NORTH DAKOTA
DEPARTMENT *of* HEALTH

ENVIRONMENTAL HEALTH SECTION
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July 5, 2006

FILE

Mr. Ken Distler
U.S. EPA - Region VIII
One Denver Place
999 18th Street, Suite 300
Denver, CO 80202-2466

Re: FY '06-'07 PPA, Air Quality
Media Workplan, Monitoring,
Item B (Network Review)

Dear Mr. Distler:

An electronic copy of the referenced review was e-mailed to you on June 30, 2006. Due to the pending update to 40 CFR 58, it is not practical for us to consider any major network changes.

Because this review is based on a calendar year, it does not include any network changes that may have occurred since January 1, 2006. Those changes will be address in the 2006 network review.

If you have any questions about this review, please contact me by e-mail at dharman@nd.gov or by phone at 701-328-5188.

Sincerely,

Daniel E. Harman
Manager
Air Quality Monitoring
Division of Air Quality

DEH:saj
Enc:

North Dakota Department of Health
Division of Air Quality

Ambient Air Quality Monitoring
Annual Network Review
2005

June 2006

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

The North Dakota Department of Health, Division of Air Quality, 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 of Air Quality ensures that the ambient air quality in North Dakota is maintained in accordance with the levels established by the state and federal Ambient Air Quality Standards (AAQS) and the Prevention of Significant Deterioration of Air Quality (PSD) Rules. To carry out this responsibility, the Division of Air Quality operates and maintains a network of ambient air quality monitors and requires three major industrial pollution sources to conduct source specific ambient air quality monitoring.

To evaluate the effectiveness of the State's air quality monitoring effort, the U.S. Environmental Protection Agency (EPA) requires the Division of Air Quality to conduct an annual review of the State's ambient air quality monitoring (AAQM) network. EPA's requirements, as set forth in 40 CFR 58.20, are to (1) determine if the system meets the monitoring objectives defined in 40 CFR 58, Appendix D, and (2) identify network modifications such as termination or relocation of unnecessary sites or establishment of new sites which are necessary. 40 CFR 58.25 requires the state to annually develop and implement a schedule to modify the AAQM network to eliminate any unnecessary sites or correct any inadequacies indicated as a result of the annual review required by 40 CFR 58.20(d). This document and subsequent revisions satisfy these annual requirements.

1.1 Network Review Process

The locations of sites in a monitoring program are established to meet certain objectives. The May 10, 1979, Federal Register (40 CFR 58, Appendix D), "Ambient Air Quality Surveillance Regulations," as amended, has specified a minimum of six basic monitoring objectives. These objectives are as follows:

1. *To determine the highest pollutant concentrations expected to occur in an area covered by the network.*
2. *To determine representative concentrations in areas of high population density.*
3. *To determine the impact on ambient pollution levels by a significant source or class categories.*
4. *To determine the genera /background concentration levels.*
5. *To determine the impact on air quality by regional transport.*
6. *To determine welfare-related impacts (such as visibility impacts and vegetation effects).*

The link between basic monitoring objectives and the physical location of a particular monitoring site involves the concept of spatial scale of representativeness. This spatial scale is determined by the physical dimensions of the air parcel nearest a monitoring site throughout which actual pollutant concentrations are reasonably similar. The goal in locating sites is to match the spatial scale represented by the sample of monitored air with a spatial scale most appropriate for the monitoring objective. Spatial scales of representativeness, as specified by EPA, are described as follows:

Microscale - 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.

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

Monitoring Objective	Appropriate Siting Scales
Highest Concentration	Micro, middle, neighborhood, urban (sometimes)
Population Exposure	Neighborhood, urban
Source Impact	Micro, middle, neighborhood
General/Background	Urban, regional
Regional Transport	Urban, regional
Welfare-related Impacts	Urban, regional

Recommended scales of representativeness appropriate to the criteria pollutants monitored in North Dakota are shown below:

Criteria Pollutant	Spatial Scales
Inhalable Particulate (PM_{10})	micro, middle, neighborhood, urban, regional
Sulfur Dioxide (SO_2)	middle, neighborhood, urban, regional
Ozone (O_3)	middle, neighborhood, urban, regional
Nitrogen Dioxide (NO_2)	middle, neighborhood, urban
Carbon Monoxide (CO)	micro, middle, neighborhood

Using this physical basis 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 an examination of existing sites to evaluate their monitoring objectives and spatial scale with sites terminated, added, or modified accordingly. Further details on network design can be found in 40 CFR 58, Appendix D.

1.2 General Monitoring Needs

As can be gathered from the prior discussion, each air pollutant has certain characteristics which must be considered when establishing a monitoring site. These characteristics may result from 1) variations in the number and types of sources and emissions in question; 2) reactivity of a particular pollutant with other constituents in the air; 3) local site influences such as terrain and land use; and 4) climatology. The State AAQM network is designed to monitor air quality data for four basic conditions: 1) background monitoring; 2) population exposure; 3) highest concentration; and; 4) long range transport/regional haze. Industrial AAQM network sites are designed to monitor air quality data for source specific highest concentration impacts on an urban scale. Tribal network sites and data are included in this review even though there is only minimal influence on the network operation.

The primary function of the department's four required sites (see Table 1) are to satisfy the six monitoring objectives. Beulah is source impact and population exposure because of the major sources in the vicinity of Beulah. The site is a combination of a down-wind site and between the city and two major sources. Fargo NW is population orientated because Fargo is a major population center with PSD sources in the Fargo-Moorhead area. The data from this site is used as input to dispersion models to evaluate permits-to-construct and permits-to-operate for projects located in or near population centers in the eastern part of the state. Dunn Center is the background site. And, TRNP-NU is the regional transport site. The remaining sites are used to support modeling and/or supplement data collected at the required sites.

Before the next network modification plan is completed in January 2007, the need for several sites/parameter combinations will be reviewed. The current list of existing sites/parameters to be reviewed are Bismarck Residential (trace level SO_2, CO and NO_y) and Fargo NW (trace level CO and NO_y) . Consideration is also being given to adding NH_3 to Fargo NW and Lostwood. Continuous PM10 analyzers will be added to Beulah – North and Hannover during the summer.

Background sites are chosen to determine concentrations of air contaminants in areas remote from urban sources and generally are sited using the regional spatial scale. This is true for NO_2 despite the fact that the regional spatial scale is not normally used for NO_2 monitoring. Once a specific location is selected for a site, the site is established in accordance with the specific probe sitting criteria specified in 40 CFR 58, Appendix E.

