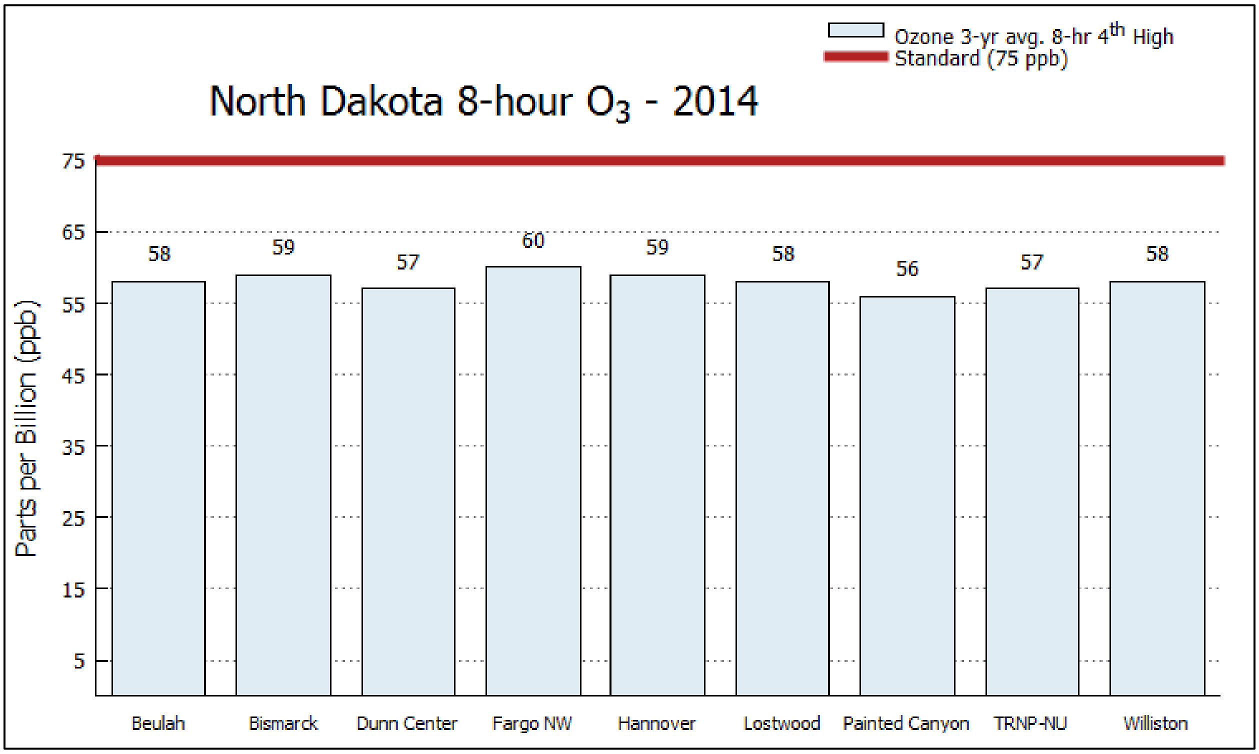

Figure 11. Ozone Concentrations Compared to the 8-hour Standard

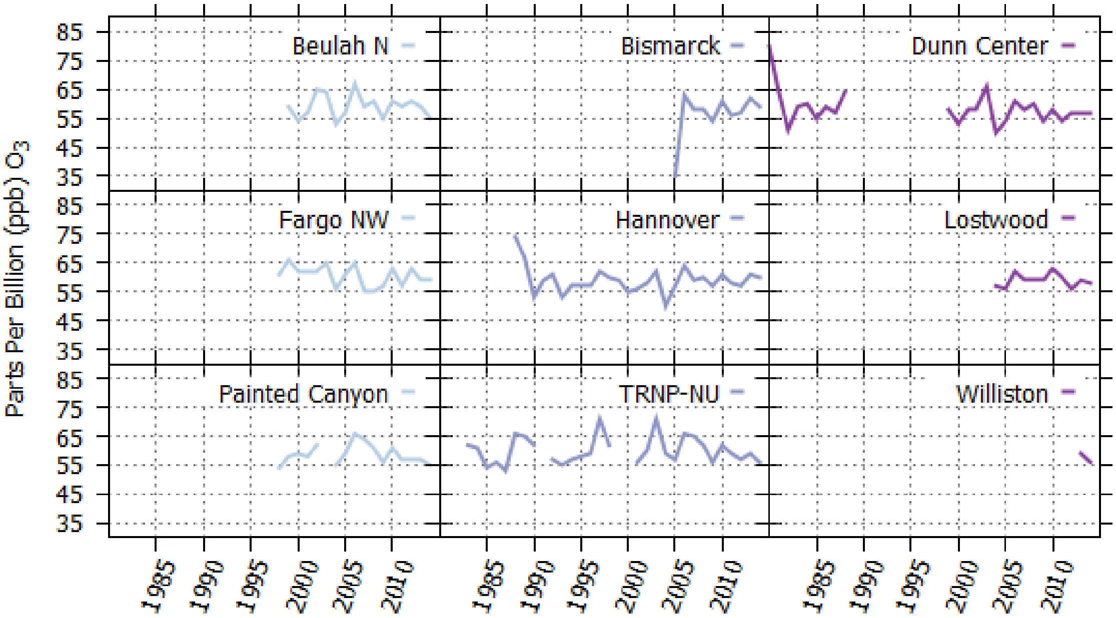

Figure 12. Annual 4th Highest 8-HR Ozone Concentrations

(Current Standard is 75 ppb)

2.4.5 Network Changes

The Department installed a chemiluminescence based ozone analyzer at the Beulah site in 2014 co-located with the previously installed UV continuous ozone analyzer.

As part of the 5-year review, it was recognized that co-location of the two types of monitors at other sites within the network may be required to define and resolve method-specific monitoring interference events. The Division will continue to review site-specific conditions and modify the network as required. See section 3.0 – Network Site Changes for the possibility of the addition of a new ambient monitoring station to the network.

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_{10} and $PM_{2.5}$. The PM_{10} particles have an aerodynamic diameter less than or equal to a nominal 10 microns, while the $PM_{2.5}$ particles have an aerodynamic diameter less than or equal to a nominal 2.5 microns.

PM_{10} 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_{10} from these sources contain a large percentage of elemental and organic carbon, which play a role in both visual haze and health issues. $PM_{2.5}$ 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 $PM_{10\text{-}2.5}$, 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 with 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. $PM_{2.5}$ (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 $PM_{2.5}$ 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.

2.5.1 Point Sources

The major PM_{10} point sources (>100 TPY) are listed in Table 5. Figure 13 shows the approximate locations of these facilities (the numbers correspond to the site and source tables). Most of these sources are large coal-fired facilities, and the PM_{10} 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 14 shows the contribution of point sources to the total PM_{10} emissions. The “Utility Boilers” category consists of power plant boilers. The “Other Point Sources” category consists of coal gasification, oil refineries, natural gas processing plants and agricultural processing plants.

2.5.2 Monitoring Network

The Department operated eight continuous PM_{10} analyzer sites, four Federal Reference Method (FRM) manual $PM_{2.5}$ sites, eight Federal Equivalent Method (FEM) continuous $PM_{2.5}$ analyzer sites, and one speciation sampler site.

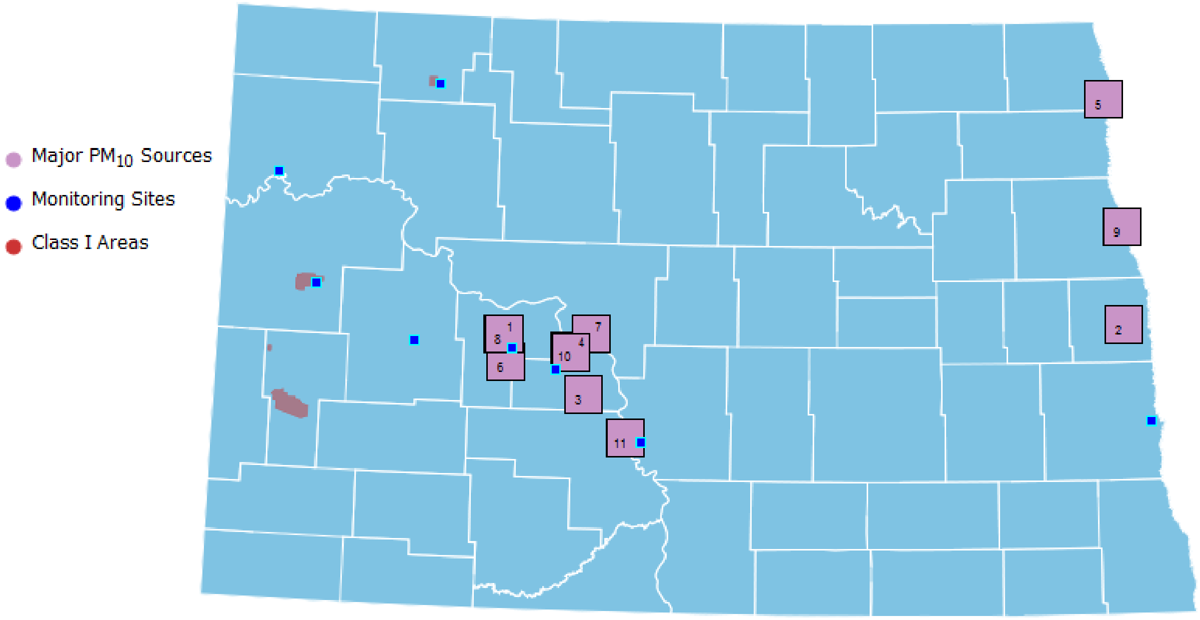

Figure 13. Major PM$_{10}$ Sources in 2014

Table 5. Major PM$_{10}$ Sources (> 100 TPY) in 2014

#	**COMPANY**	**SOURCE**	**EIS Facility ID**
1	Basin Electric Power Cooperative	Antelope Valley Station	8086511
2	American Crystal Sugar Company	Hillsboro Plant	7939011
3	Minnkota Power Cooperative, Inc.	Milton R. Young Station	8087911
4	Basin Electric Power Cooperative	Leland Olds Station	8086311
5	American Crystal Sugar Company	Drayton Plant	7923811
6	Otter Tail Power Company	Coyote Station	8086611
7	Great River Energy	Coal Creek Station	8011011
8	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
9	North Dakota Mill	State Mill	7293411
10	Great River Energy	Stanton Station	8086411
11	Tesoro Refining and Marketing Company	Mandan Refinery	7923611