Since all industrial AAQM network sites are source specific, all the pollutants at industry sites are source oriented on an urban scale. Industrial sites are initially selected using dispersion modeling results and meteorological data. If a particular location is determined not to be practical due to, for example, inaccessibility or power not reasonably available, then sites in a prevailing wind direction are considered. These sites are the most likely locations to have elevated ambient concentrations. The data collected at the industry-operated sites is included in the data summaries for comparison but not included in any discussion of the State ambient monitoring network needs or analysis. Each industry network is an entity unto itself and does not influence the placement of State operated sites.

1.3 Monitoring Objectives

The monitoring objectives of the Department are to track those pollutants that are judged to have the potential for violating either State or Federal Ambient Air Quality Standards and to ensure that those pollutants do not cause significant deterioration of our existing air quality. To accomplish these objectives, the Department operated 10 AAQM sites around the State. Eight were SLAMS sites, and two were special purpose monitoring (SPM) sites. There were three industries reporting ambient air quality data to this Department. Table 1 lists each site's type and the parameters monitored. Figure 1 shows the approximate site locations. For the industry networks, each network is represented by a single circle whether there is a single site or multiple sites.

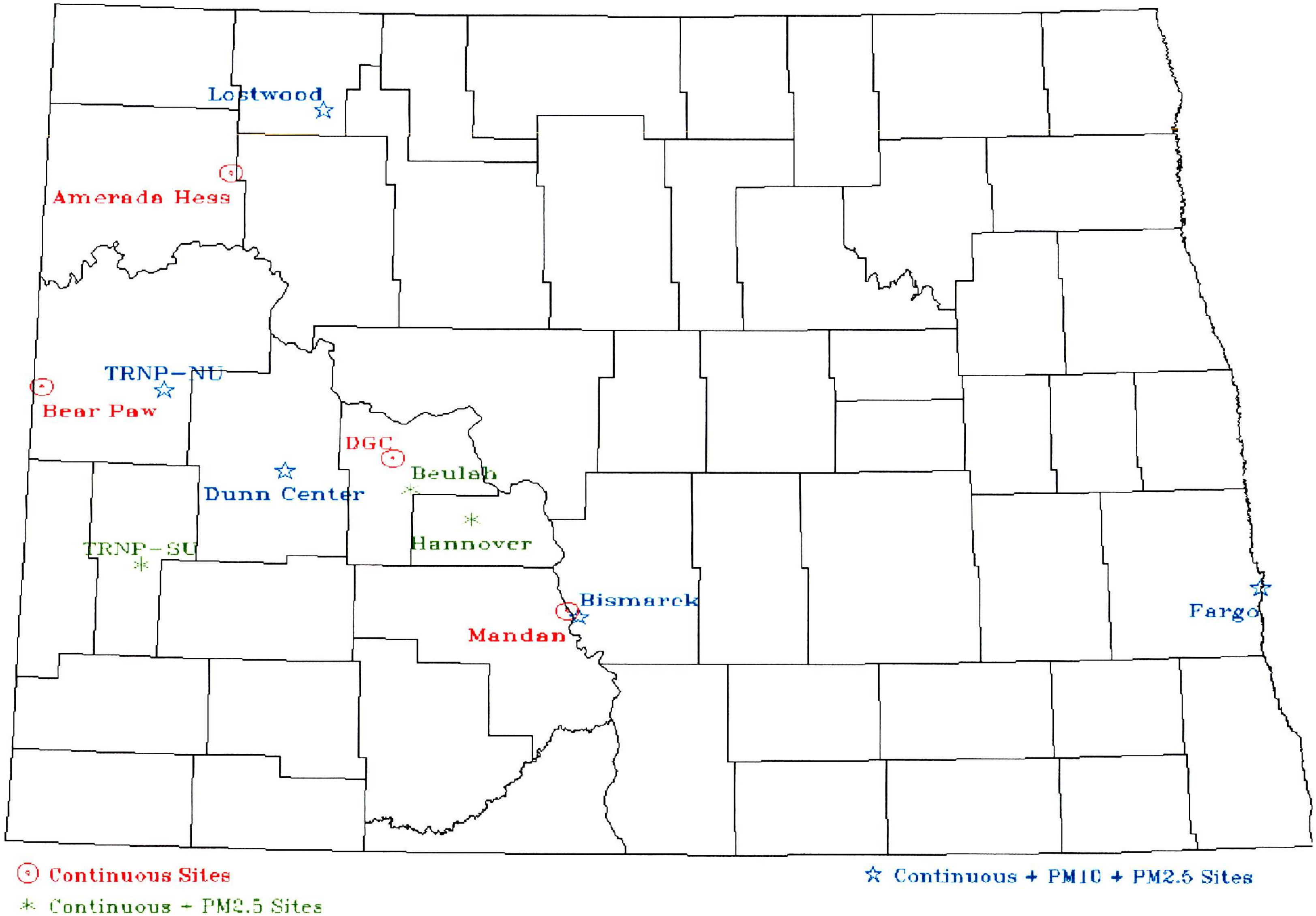
The numbers in the Site Name/Company column in Table 1 and in the '#' column in Tables 2, 5, 7, 9, 14, and 15 correspond to the numbers on the figures. The numbers in the circles correspond to the monitoring site monitoring that pollutant and the squares correspond to the major sources for that particular pollutant.