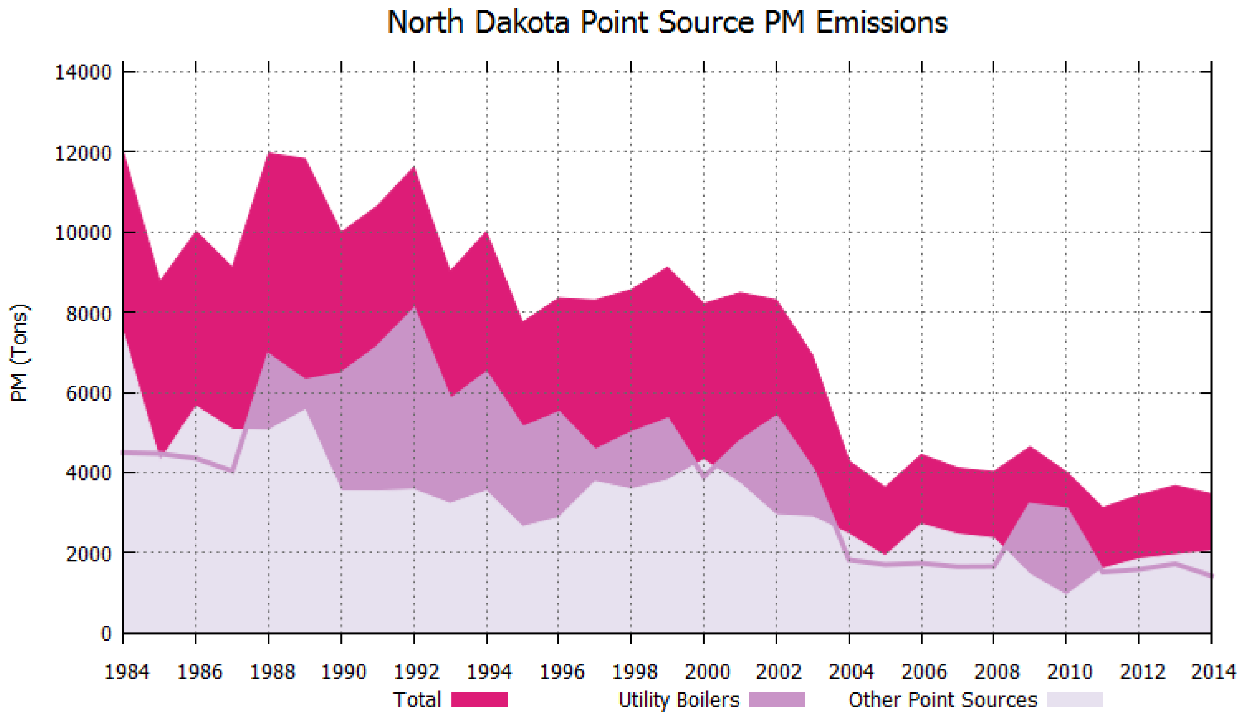

Figure 14. Annual PM Emissions

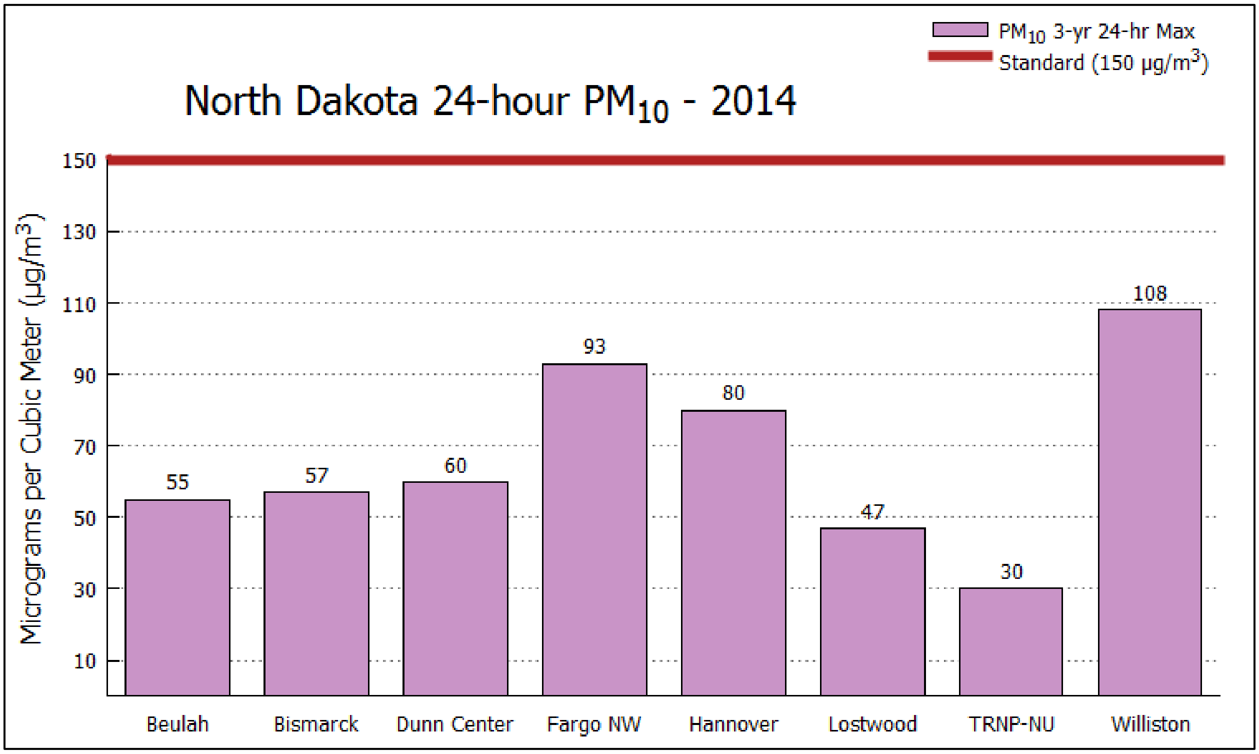

Figure 15. PM_{10} Concentrations Compared to the 24-hour Standard

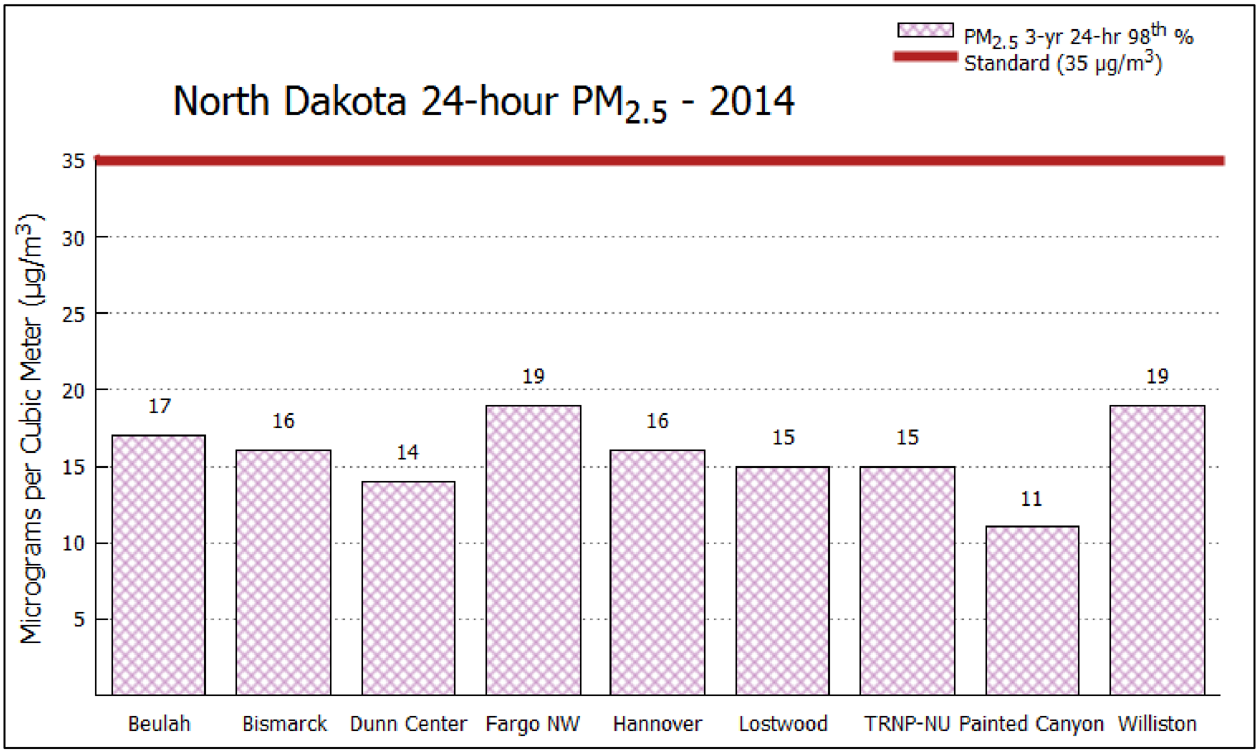

Figure 16. $PM_{2.5}$ Concentrations Compared to the 24-hour Standard

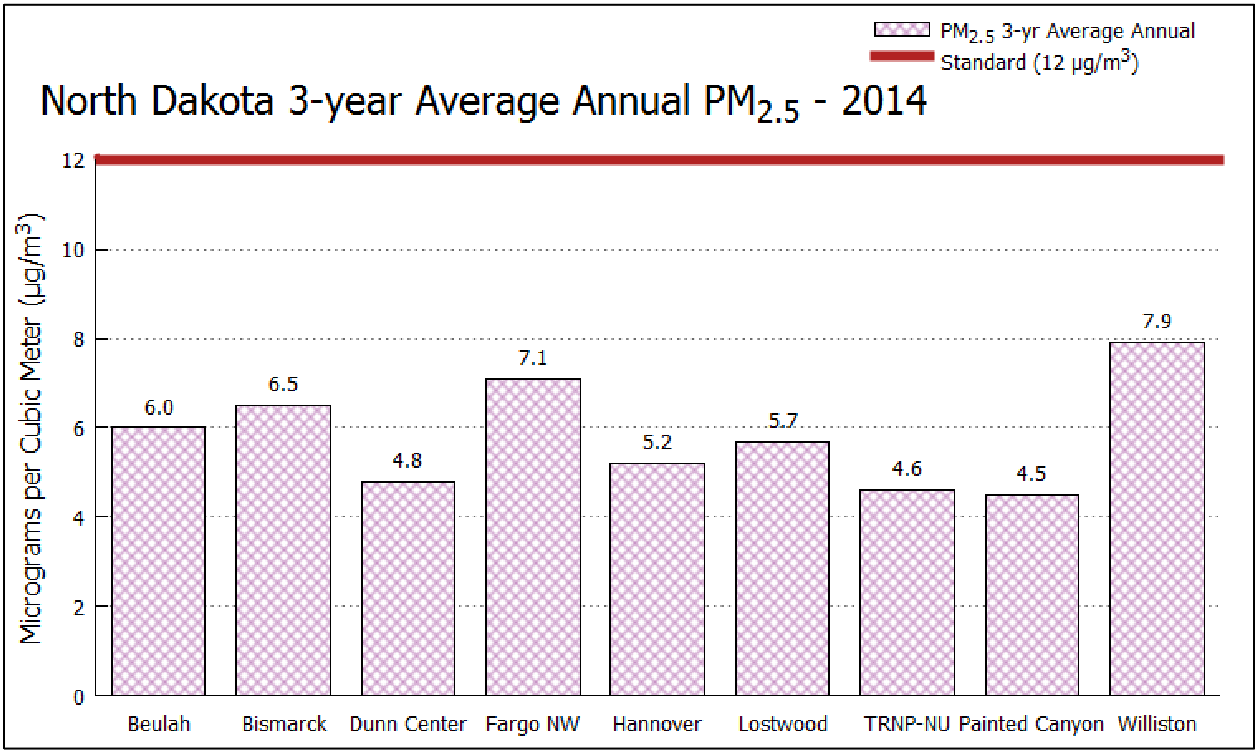

Figure 17. $PM_{2.5}$ Concentrations Compared to the Annual Standard

2.5.3 PM_{10} Network Analysis

PM_{10} and smaller particles are of concern mainly because of their health effects. Continuous PM_{10} analyzers are used with the continuous $PM_{2.5}$ analyzers to determine the $PM_{10-2.5}$ fraction. The data also are compared to both the state and federal ambient air quality standards. Figure 15 shows the 2014 PM_{10} particulate monitoring results in comparison to the 24-hour NAAQS. Numbers above the bars indicate monitored concentrations.

2.5.4 $PM_{2.5}$ Network Analysis

The manual $PM_{2.5}$ network currently has four sites: Bismarck, Beulah, Fargo and Painted Canyon. Bismarck and Fargo operate on a 1-in-3 day schedule, while Beulah and Painted Canyon operate on a 1-in-6 day schedule. FEM continuous $PM_{2.5}$ analyzers have been installed at all sites in the network. Figures 16 and 17 show the 2014 $PM_{2.5}$ particulate monitoring results in comparison to the 24-hour and annual standards. Numbers above the bars indicate monitored concentrations.

2.5.5 Speciation Network

One speciation sampler is installed as a National Trends Network sampler in Fargo. The data collected by this sampler are added to the Air Quality System (AQS) database by an EPA contractor[9].

2.5.6 Network Changes

In the past year, a non-FEM $PM_{2.5}$ Tapered Element Oscillating Microbalance (TEOM) was replaced by a FEM $PM_{2.5}$ Bata Attenuation Monitor (BAM) at the Painted Canyon site located in the south unit of Theodore Roosevelt National Park (operated in partnership with the NPS). No other substantive changes were made to the $PM_{2.5}$ network in 2014.

The Department is currently evaluating the possibility of relocating the NCore site from Fargo to Bismarck. If the Department does commit to this move within 2015-2016, the $PM_{2.5}$ speciation samplers would move as well. See section 3.0 – Network Site Changes for the possibility of the addition of a new ambient monitoring station to the network.

2.6 Sulfur Dioxide

Sulfur dioxide (SO_2) 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_2SO_3). In the atmosphere, sulfurous acid is easily converted to sulfuric acid (H_2SO_4), 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

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[9] RTI International

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_2. 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_2 in the atmosphere, are corrosive and potentially carcinogenic (cancer-causing). The major health effects of SO_2 appear when it is associated with high levels of other pollutants, such as particulate. SO_2 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[10].

Particulate matter sulfates resulting from SO_2 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_2 is one of the Department's primary 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_2 point sources (>100 TPY) based on 2014 emissions are listed in Table 6. Figure 18 shows the approximate locations of these facilities. Figure 19 shows the total annual SO_2 emissions from point sources and three sub-categories for 1984 through 2014.

2.6.2 Other Sources

The western part of the state has a number of potential SO_2 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_2 and contributing to concentrations of this pollutant.

2.6.3 Monitoring Network

There are eight SO_2 monitoring sites in the state. As can be seen in Figure 18, 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.

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[10] 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.

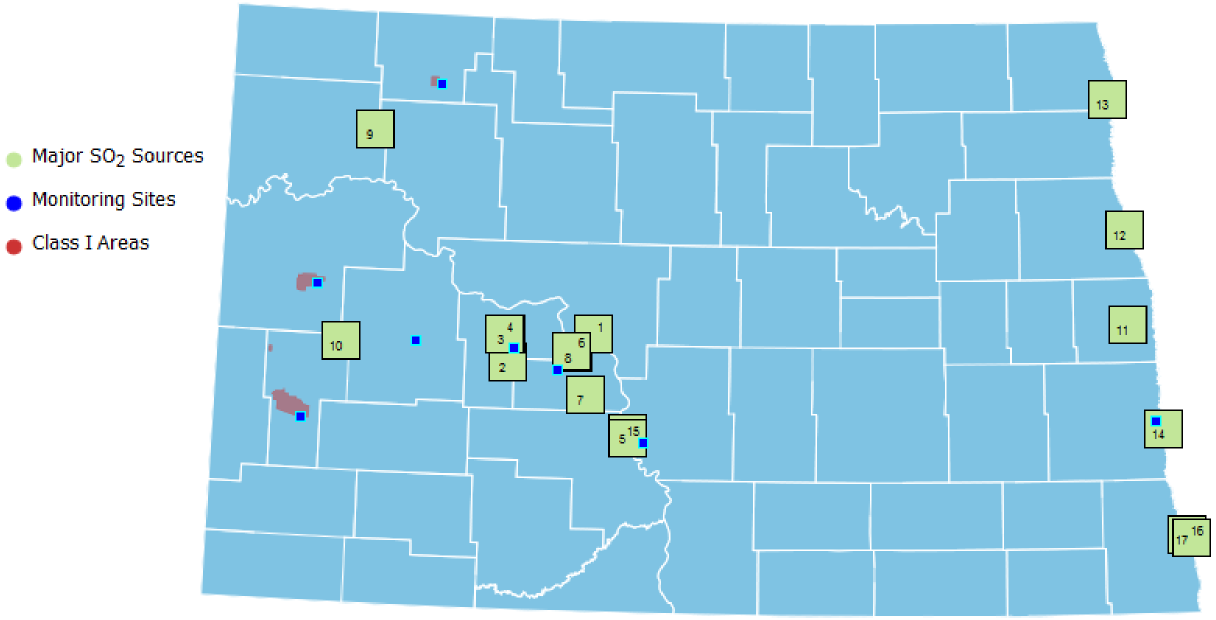


Figure 18. Major Sulfur Dioxide Sources in 2014

Table 6. Major SO_2 Sources (>100 TPY) in 2014

#	Company Name	Source	EIS Facility ID
1	Great River Energy	Coal Creek Station	8011011
2	Otter Tail Power Company	Coyote Station	8086611
3	Basin Electric Power Cooperative	Antelope Valley Station	8086511
4	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
5	Montana Dakota Utilities Company	RM Heskett Station	8087011
6	Great River Energy	Stanton Station	8086411
7	Minnkota Power Cooperative, Inc.	Milton R. Young Station	8087911
8	Basin Electric Power Cooperative	Leland Olds Station	8086311
9	Hess Corporation	Tioga Gas Plant	8013911
10	Petro-Hunt, LLC	Little Knife Gas Plant	8023811
11	American Crystal Sugar Company	Hillsboro Plant	7939011
12	University of North Dakota	UND Heating Plant	7292911
13	American Crystal Sugar Company	Drayton Plant	7923811
14	North Dakota State University	NDSU Heating Plant	8448211
15	Tesoro Refining and Marketing Company	Mandan Refinery	7923611
16	Minn-Dak Farmers' Cooperative	Wahpeton Plant	7924011
17	Cargill Corn Milling	Wahpeton Facility	10612711

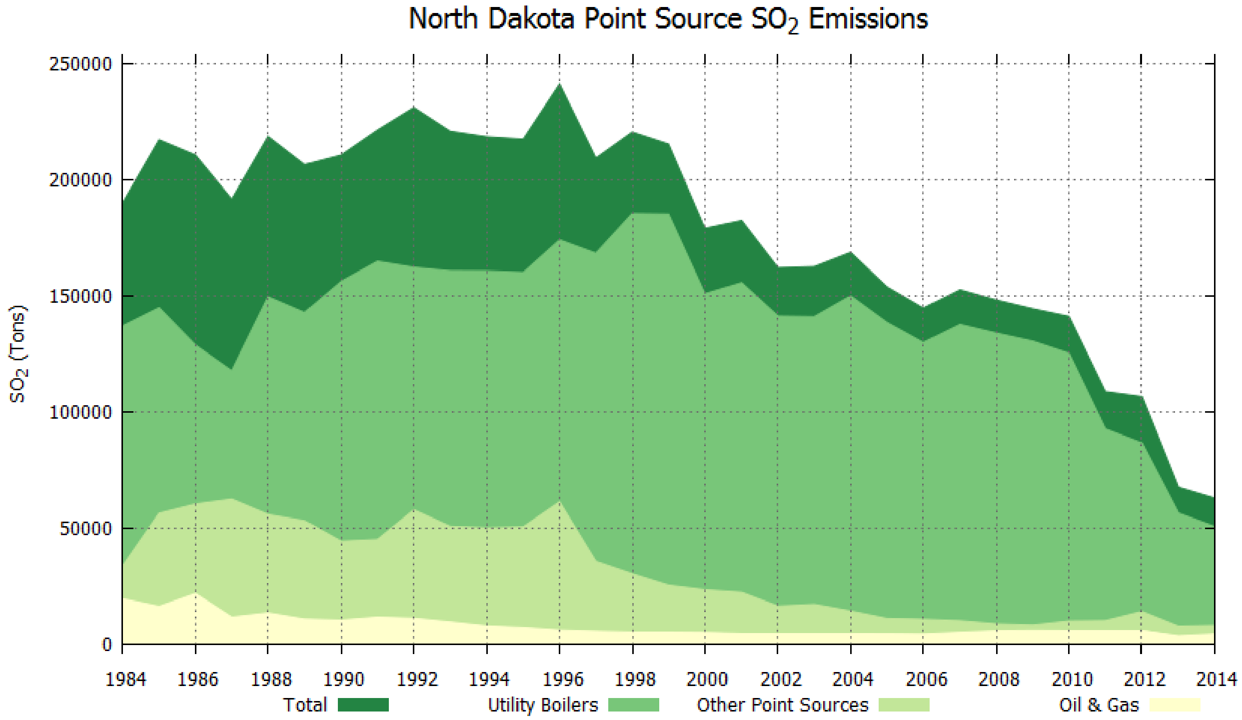


Figure 19. Annual Sulfur Dioxide Emissions

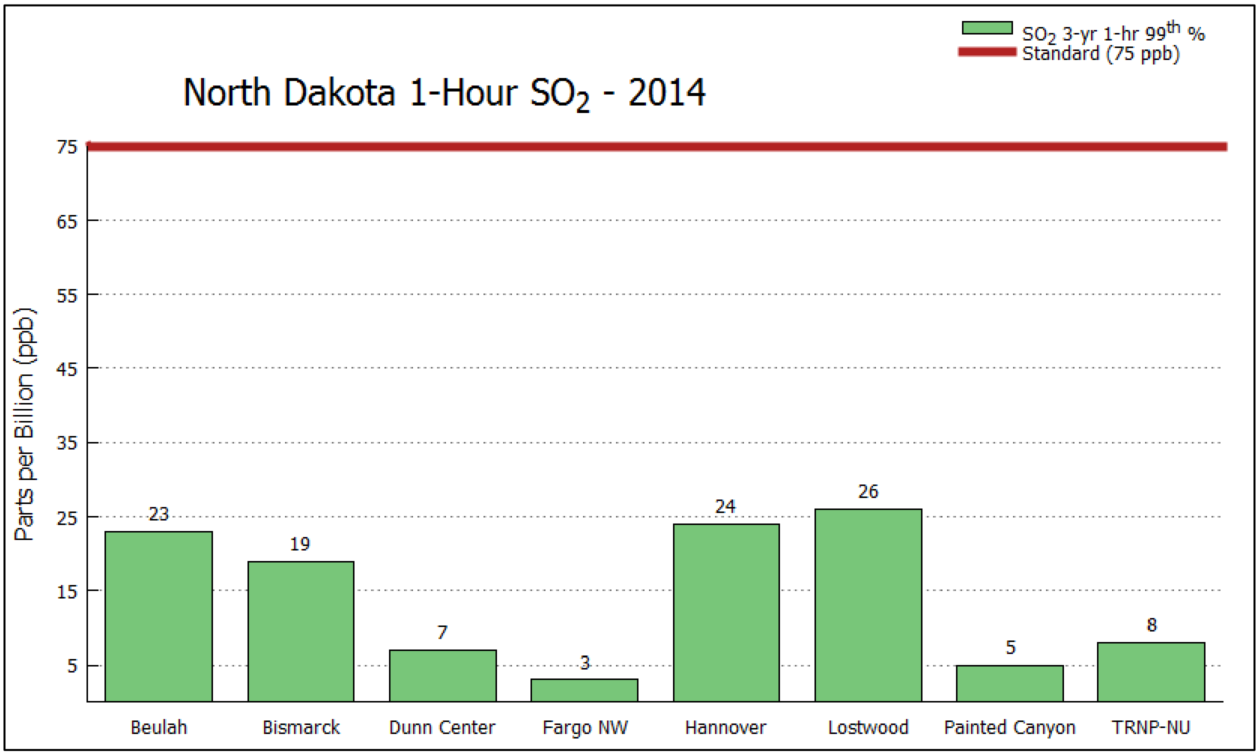


Figure 20. SO_2 Concentrations Compared to the 1-hour Standard

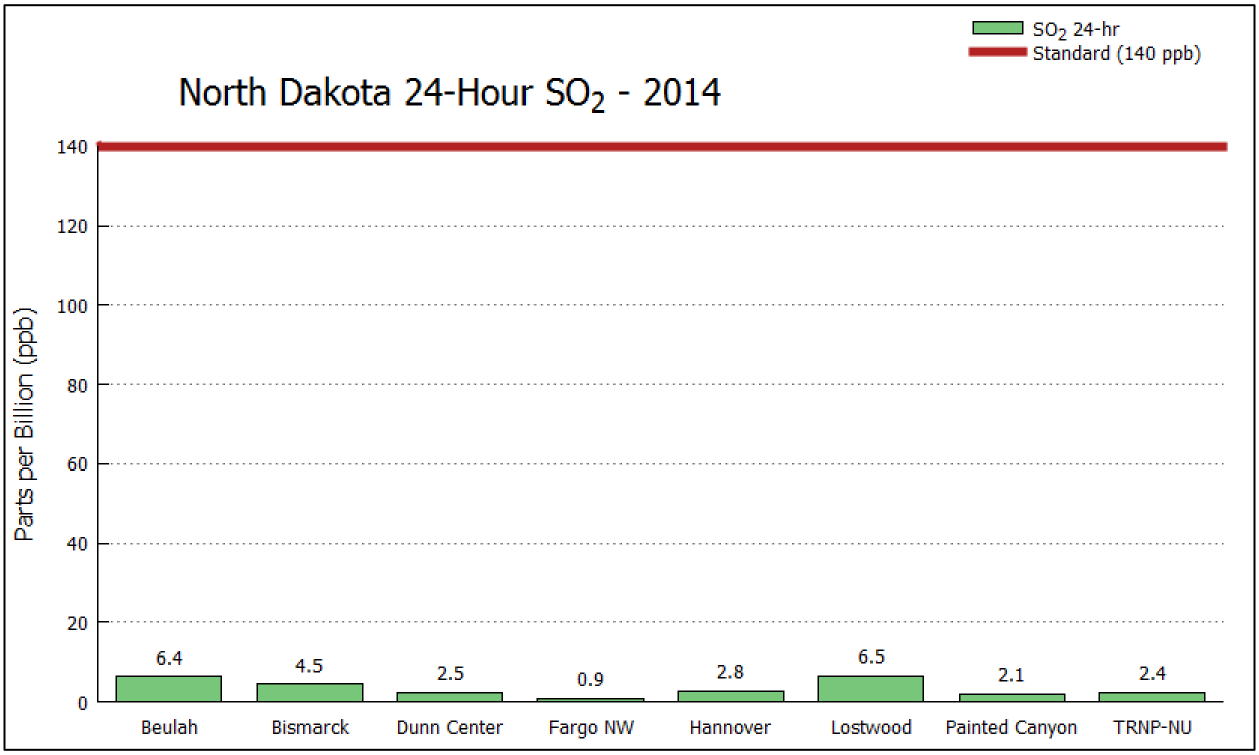


Figure 21. SO_2 Concentrations Compared to the 24-hour Standard

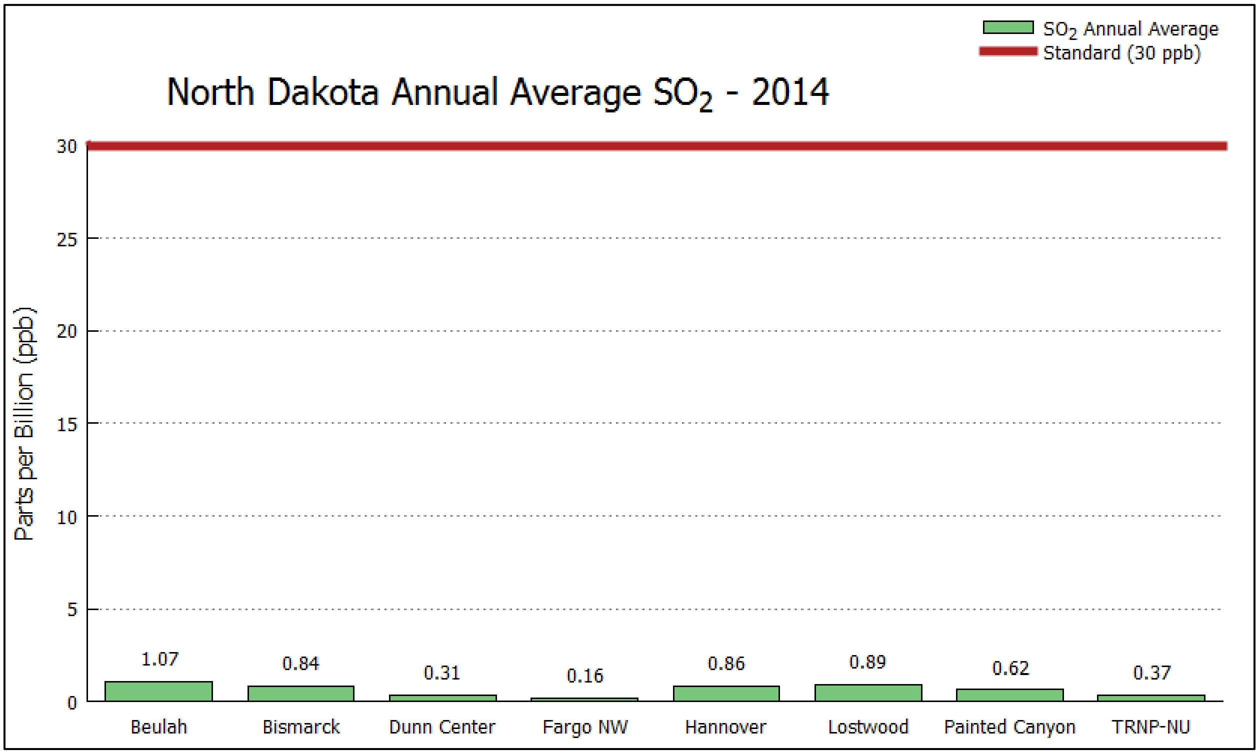


Figure 22. SO_2 Concentrations Compared to the Annual Standard

2.6.4 Network Analysis

Figures 20, 21, and 22 show the 2014 SO_2 monitoring results in comparison to the 1-hour, 24-hour, and annual SO_2 NAAQS. Numbers above the bars indicate monitored concentrations.