Table 1
AAQM Network Description

Site Name AQS Site #	Type Station	Parameter Monitored[1]	Operating Schedule	Monitoring Objective[2]	Spatial Scale[2]	Date Site/Parameter Began
1 Beulah North 380570004	SLAMS Required PM non-CORE required	$PM_{2.5}$ SO_2, NO_2, O_3, MET NH_3 cont. $PM_{2.5}$	6th Day cont. cont. cont.	Population Exposure Population Exposure General Background[3] Population Exposure	Neighborhood Neighborhood Regional Neighborhood	12/1998 04/1980 11/2000 10/2000
2 Bismarck Residential 380150003	SLAMS PM non-CORE required	SO_2, NO_2, O_3, MET cont. $PM_{2.5}$, PM_{10}[5] $PM_{2.5}$ $PM_{2.5}$ Speciation PM_{10}[4]	cont. 3rd Day 6th Day 6th Day	Population Exposure	Urban	10/05 12/1998 1/2001 1/2001
3 Dunn Center 380250003	SLAMS Required	SO_2, NO_2, O_3, MET cont. $PM_{2.5}$, cont. PM_{10}	cont.	General Background	Regional	10/1979 09/2005
4 Fargo NW 380171004	SLAMS Required required	SO_2, NO_2, O_3, MET cont. $PM_{2.5}$, PM_{10} $PM_{2.5}$ $PM_{2.5}$ Speciation	cont. cont. 3rd Day 3rd Day	Population Exposure Population Exposure Population Exposure Population Exposure	Urban Urban Urban Urban	05/1998 7/2000 12/1998 7/2001
5 Hannover 380650002	SLAMS	SO_2, NO_2, O_3, MET cont. PM2.5	cont.	Source Impact	Urban	10/1984 10/2002
6 Lostwood NWR 380130004	SLAMS	SO_2, NO_2, O_3, MET, cont. $PM_{2.5}$, cont. PM_{10}	cont.	General Background	Regional	10/2003
7 Mandan Refinery - SPM 380590002	SPM	SO_2, MET[6]	cont.	Source Impact	Neighborhood	12/1995
8 Mandan Refinery NW - SPM 380590003	SPM	SO_2, MET[6]	cont.	Source Impact	Neighborhood	09/1998
9 TRNP - NU 380530002	SLAMS Required	SO_2, NO_2, O_3, MET cont. $PM_{2.5}$, PM_{10} $PM_{2.5}$ $PM_{2.5}$ Speciation	cont. cont. 6th Day 6th Day	General Background/ Long range Transport	Regional	8/2001
10 TRNP - SU 380070002	SLAMS	SO_2, O_3 MET $PM_{2.5}$ cont. $PM_{2.5}$	cont. 6th Day	General Background/ Long range Transport	Regional	07/1998 06/2000 04/2003
Company	**Site Name** **AQS Site #**					
11 Amerada Hess Corporation	TIOGA #1 381050103 TIOGA #3 381050105	SO_2 SO_2	cont. cont.	Source Impact Source Impact	Urban Urban	07/1987 11/1987
12 Bear Paw Energy, Inc.	MGP #3 380530104 MGP #5 380530111	SO_2, MET SO_2, MET	cont. cont.	Source Impact Source Impact	Urban Urban	11/1994 05/1994
13 Dakota Gasification Company	DGC #12 380570102 DGC #14 380570118 DGC #16 380570123 DGC #17 380570124	SO_2, NO_2, MET SO_2 SO_2 SO_2, NO_2	cont. cont. cont. cont.	Source Impact Source Impact Source Impact Source Impact	Urban Urban Urban Urban	01/1980 01/1989 10/1995 10/1995

1. MET refers to meteorological and indicates wind speed and wind direction monitoring equipment.
2. Not applicable to MET.
3. This analyzer will serve a dual role of population exposure and general background.
4. Terminated effective September 26.
5. Began effective October 3.
6. Terminated effective June28

Figure 1 North Dakota Ambient Air Quality Monitoring Sites



2.0 Ambient Air Monitoring Network Coverage

The state of North Dakota is attainment for all criteria pollutants, including $PM_{2.5}$ and 8-hour Ozone. As such, there are no "problem areas" in the general sense of the term. However, there are areas of concern where the department has established monitoring sites to track the emissions of specific pollutants from point sources. Also, three major sources maintained monitoring networks in the vicinity of their plants (see Table 1 and Figure 1).

2.1 Sulfur Dioxide

Energy development in the west and west-central portions of North Dakota has produced a number of sources of sulfur dioxide (SO_2). These sources include coal-fired steam-powered electrical generating facilities, a coal gasification plant, natural gas processing plants, an oil refinery, and flaring at oil/gas well sites. As a result, SO_2 is one of the Department's major concerns in regard to ambient air quality monitoring.

2.1.1 Point Sources

The major SO_2 point sources (>100 TPY) are listed in Table 2 along with their emissions from the emissions inventories reported to the Department. Figure 2 shows the approximate locations of these facilities (the numbers correspond to the site and source tables). Figure 2A shows the contribution of point sources to the total SO_2 emissions.

2.1.2 Other Sources

The western part of the State has a number of potential SO_2 sources associated with the development of oil and gas. These sources include individual oil/gas wells, oil storage facilities, and compressor stations. Emissions from such sources can create two problems. First, these sources may directly emit significant amounts of hydrogen sulfide (H_2S) to the ambient air (see Section 2.7). Second, flaring the H_2S from these sources can create significant concentrations of SO_2 in the ambient air. The primary counties for these sources in western North Dakota are outlined in green on Figure 2. Figure 2A shows the contribution of "Other Point Sources" that consists of DGC, oil refineries, natural gas processing plants, and agricultural processing plants.

Table 2

Major SO_2 Sources

(>100 TPY)

2005

#	Company Name	SOURCE	SO2	Percent of Total Emissions	Facility ID
1	Basin Electric Power Cooperative	Leland Olds Station	48,375	32.50%	3805700001
2	Minnkota Power Cooperative, Inc.	M R Young Station 1 & 2	29,407	19.75%	3806500001
3	Great River Energy	Coal Creek Station	27,391	18.40%	3805500017
4	Otter Tail Power Company	Coyote	13,717	9.21%	3805700012
5	Basin Electric Power Cooperative	Antelope Valley Station	13,074	8.78%	3805700011
6	Dakota Gasification Co.	Plant	5,208	3.50%	3805700013
7	Montana Dakota Utilities Co.	RM Heskett Station	3,746	2.52%	3805900001
8	Great River Energy	Stanton Station	2,704	1.82%	3805700004
9	Amerada Hess Corporation	Tioga Gas Plant	1,549	1.04%	3810500004
10	American Crystal Sugar	Hillsboro Plant	641	0.43%	3809700019
11	Tesoro Refining and Marketing Company	Tesoro Mandan Refinery	640	0.43%	3805900003
12	Bear Paw Energy, L.L.C.	Grasslands Plant	626	0.42%	3805300023
13	American Crystal Sugar	Drayton Plant	603	0.41%	3806700003
14	Petro-Hunt, L.L.C.	Little Knife Gas Plant	465	0.31%	3800700002
15	ADM Corn Processing	Walhalla	222	0.15%	3806700004
16	RDO Foods Company	Grand Forks	195	0.13%	3803500058
17	Minn-Dak Farmers Cooperative	Wahpeton Plant	180	0.12%	3807700026
18	Hebron Brick Company	Brick Kiln & Dryers	118	0.08%	3805900017