Ten major SO_2 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 on line beginning in 1980, a noticeable change would be seen on the ambient air quality. This has not been the case. There have been possible short-term influences, but no significant long-term impact by these sources combined has been demonstrated in the data. Figures 23, 24 and 25 present the following for the Department-operated sites: (1) 1-hour maximums; (2) 24-hour maximums; and (3) annual maximums.

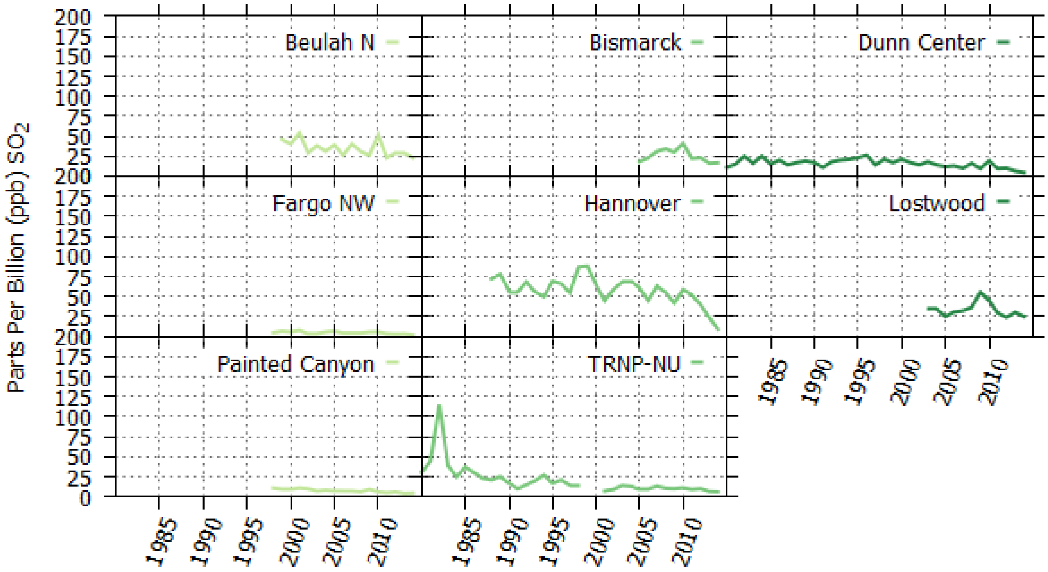


Figure 23. SO_2 99th Percentile 1-Hour Concentrations

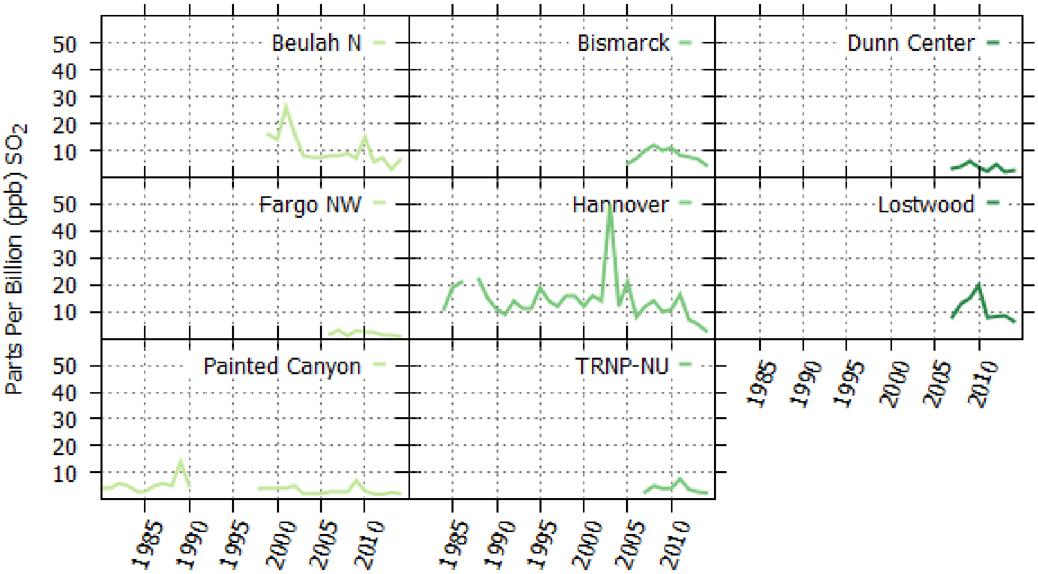


Figure 24. SO$_2$ Maximum 24-Hour Concentrations

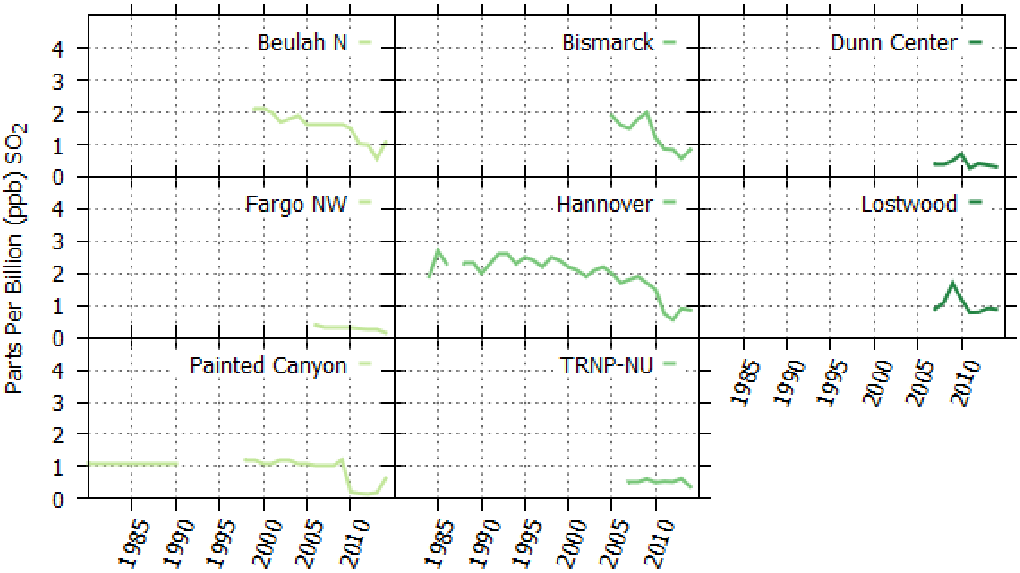


Figure 25. SO$_2$ Maximum Annual Concentrations

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 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 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, 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_2 monitoring network in 2014. See section 3.0 – Network Site Changes for the possibility of the addition of a new ambient monitoring station to the network.

2.7 Hydrogen Sulfide

Hydrogen sulfide (H_2S) 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_2S 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_2S, the state of North Dakota has developed H_2S standards in response to historically high petroleum sulfur content (during the 1980s in particular) and associated high H_2S. The major source of H_2S 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_2S emissions when compared to legacy (non-Bakken) operations.

2.7.1 Point Sources

H_2S emissions of concern stems almost totally from the oil and gas 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_2S emission sources.

2.7.2 Monitoring Network

Currently there are no state H_2S monitoring sites.

2.7.3 Network Changes

There were no significant changes made to the H_2S network in 2014. There are no changes planned for 2015.

As part of the 5 year assessment, the H_2S network was reviewed. With a greater proportion of oil and gas activity concentrating on “sweet” formations (i.e. those with low H_2S concentrations), emissions of H_2S are anticipated to decrease or remain unchanged over the upcoming 5 year period. Because of this, there are no planned changes to the H_2S monitoring network.

2.8 Ammonia

Ammonia (NH_3) is a corrosive, colorless gas with a strong irritating odor. It is used in making fertilizer, plastics, dyes, textiles, detergents, and pesticides. It reacts with acids and oxidizing materials (fluorine, chlorine, etc.). It is corrosive to copper, zinc, and many metal surfaces and reacts with hypochlorite and halogens to form explosive compounds that are pressure and temperature sensitive. In combination with oxides of nitrogen and sulfur, NH_3 can form small particulates with potential impact to health and visibility.

In mild concentrations (< 25,000 ppb), NH_3 will cause conjunctivitis and dermatitis. At higher concentrations, it will cause swelling of tissue, painful burns, lesions, and possible loss of vision. On contact with the skin, it will cause caustic-like burns and inflammation. Toxic level skin exposure (± 300,000 ppb) may cause skin lesions resulting in early necrosis and scarring. Inhalation of NH_3 is corrosive and irritating to the upper respiratory system and mucus membranes. Depending on the concentration inhaled, NH_3 may cause burning sensations, coughing, wheezing, shortness of breath, headache and nausea, with eventual collapse and death.

There is no ambient air quality standard for NH_3. However, because NH_3 concentrations are an important factor in the secondary formation of fine particulate matter through reactions with NO_x and SO_2, the Department maintains a select number of NH_3 monitors throughout North Dakota.

2.8.1 Point Sources

The major sources of NH_3 are listed in Table 8 and Figure 26 shows the approximate locations of these facilities (the numbers correspond to the source table).

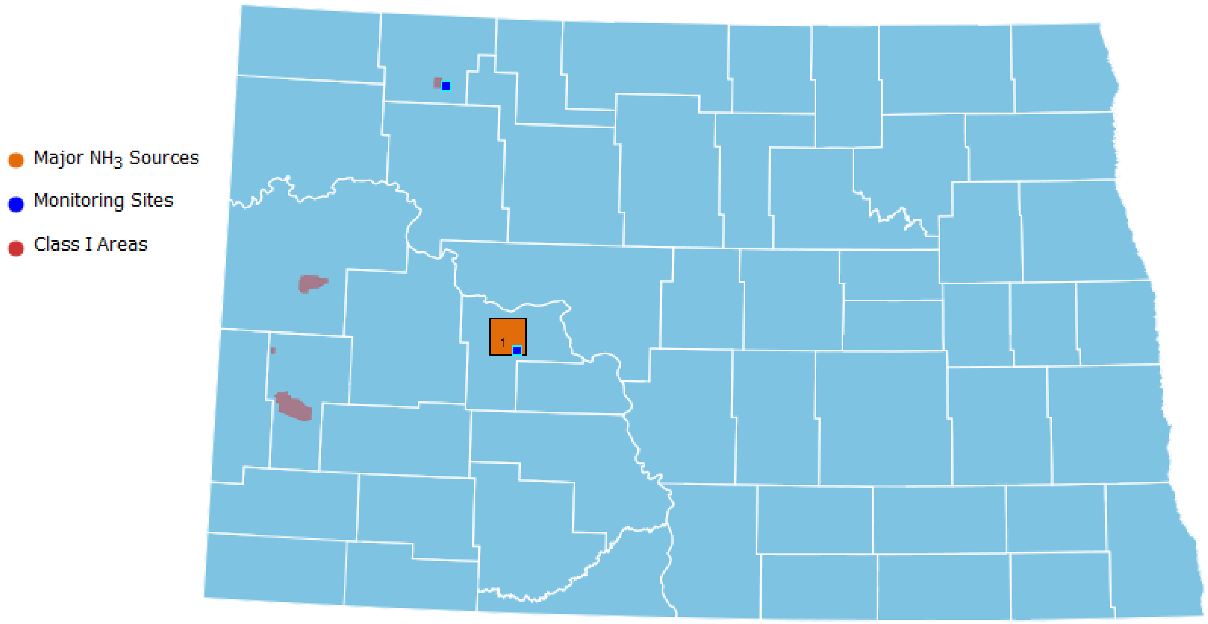


Figure 26. Major Ammonia Sources in 2014

Table 8. Major Ammonia Sources (> 100 TPY) in 2014

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

2.8.2 Monitoring Network

Currently there are two NH_3 monitoring sites in the state.

2.8.3 Network Analysis

Figure 27 shows maximum monitored NH_3 concentrations at the two monitoring sites in comparison with the arithmetic mean yearly concentration. As there is currently no NAAQS for NH_3, none is shown on the chart.

2.8.4 Network Changes

There were no significant changes made to the NH_3 network in 2014. There are no changes planned for 2015.

As part of the 5 year assessment, the NH_3 network was reviewed. At this point in time, the network is adequate for the Department's needs. However, a changing regulatory environment with a focus on $PM_{2.5}$ precursors and the possibility of a greater reliance on ambient NH_3 data for advanced chemistry dispersion modeling could result in the need for different monitoring options in the future. The Department will continue to evaluate the need and make changes as necessary.

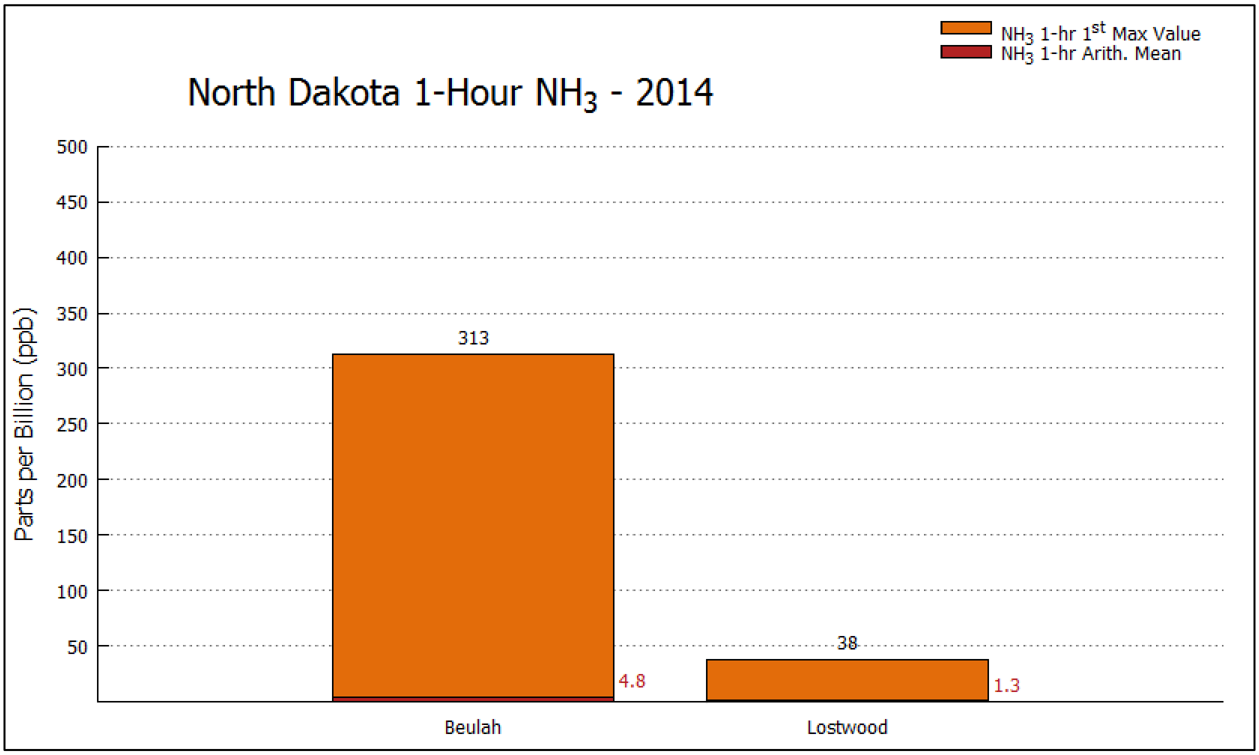


Figure 27. NH_3 Concentrations: Maximum Value and Arithmetic Mean

2.9 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."[11] Currently there are no state or federal air toxics monitoring sites in North Dakota.

2.9.1 Point Sources

The major air toxics sources are listed in Table 7 and Figure 25 shows the approximate locations of these facilities (the numbers correspond to the source table).

2.9.2 Monitoring Network

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

---

[11] 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

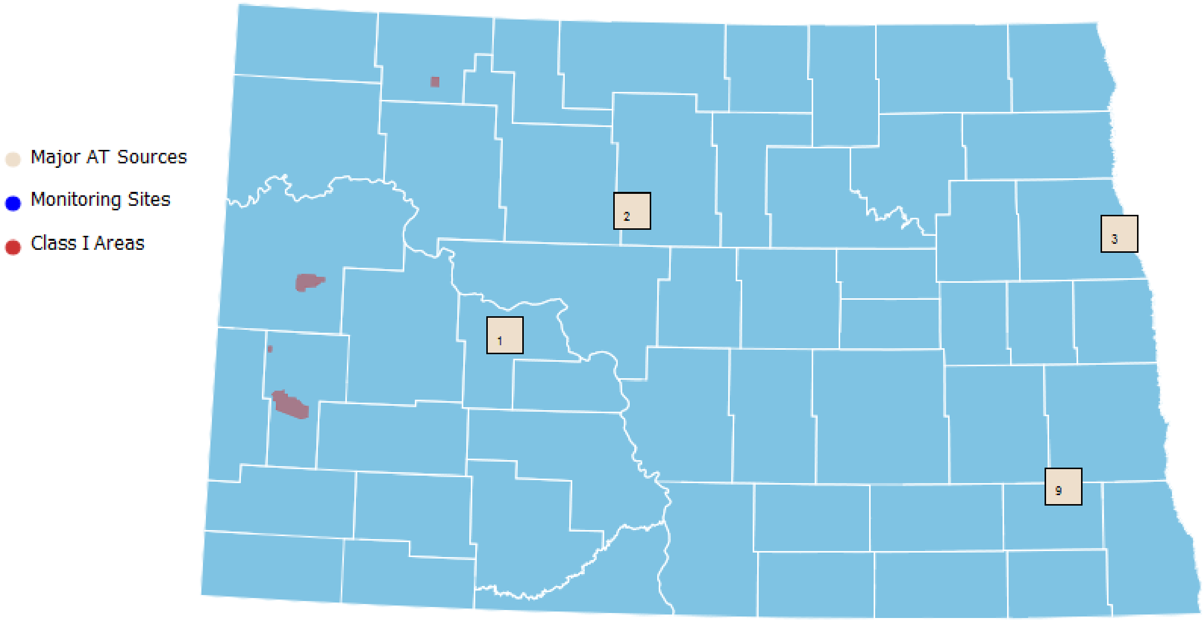


Figure 28. Major Air Toxics Sources in 2014

Table 9. Major Air Toxics Sources (> 100 TPY) in 2014

#	COMPANY	SOURCE	EIS Facility ID
1	Dakota Gasification Company	Great Plains Synfuels Facility	8086711
2	ADM Processing	Velva Facility	8085211
3	LM Wind Power Blades	Grand Forks Facility	7293311
4	Northern Sun (Division of ADM)	Enderlin Facility	7923911

2.9.3 Network Changes

There were no significant changes made to the Air Toxics network in 2014. There are no changes planned for 2015.

As part of the 5 year assessment, the Air Toxics network was reviewed. Based on the trends of the past 5 years, barring unforeseen changes to the air toxics emissions landscape, no significant changes to the network were identified as being required.

3.0 NETWORK SITE CHANGES

To continue its mission to gain an accurate picture of the air quality in North Dakota, the Department has been charged with deploying a new, 10th, ambient monitoring station. The purpose of this station is to gain a fuller understanding of the impacts on air quality due to oil and gas development in the state. Although a site location has not yet been finalized, the Department is tentatively considering the north-central part of the state on the eastern edge of the oil patch (Ward County) in the Minot area.

The new site is envisioned to consist of a suite of pollutant monitoring instruments selected to best provide an accurate assessment of air quality conditions. Monitors at the station may include ones designed to measure NO_2, SO_2, O_3, and $PM_{2.5}$. Additionally, the site will host a complement of meteorological instrumentation (e.g. wind speed and wind direction).

It is anticipated that a location for the new site and which parameters will be monitored will be finalized in late 2015 – early 2016.

4.0 SUMMARY AND CONCLUSIONS

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 – 569 ppb; 8-hour – 300 ppb.

The Department is evaluating the possibility of moving the trace-level CO monitor from Fargo to Bismarck as part of a larger NCore site relocation.

4.2 ● Lead

No lead monitoring was conducted. No changes to the network were identified as part of the 5 year assessment.

4.3 ● Nitrogen Dioxide (NO_2)

Neither the state nor federal NO_2 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 98th percentile 1-hour average concentrations – 35 ppb; annual – 5.52 ppb.

The Department is evaluating the possibility of moving the NO_y monitor from Fargo to Bismarck as part of a larger NCore site relocation. A NO_2 monitor may be selected to be installed at the new ambient monitoring station.

4.4 ● Ozone (O_3)

Neither the state nor federal O_3 standard of 75 ppb was exceeded during the year. The maximum fourth-highest 8-hour concentration was 60 ppb.

4.5 ● Particulate Matter (PM_{10}, $PM_{2.5}$)

Neither the state nor federal PM_{10} 24-hour standard of 150 $\mu g/m^3$ was exceeded during the year. The maximum concentration was: 24-hour – 108.0 $\mu g/m^3$.

Neither the state nor federal $PM_{2.5}$ standards of 35 $\mu g/m^3$ (24-hour) and 12 $\mu g/m^3$ (annual) were not exceeded during the year. The maximum concentrations are as follows: 24-hour – 19 $\mu g/m^3$; annual – 7.9 $\mu g/m^3$.

The Department is evaluating the possibility of moving the $PM_{2.5}$ speciation samplers from Fargo to Bismarck as part of a larger NCore site relocation. A continuous $PM_{2.5}$ monitor may be selected to be installed at the new ambient monitoring station.

4.6 ● Sulfur Dioxide (SO_2)

Neither the state nor federal SO_2 standards of 75 ppb (1-hour), 140 ppb (24-hour), or 30 ppb (annual) were exceeded at any state operated monitoring site. The maximum concentrations were as follows: 3-year average 1-hour 99th percentile – 26 ppb; 24-hour – 6.5 ppb; annual 1.07 ppb. A SO_2 monitor may be selected to be installed at the new ambient monitoring station.

4.7 ● Hydrogen Sulfide (H_2S)

No H_2S monitoring was conducted. No changes to the network were identified as part of the 5 year assessment.

4.8 ● Ammonia (NH_3)

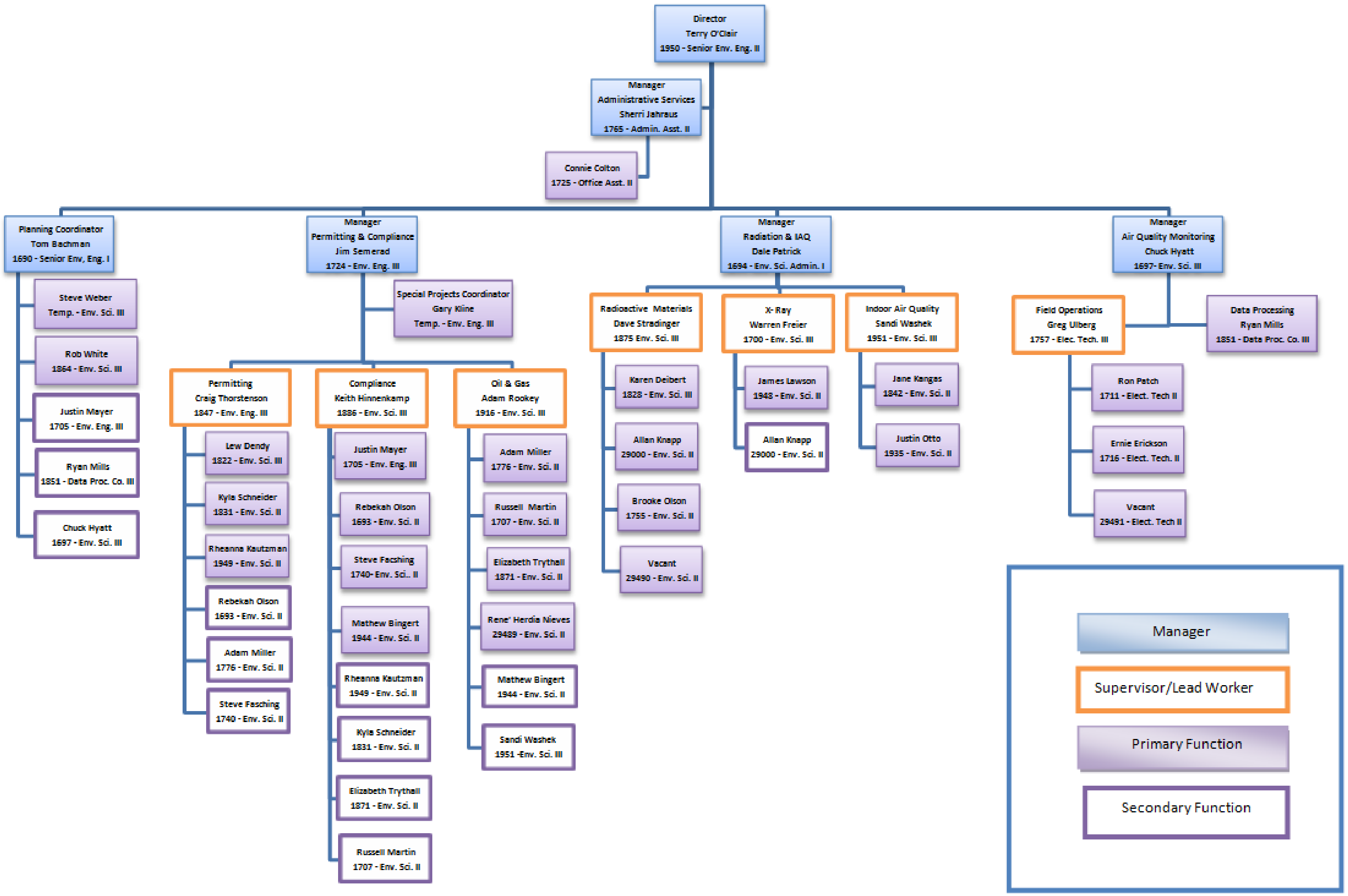
There is no ambient air quality standard for ammonia. The maximum 1-hour concentration measured was 313 ppb with a maximum yearly average (arithmetic mean) of 4.8 ppb. No immediate changes to the network were identified as part of the 5 year assessment.