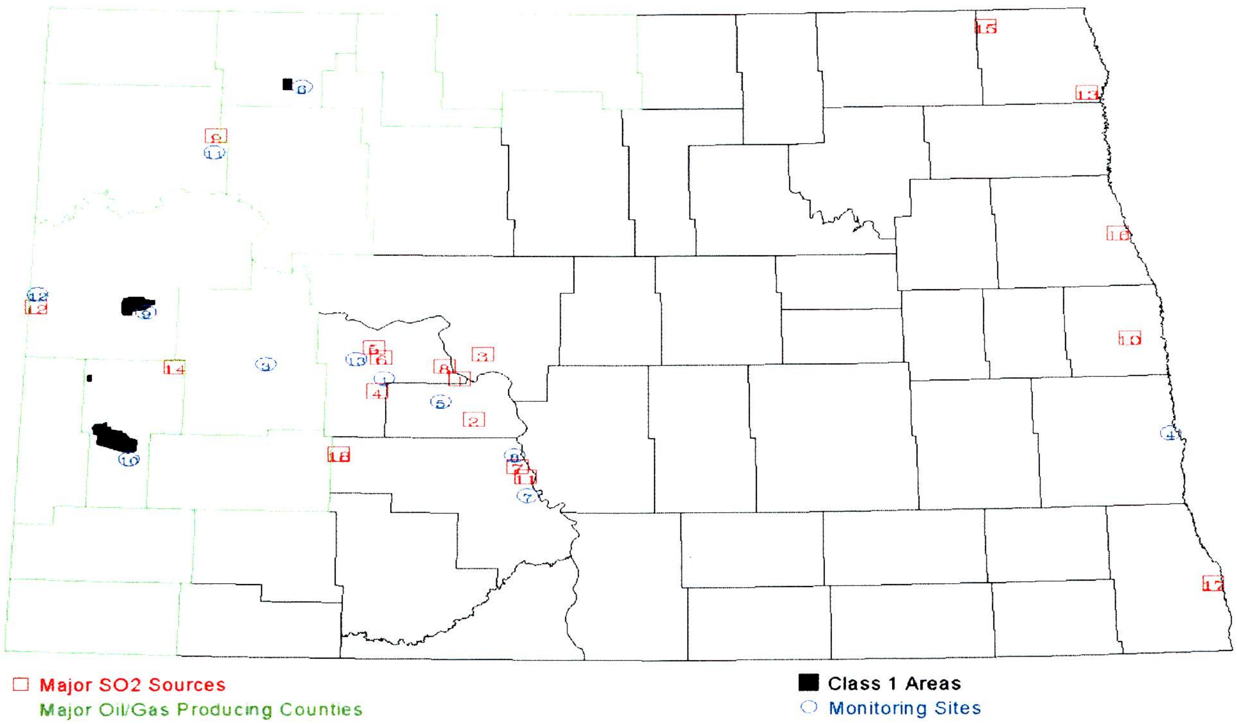


Figure 2 Major Sulfur Dioxide Sources

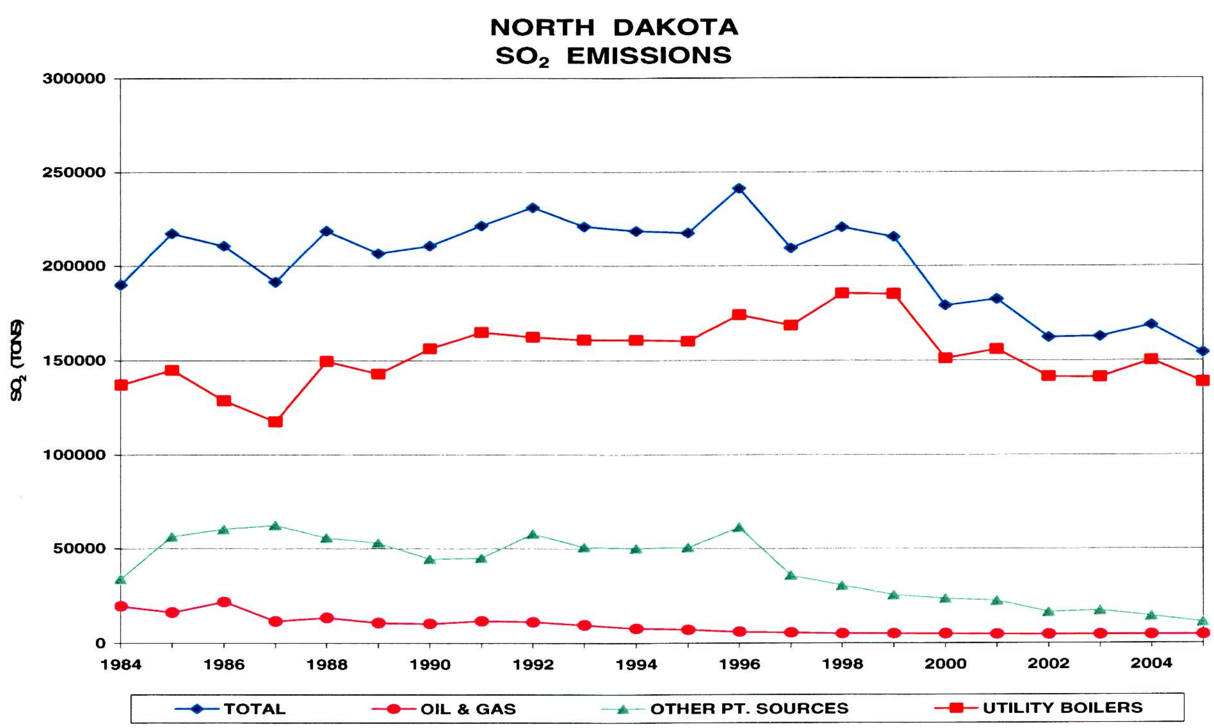


Figure 2A Annual Sulfur Dioxide Emissions

2.1.3 Monitoring Network

The SO_2 monitoring sites are shown on Figure 2. As can be seen, these monitoring 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. Table 3 shows the 2005 annual SO_2 data summaries; Table 4 shows the 5-minute data summary. There were no exceedances of either state or federal SO_2 standards.

2.1.4 Network Analysis

The nine largest SO_2 sources in the state are within 45 miles of both the Beulah and Hannover sites. This makes these two sites very important in tracking the impact of these nine sources on the ambient air. One would expect that as the large sources 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 nine sources combined. Figures 3, 4, 5, and 6, present the following: 1) the percentage of data greater than the minimum detectable value (MDV); 2) 1-hour maximums; 3) 3-hour maximums; and 4) 24-hour maximums, for the state-operated sites. Because the industry sites are sited specifically for maximum expected concentrations (primarily as predicted by dispersion models and secondarily in a downwind direction), the industry sites are not reviewed for particular long term trends.

The best long term indicator of any change in the amount of SO_2 in the ambient air is seen by reviewing the percentages of hourly data points greater than the MDV. Figure 3 presents this data for the current active state sites from 1980 through 2005. To calculate valid, unbiased statistics, at least 75% of the data for the averaging period must be greater than the MDV. Therefore, the annual mean is not a valid indicator and, consequently, not addressed.

TABLE 3

COMPARISON OF AIR QUALITY DATA WITH
THE NORTH DAKOTA AMBIENT AIR QUALITY STANDARDS *

POLLUTANT : SULFUR DIOXIDE (ppb)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MAXIMA 1 - HOUR 1ST MM/DD:HH	1 - HOUR 2ND MM/DD:HH	3 - HOUR 1ST MM/DD:HH	3 - HOUR 2ND MM/DD:HH	24 - HOUR 1ST MM/DD	24 - HOUR 2ND MM/DD	ARITH MEAN	1HR #>273	24HR #>99	% >MDV
Amerada Hess - Tioga #1	2005	JAN-DEC	8448	190 03/25:22	93 06/02:19	83 03/25:23	41 06/10:08	20 03/25	14 08/05	1.7			11.9
Amerada Hess - Tioga #3	2005	JAN-DEC	8620	193 04/26:07	148 02/21:19	117 02/21:20	91 04/26:08	43 12/15	38 04/26	4.0			24.4
Bear Paw - MGP #3	2005	JAN-DEC	8639	80 06/11:08	42 09/27:08	30 06/11:08	16 06/11:11	7 06/11	3 09/27	1.1			3.1
Bear Paw - MGP #5	2005	JAN-DEC	8649	102 02/25:10	81 05/16:13	63 02/25:11	44 05/16:14	9 05/16	9 02/25	1.1			4.1
Beulah - North	2005	JAN-DEC	8338	43 07/22:09	43 08/21:09	24 08/21:11	23 07/22:11	7 07/22	7 08/21	1.6			18.9
Bismarck Residential	2005	OCT-DEC	2087	18 10/31:09	17 10/29:18	12 10/25:14	12 10/29:20	5 10/29	5 12/06	1.9			25.2
DGC #12	2005	JAN-DEC	8638	66 08/21:09	61 07/18:07	42 08/21:11	34 07/18:08	10 07/18	10 08/21	1.7			15.8
DGC #14	2005	JAN-DEC	8656	80 03/23:09	54 07/19:11	27 03/23:11	26 03/19:11	6 02/25	6 03/19	1.6			13.9
DGC #16	2005	JAN-DEC	8264	56 07/13:21	53 03/19:11	35 07/13:23	33 03/16:14	9 08/23	8 07/15	1.8			17.2
DGC #17	2005	JAN-DEC	8669	89 07/21:03	45 03/19:11	39 03/16:14	34 07/21:05	8 02/25	8 08/30	1.7			12.6
Dunn Center	2005	JAN-DEC	8445	19 03/16:09	18 03/16:12	15 03/18:14	13 03/16:11	5 03/18	4 03/16	1.1			6.0
Fargo NW	2005	JAN-DEC	8611	8 02/12:12	8 12/19:01	6 12/19:02	5 01/02:17	3 01/19	3 01/10	1.1			4.0
Hannover	2005	JAN-DEC	8679	115 02/17:10	99 07/20:08	69 07/20:08	64 02/17:11	21 07/20	12 04/19	2.0			20.7
Lostwood NWR	2005	JAN-DEC	8686	55 12/18:02	47 12/18:01	40 12/18:02	21 01/09:08	9 12/06	8 01/09	1.6			15.2
Mandan - SPM	2005	JAN-JUN	4279	94 01/21:14	51 01/28:17	42 01/21:14	35 01/28:17	14 05/14	14 01/21	3.3			34.9
Mandan NW - SPM	2005	JAN-JUN	4256	48 02/25:10	48 05/16:21	29 02/25:11	29 05/16:20	15 05/16	10 01/05	2.4			34.4
TRNP - NU	2005	JAN-DEC	8699	14 06/29:10	11 10/01:06	7 02/07:23	7 06/06:08	4 03/18	3 02/19	1.1			7.0
TRNP - SU	2005	JAN-DEC	8270	8 07/20:20	8 11/12:02	5 02/07:17	5 07/20:20	2 09/21	2 03/28	1.1			3.9

The maximum 1-hour concentration is 193 ppb at Amerada Hess - Tioga #3 on 04/26:07
The maximum 3-hour concentration is 117 ppb at Amerada Hess - Tioga #3 on 02/21:20
The maximum 24-hour concentration is 43 ppb at Amerada Hess - Tioga #3 on 12/15

* The air quality standards are:

STATE Standards -

1) 273 ppb maximum 1-hour average concentration.
2) 99 ppb maximum 24-hour average concentration.
3) 23 ppb maximum annual arithmetic mean concentration.

FEDERAL Standards -

1) 500 ppb maximum 3-hour concentration not to be exceeded more than once per year.
2) 140 ppb maximum 24-hour concentration not to be exceeded more than once per year.
3) 30 ppb annual arithmetic mean.