4.9 ● Air Toxics (HAP)

No Air Toxics monitoring was conducted. No changes to the network were identified as part of the 5 year assessment.

Appendix A Air Quality Personnel Organizational Chart

Air Quality Division



Appendix B Ambient Air Quality Standards

Ambient Air Quality Standards

Pollutant		Averaging Period	North Dakota		Federal	
			µg/m^3	ppb	µg/m^3	ppb
Carbon Monoxide (CO)		1-hour [a]	40,000	35,000	40,000	35,000
		8-hour [a]	10,000	9,000	10,000	9,000
Lead		3-month [b]	0.15	--	0.15	--
Nitrogen Dioxide (NO_2)		Annual [c]	100	53	100	53
		1-hour [d]	188	100	188	100
Ozone (O_3)		8-hour [e]	147	75	147	75
Particulate Matter	PM_{10}	24-hour [f]	150	--	150	--
	$PM_{2.5}$	24-hour [g]	35	--	35	--
		Annual [h]	12	--	12	--
Sulfur Dioxide (SO_2)		1-hour [i]	196	75	196	75
		3-hour [a]	1309	500	1309	500
		24-hour [a]*	--	--	365	140
		Annual [c]*	--	--	80	30
Hydrogen Sulfide (H_2S)		Instantaneous	14,000	10,000	--	--
		1-hour [j]	280	200	--	--
		24-hour [a]	140	100	--	--
		Quarter	28	20	--	--

[a] Not to be exceeded more than once per calendar year.
[b] Not to be exceeded by a rolling three month arithmetic mean.
[c] Annual arithmetic mean.
[d] Three year average of 98th percentile of 1-hour daily maximum concentrations.
[e] Three year average of the annual fourth-highest daily maximum 8-hour concentrations.
[f] Not to be exceeded more than once per year on average over a 3 year period.
[g] Three year average of the annual 98th percentile values.
[h] Three year average of annual concentrations.
[i] Three year average of 99th percentile of 1-hour daily maximum concentrations.
[j] Not to be exceeded more than once per month.

* The 24-hour and Annual SO^2 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^2 standard are complete for a given area.

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. 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 $PM_{2.5}$ monitoring sites for North Dakota

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
Ozone	Instrumental Chemiluminescence	Continuous	Population Exposure	Urban
Ammonia	Instrumental Chemiluminescence	Continuous	General Background	Regional
$PM_{2.5}$	24-hour Gravimetric	1/6	Population Exposure	Urban
$PM_{2.5}$	FEM $PM_{2.5}$ BAM	Continuous	Population Exposure	Urban
PM_{10}	PM_{10} 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
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

North Dakota state agencies and the ND GIS Hub

Site Name: Bismarck Residential

Station Type: SLAMS
AQS#: 38-015-0003 **MSA:** 1010
Address: 1810 N 16th Street
Bismarck, ND
Latitude: +46.825425 **Longitude:** -100.768210

Site Description: This site is located in the second largest metropolitan area in the state. When two special purpose sites in Mandan were closed, this site was expanded from a particulates-only site to be a full site for gases, continuous particulates (inc. ambient pressure) and the basic meteorological parameters (wind speed, wind direction and temperature). Another key role this site plays is to field test new types of equipment and procedures isolated from the equipment used to report data to AQS.

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
$PM_{2.5}$	24-hour Gravimetric	1/3	Population Exposure	Urban
$PM_{2.5}$	FEM $PM_{2.5}$ BAM	Continuous	Population Exposure	Urban
PM_{10}	PM_{10} BAM	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

There are no plans to move or remove this site.

Site Pictures: **Bismarck Residential**

North

East

West

Looking Northwest

South

Looking Southeast

Bismarck Residential

North Dakota state agencies and the ND GIS Hub

Site Name: Dunn Center

Station Type: SLAMS
AQS#: 38-025-0003 **MSA:** 0000
Address: 9610 Seventh Street SW
Dunn Center, ND
Latitude: +47.313200 **Longitude:** -102.527300

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 $PM_{2.5}$ 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
$PM_{2.5}$	FEM $PM_{2.5}$ BAM	Continuous	General/Background	Urban
PM_{10}	PM_{10} 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

Changing site conditions have prompted the Department to evaluate the possibility of relocating this site. It is the Department's aim to continue to have the site meet appropriate siting criteria (including continued staff accessibility). Any relocation would maintain instrumental consistency. A new site would remain in the general geographic location in order to preserve, as much as possible, data continuity.

Site Pictures: **Dunn Center**


North


West

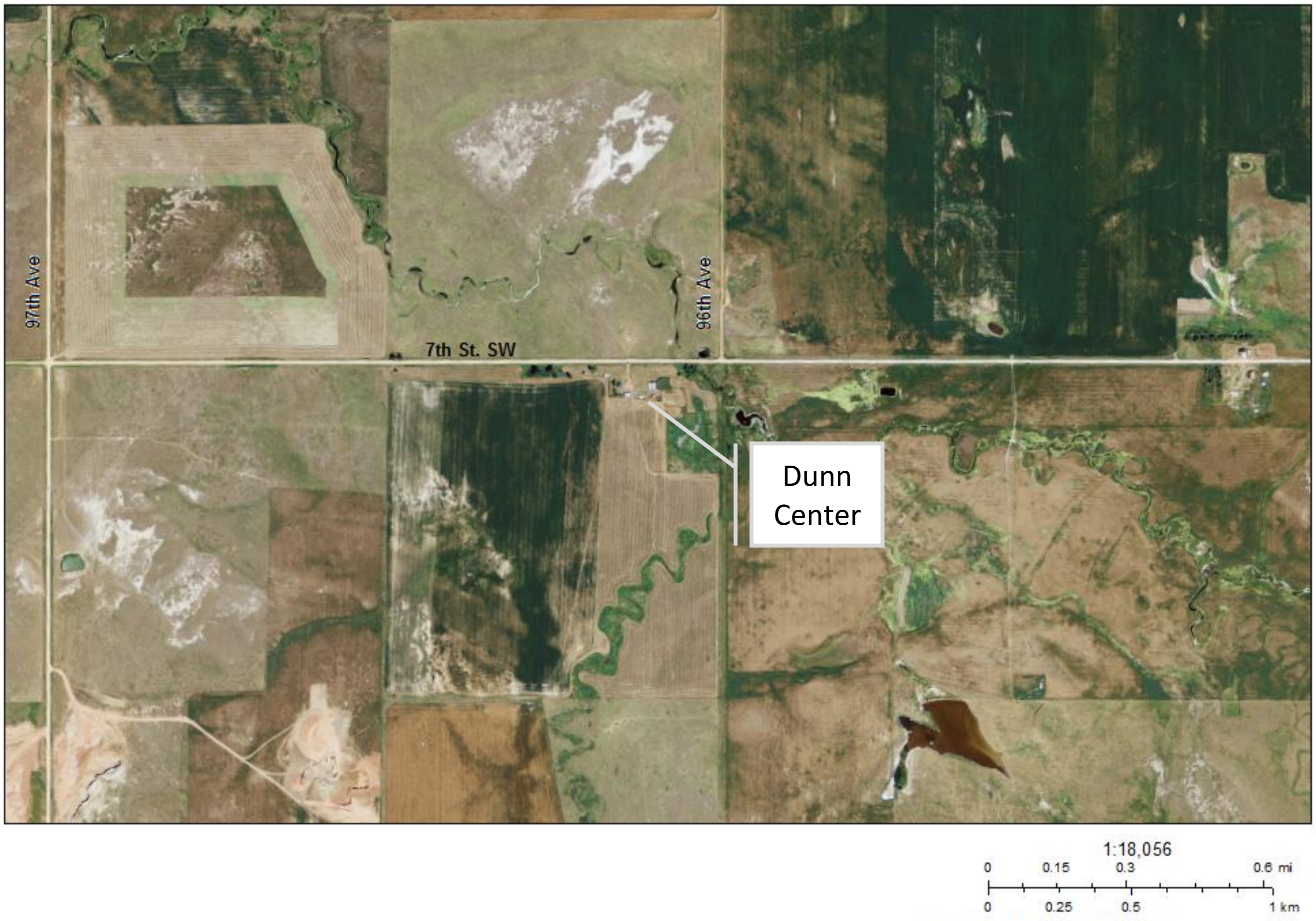

East


South


Looking Northwest


Looking Northeast

Dunn Center



North Dakota state agencies and the ND GIS Hub

Site Name: Fargo NW

Station Type: SLAMS (required)
AQS#: 38-017-1004 **MSA:** 2520
Address: 4266 40th Avenue North
Fargo, ND
Latitude: +46.933754 **Longitude:** -96.855350

Site Description: This site is one of EPA's 54 Speciation Trends Network sites, the state's required NCORE site, 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. As an NCORE site, it is required to have trace level analyzers for sulfur dioxide, carbon monoxide, and NO_Y (total reactive nitrogen) operational by January 1, 2011. The trace level analyzers are installed.

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_y	Instrumental Chemiluminescence	Continuous	Population Exposure	Urban
Ozone	Instrumental Ultraviolet	Continuous	Population Exposure	Urban
$PM_{2.5}$	24-hour Gravimetric	1/3	Population Exposure	Urban
$PM_{2.5}$	FEM $PM_{2.5}$ BAM	Continuous	Population Exposure	Urban
PM_{10}	PM_{10} BAM	Continuous	Population Exposure	Urban
$PM_{10-2.5}$ Speciation	METOne SASS 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: **Fargo NW**

North

West

East

South

Looking Northeast

Looking West

Fargo NW

North Dakota state agencies and the ND GIS Hub

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
$PM_{2.5}$	FEM $PM_{2.5}$ BAM	Continuous	Source Oriented	Urban
PM_{10}	PM_{10} 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.

Site Pictures: **Hannover**

North

East

South

West

Looking Southwest

Looking Northeast

Hannover

North Dakota state agencies and the ND GIS Hub

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
$PM_{2.5}$	FEM $PM_{2.5}$ BAM	Continuous	Regional Transport	Regional
PM_{10}	PM_{10} 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.

Site Pictures: **Lostwood NWR**


North


South


East


West


Looking Northwest


Looking North

Lostwood NWR

North Dakota state agencies and the ND GIS Hub

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
$PM_{2.5}$	FEM $PM_{2.5}$ BAM	Continuous	General/Background	Urban
$PM_{2.5}$	24-hour Gravimetric	1/6	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

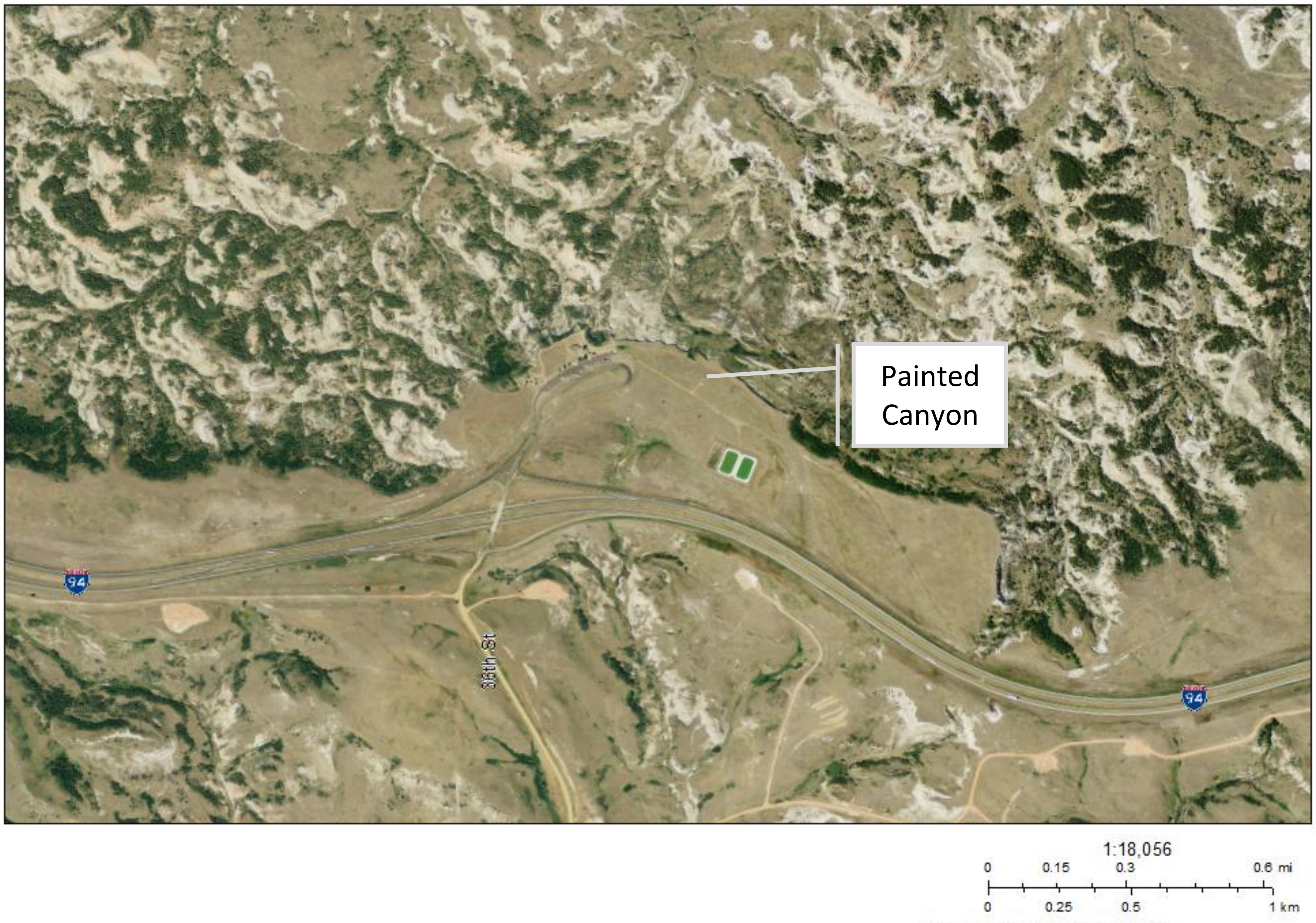
East

South

West

Looking Southwest

Painted Canyon



North Dakota state agencies and the ND GIS Hub

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 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:

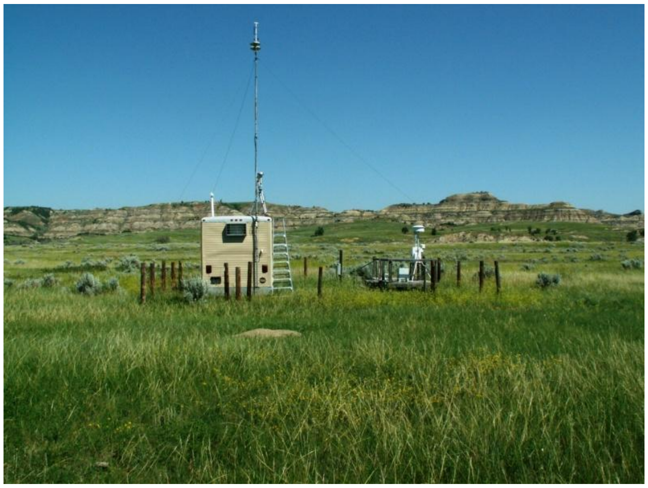
Parameter	Sampling & Analysis Method	Operating Schedule	Monitoring Objective	Spatial Scale
Sulfur Dioxide	Instrumental Pulsed Florescent	Continuous	General/Background	Regional
Nitrogen Dioxide	Instrumental Chemiluminescence	Continuous	General/Background	Regional
Ozone	Instrumental Ultraviolet	Continuous	General/Background	Regional
$PM_{2.5}$	FEM $PM_{2.5}$ BAM	Continuous	General/Background Regional Transport	Regional
PM_{10}	PM_{10} 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.

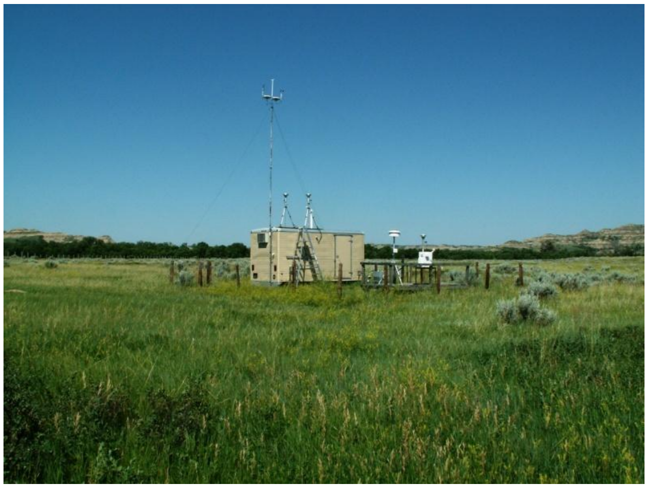
Site Pictures: **TRNP-NU**



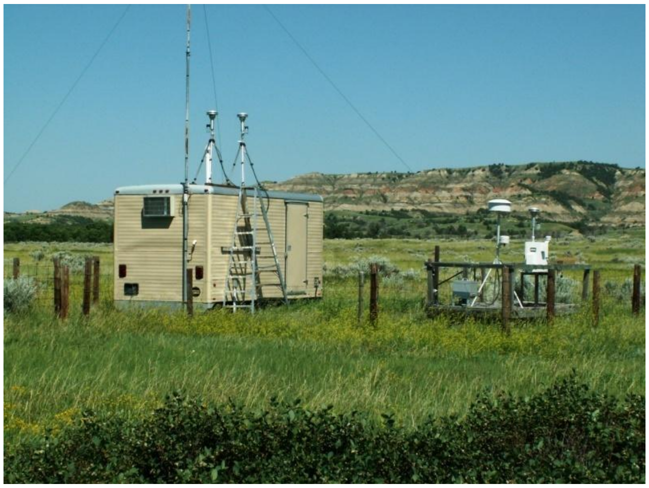
North

South

East



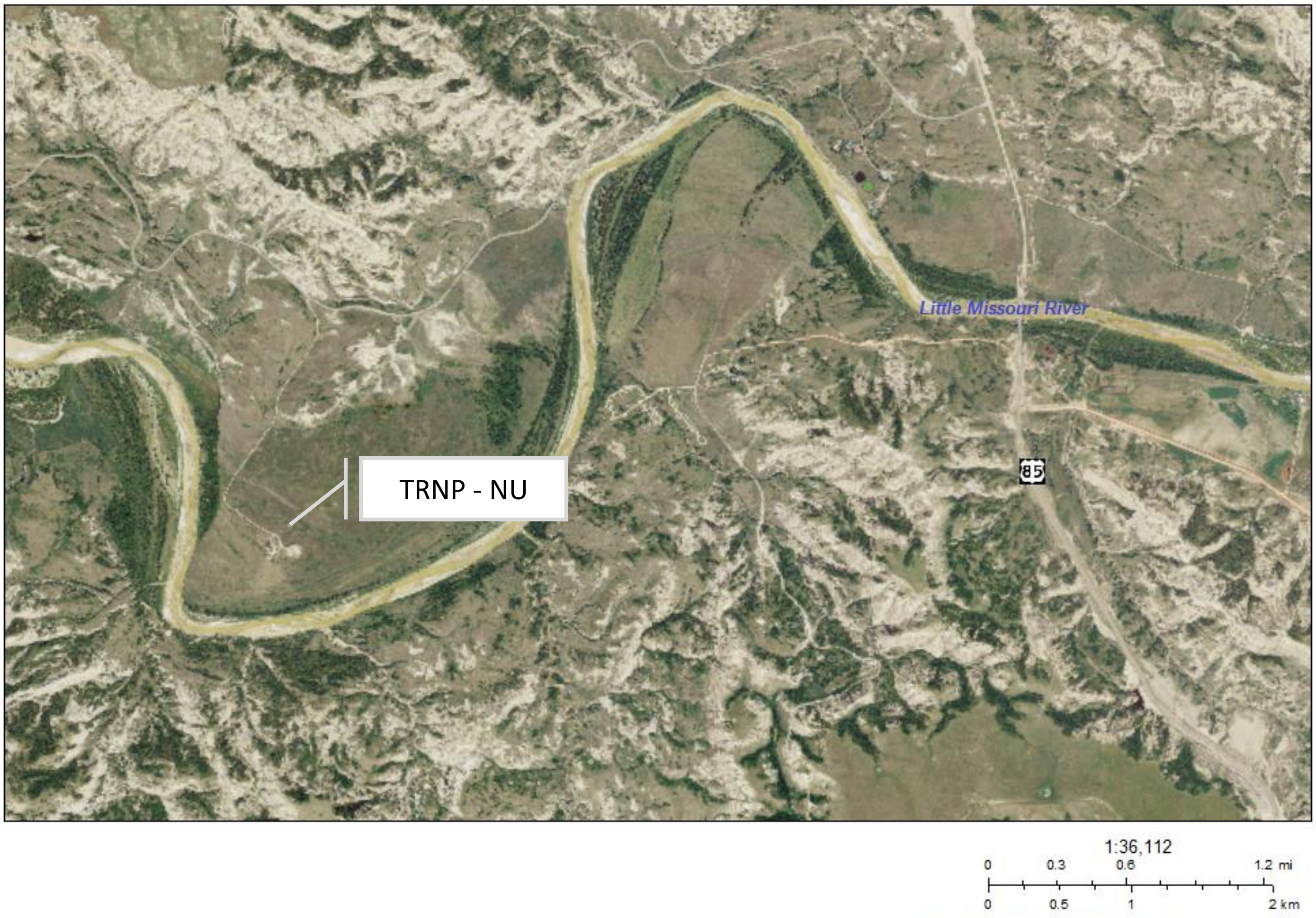
West



Looking Northwest

Looking Northeast

Theodore Roosevelt National Park - North Unit



North Dakota state agencies and the ND GIS Hub

Site Name: Williston

Station Type: SLAMS
AQS#: 38-105-0003 **MSA:** 0000
Address: 10th 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
$PM_{2.5}$	FEM $PM_{2.5}$ BAM	Continuous	Population Exposure	Urban
PM_{10}	PM_{10} 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

There are no plans to move or remove this site.

Site Pictures: **Williston**

North

South

East

West

Williston

North Dakota state agencies and the ND GIS Hub

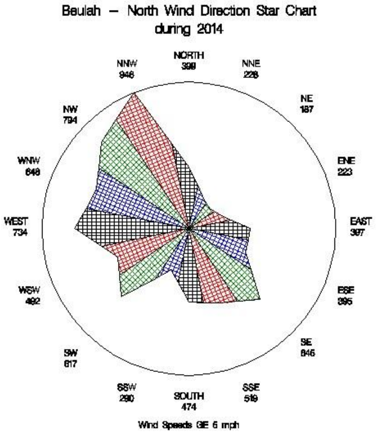
Appendix D Wind and Pollution Roses

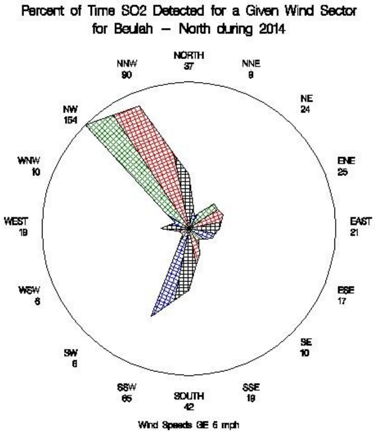
The figures in this appendix are arranged with the site’s wind rose in the upper left hand position. To remove most of the wind direction bias caused by low wind speeds, wind speeds less than 5 mph were removed from the data. For each site, the pollution roses are arranged with sulfur dioxide in the upper right-hand position. Next is either hydrogen sulfide or nitrogen dioxide.

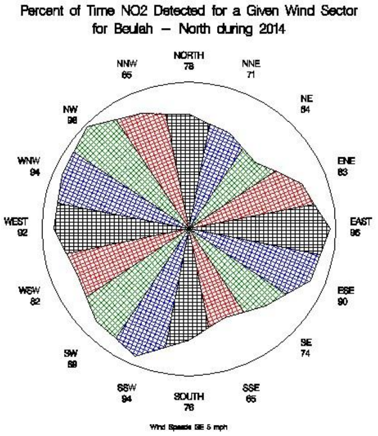
The pollution roses present the percentage of time a pollutant is detected when the wind is from a given direction. For example, a wind rose shows a frequency of 122, and a pollution rose shows a 66 for the same direction. This means that 66 percent of the time (80 of the possible 122 hours) the wind was greater than 5 mph from that direction and an hourly average for that pollutant had a detectable concentration.

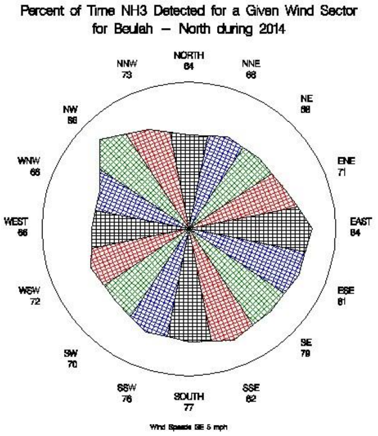
Ozone pollution roses are not presented because the percentage of time would be essentially 100 percent for each wind sector.