*** Less than 80% of the possible samples (data) were collected.

TABLE 4

COMPARISON OF AIR QUALITY DATA WITH
THE NORTH DAKOTA AMBIENT AIR QUALITY STANDARDS *

POLLUTANT : SO_2 5-Minute Averages (ppb)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	5-MINUTE MAXIMA 1ST	DATE MM/DD:HH	2ND	DATE MM/DD:HH	3RD	DATE MM/DD:HH	# HOURS >600	>MDV
Amerada Hess - Tioga #1	2005	JAN-DEC	8449	350	03/25:22	205	06/20:06	204	04/03:05	0	[illegible].7
Amerada Hess - Tioga #3	2005	JAN-DEC	8620	358	04/26:07	252	02/21:19	251	02/21:18	0	[illegible]4.1
Bear Paw - MGP #3	2005	JAN-DEC	8639	138	09/27:08	131	06/11:08	100	05/18:13	0	7.0
Bear Paw - MGP #5	2005	JAN-DEC	8649	285	02/25:10	220	05/16:13	194	08/23:17	0	11.2
Beulah - North	2005	JAN-DEC	7049	95	07/19:14	87	03/16:11	83	07/24:10	0	28.8
Bismarck Residential	2005	OCT-DEC	1742	29	12/26:18	28	10/12:17	27	12/18:11	0	36.2
Dunn Center	2005	JAN-DEC	7201	34	03/16:09	28	09/15:23	25	03/16:12	0	6.9
Fargo NW	2005	JAN-DEC	7287	11	07/05:00	10	03/02:10	9	04/01:23	0	4.7
Hannover	2005	JAN-DEC	7246	257	08/07:07	238	07/20:08	131	07/20:07	0	24.8
Lostwood NWR	2005	JAN-DEC	7299	77	12/07:02	69	12/18:02	63	12/18:01	0	21.1
Mandan - SPM	2005	JAN-JUN	2979	104	03/14:13	92	04/04:10	82	04/11:20	0	37.9
Mandan NW - SPM	2005	JAN-JUN	2954	101	02/25:10	83	05/16:18	82	02/25:11	0	34.8
TRNP - NU	2005	JAN-DEC	7508	14	04/05:17	14	07/20:06	13	06/06:07	0	9.5
TRNP - SU	2005	JAN-DEC	6993	17	11/12:02	13	10/25:05	12	09/05:02	0	7.3

The maximum 5-minute concentration is 358 ppb at Amerada Hess - Tioga #3 on 04/26:07

* No Standard is currently in effect:

Beginning in 1980, major events are easily traceable. In 1980, the oil industry was expanding. In 1981, Otter Tail Power's Coyote Power Station began operation. In 1982 the oil industry in western North Dakota hit its peak activity. 1983, 1984, and 1985 were startup years for Basin Electric's Antelope Valley Unit #1, the synthetic natural gas plant (aka, Dakota Gasification Company), and Antelope Valley Unit #2, respectively. At Hannover, from 1987 through 1993, there was a steady increasing trend in the percentage of data greater than the MDV. However, Hannover showed a decrease from 1993 to 2005. The Beulah - North site began operation in 1998 and tracked the Hannover data, showing a similar trend.

Fargo NW has both a low detection percentage and low maximum concentrations. It appears the most significant influence on the detection percentage and maximum concentrations is the meteorology.

Both of the Mandan sites are source specific to the Tesoro Refinery. The primary function for the Mandan – SPM site was to validate the dispersion modeling results for the refinery and the R. M. Heskett power plant. The Mandan NW – SPM site was added after a near-exeedance of the federal 24-hour standard occurred in 1998. Since then, both sites have been used to track the emissions reductions at the refinery. Since 1996, the SO_2 emissions have decreased 90 percent and the ambient concentrations followed the emissions reductions. It has been determined both sites have fulfilled their monitoring objectives and have been terminated.

The same patterns seen in Figure 3 are discernable in the 1-hour, 3-hour, and 24-hour maximum concentration graphs (see Figures 4, 5, and 6, respectively). Because Lostwood has a limited amount of data, no attempt is made to evaluate the results.

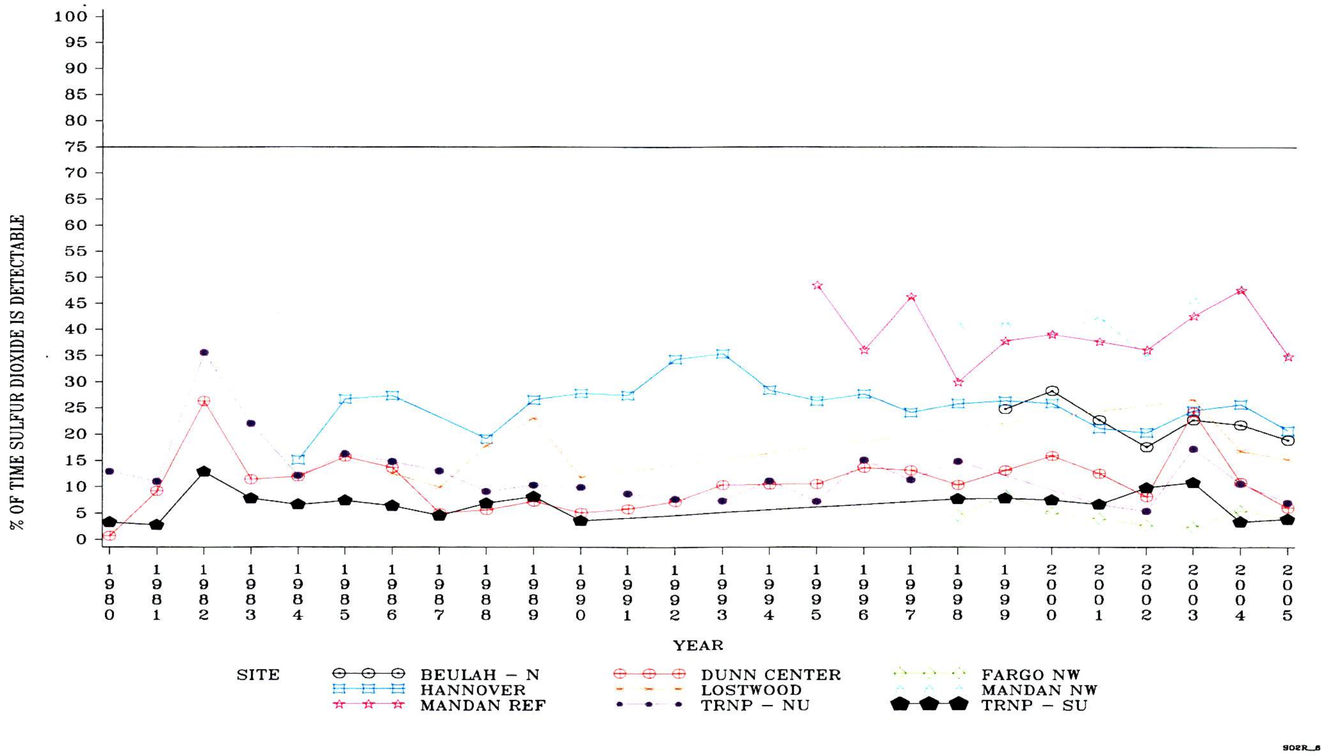


Figure 3 Percentage of Time SO_2 Detectable

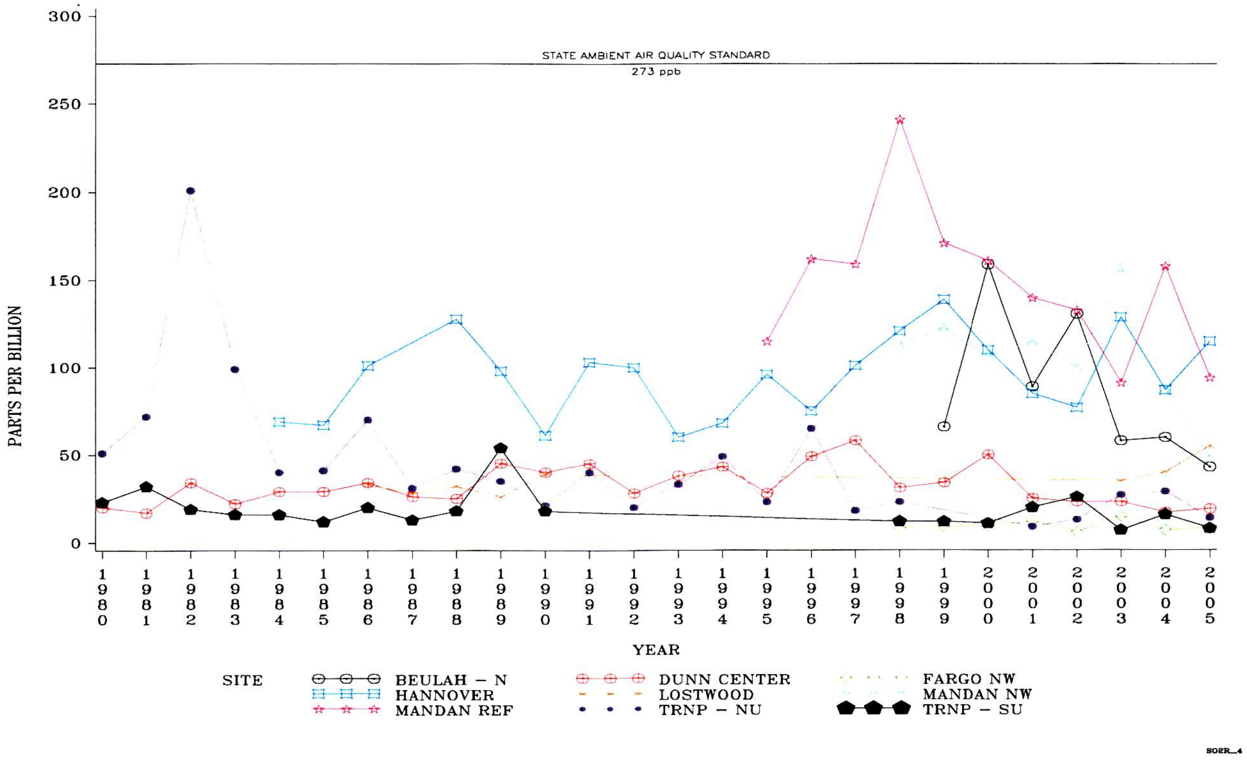


Figure 4 SO_2 Maximum 1-Hour Concentrations

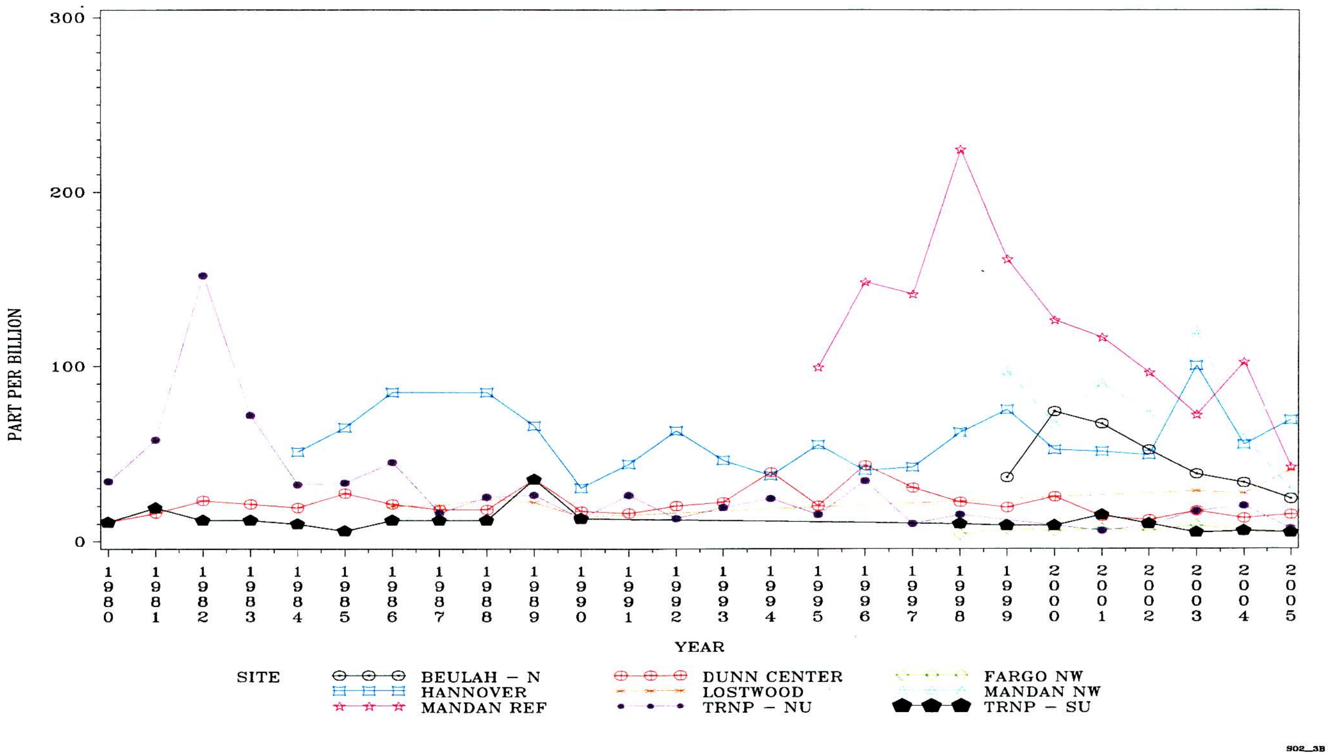


Figure 5 SO_2 Maximum 3-Hour Concentrations

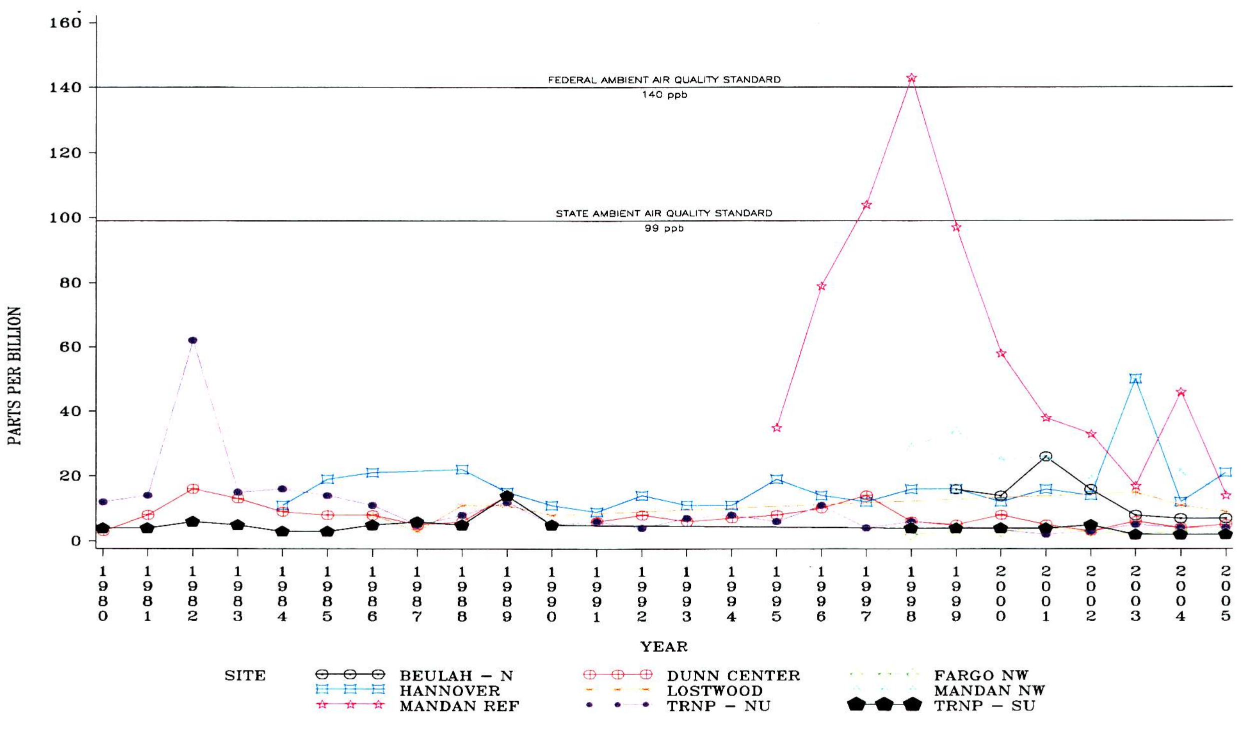


Figure 6 SO_2 Maximum 24-Hour Concentrations

2.2 Oxides of Nitrogen

"Oxides of Nitrogen" (NO_x) is the term used to represent both nitric oxide (NO) and nitrogen dioxide (NO_2). NO_2 is formed when NO is oxidized in the ambient air. There is no ambient air quality standard for NO.

2.2.1 Point Sources

The major NO_x stationary point sources (>100 TPY) are listed in Table 5 along with their emissions as calculated from the most recent emission inventories reported to the department. Figure 7 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 7A shows the contribution of point sources to the total NO_2 emissions. The "Point Sources" category consists of Utility Boilers (power plant boilers) and oil and gas wells.

2.2.2 Area Sources

Another source of NO_X is automobile emissions. North Dakota has no significant urbanized areas with regard to oxides of nitrogen; the entire population of the State is less than the 1,000,000 population figure that EPA specifies in the NO_2 requirement for NAMS monitoring. Figure 7A shows the contribution of "Other Point Sources" and "Utility Boilers." The "Other Point Sources" category consists of DGC, oil refineries, natural gas processing plants, and agricultural processing plants.

2.2.3 Monitoring Network