Site Name: Beulah – North

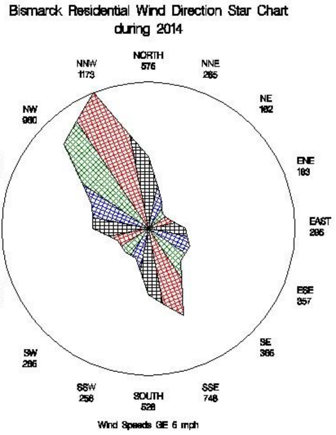

Beulah – North Wind Direction Star Chart during 2014


Percent of Time SO2 Detected for a Given Wind Sector for Beulah – North during 2014

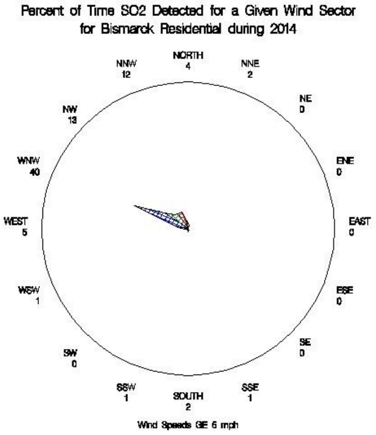

Percent of Time NO2 Detected for a Given Wind Sector for Beulah – North during 2014


Percent of Time NH3 Detected for a Given Wind Sector for Beulah – North during 2014

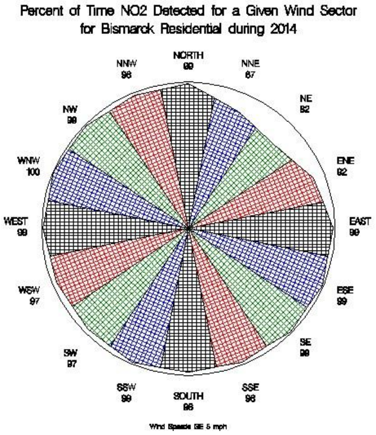
Site Name: Bismarck Residential



Bismarck Residential Wind Direction Star Chart during 2014

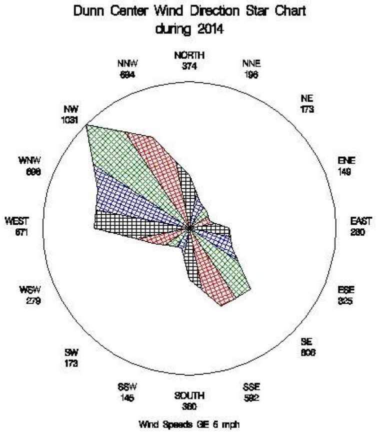


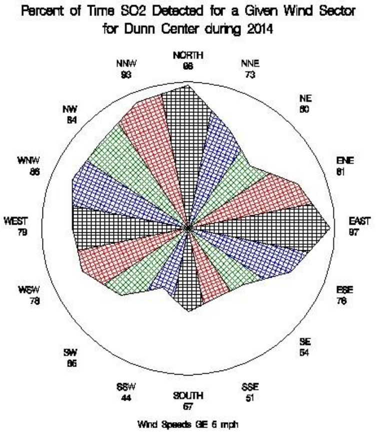
Percent of Time SO2 Detected for a Given Wind Sector for Bismarck Residential during 2014

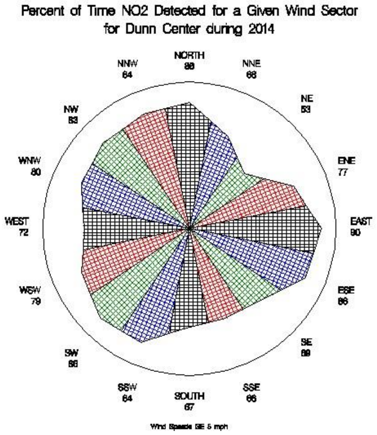


Percent of Time NO2 Detected for a Given Wind Sector for Bismarck Residential during 2014

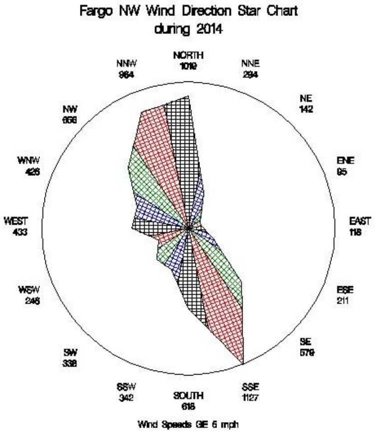
Site Name: Dunn Center

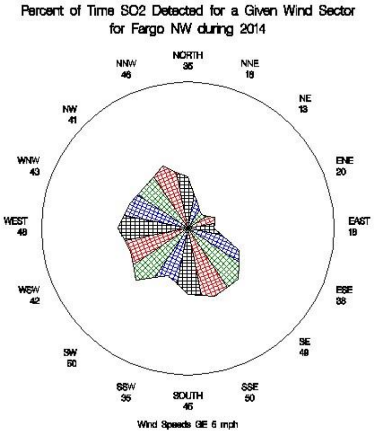

Dunn Center Wind Direction Star Chart
during 2014

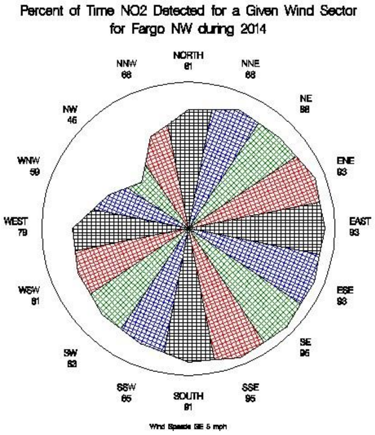

Percent of Time SO2 Detected for a Given Wind Sector
for Dunn Center during 2014


Percent of Time NO2 Detected for a Given Wind Sector
for Dunn Center during 2014

Site Name: Fargo NW

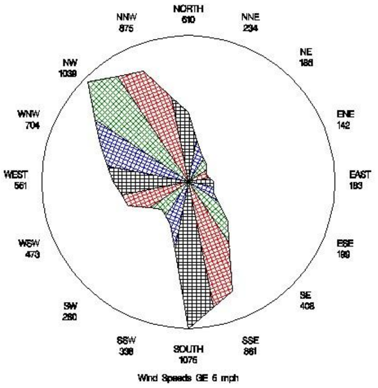




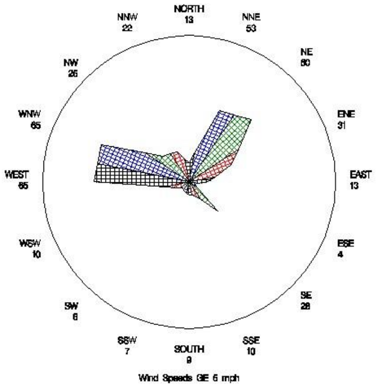


Site Name: Hannover

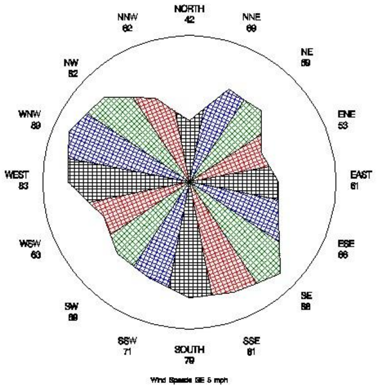
Hannover Wind Direction Star Chart during 2014



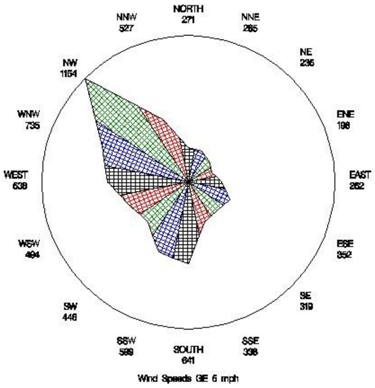
Percent of Time SO2 Detected for a Given Wind Sector for Hannover during 2014



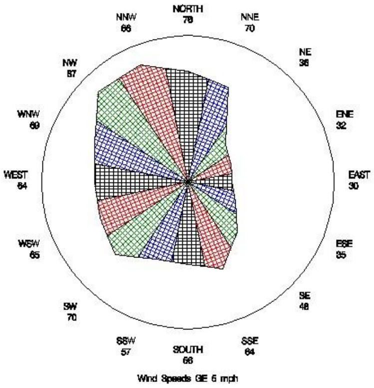
Percent of Time NO2 Detected for a Given Wind Sector for Hannover during 2014



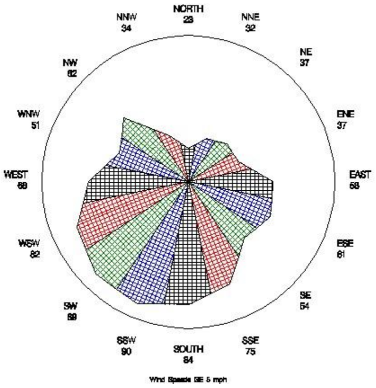
Site Name: Lostwood NWR



Lostwood NWR Wind Direction Star Chart
during 2014

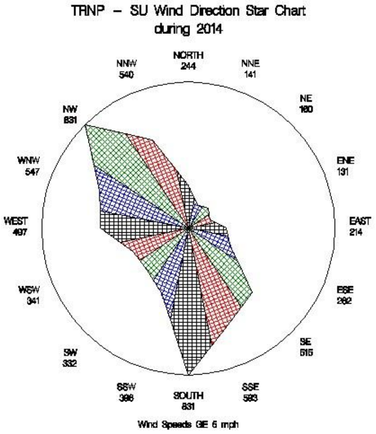


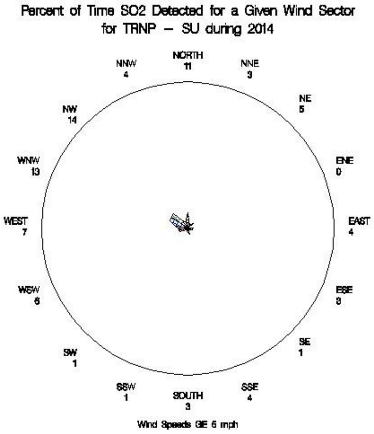
Percent of Time SO2 Detected for a Given Wind Sector
for Lostwood NWR during 2014



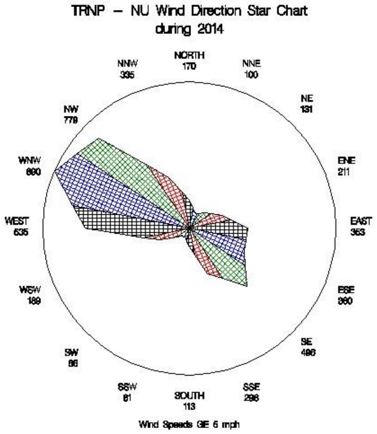
Percent of Time NO2 Detected for a Given Wind Sector
for Lostwood NWR during 2014

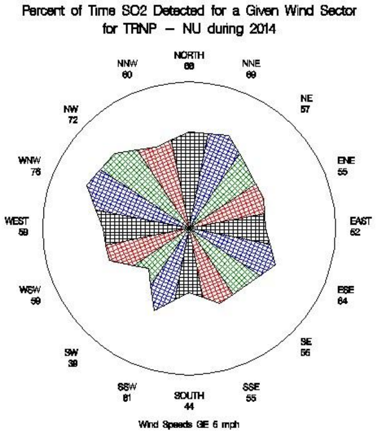
Site Name: Painted Canyon (TRNP - SU)

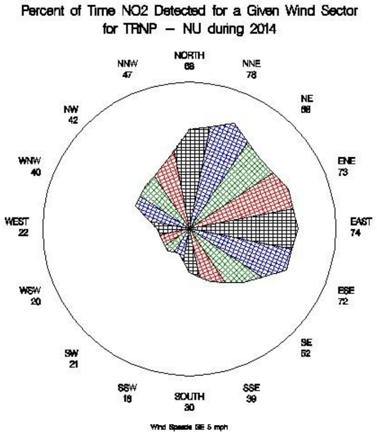




Site Name: TRNP-NU


TRNP – NU Wind Direction Star Chart during 2014


Percent of Time SO2 Detected for a Given Wind Sector for TRNP – NU during 2014


Percent of Time NO2 Detected for a Given Wind Sector for TRNP – NU during 2014

Appendix E Public Comments

A 30-day public comment period for a draft of this document was held from August 13, 2015 through September 13, 2015. No comments were received during the comment period.

Notice for the comment period and a link to an electronic version of the document were placed on the North Dakota Department of Health Air Quality Monitoring web page at: http://www.ndhealth.gov/AQ/Ambient.aspx, on the Division of Air Quality Public Comments & Notices web page at: http://www.ndhealth.gov/AQ/PublicCom.aspx, and the Calendar & Events page at: http://www.ndhealth.gov/AQ/PublicCom.aspx; as well as on the ND Department of Health Public Notices/Public Comment system which includes the webpage at http://www.ndhealth.gov/DoH/PublicNotices.aspx, an e-mail notification, and an RSS feed.

Small non-substantive formatting and typographical changes were made to the draft to prepare it for final publication.