The Department currently operates seven $NO/NO_2/NO_x$ analyzers. The Dakota Gasification Company (DGC) network also operates analyzers at sites DGC #12 and DGC #17. Table 6 shows the 2005 NO_2 data summaries. The measured NO_2 values are quite low. From Figure 7 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: Dunn Center and TRNP - NU are defined as a background and long range transport/regional haze sites.

TABLE 5

Major NO_x Sources

(> 100 TPY)

2005

#	COMPANY	SOURCE	NOX	Percent of Total Emissions	Facility ID
1	Minnkota Power Cooperative, Inc.	M R Young Station 1 & 2	23,529	27.85%	3806500001
2	Basin Electric Power Cooperative	Leland Olds Station	13,241	15.67%	3805700001
3	Basin Electric Power Cooperative	Antelope Valley Station	12,467	14.76%	3805700011
4	Otter Tail Power Company	Coyote	12,261	14.51%	3805700012
5	Great River Energy	Coal Creek Station	11,538	13.66%	3805500017
6	Dakota Gasification Co.	Plant	3,095	3.66%	3805700013
7	Great River Energy	Stanton Station	2,194	2.60%	3805700004
8	Amerada Hess Corporation	Tioga Gas Plant	1,667	1.97%	3810500004
9	Montana Dakota Utilities Co.	RM Heskett Station	1,064	1.26%	3805900001
10	Tesoro Refining and Marketing Co.	Tesoro Mandan Refinery	841	1.00%	3805900003
11	American Crystal Sugar	Hillsboro Plant	736	0.87%	3809700019
12	American Crystal Sugar	Drayton Plant	528	0.62%	3806700003
13	Minn-Dak Farmers Cooperative	Wahpeton Plant	409	0.48%	3807700026
14	Cavalier Air Force Station	Power Plant	256	0.30%	3806700005
15	Bear Paw Energy, L.L.C.	Alexander	182	0.22%	3805300024
16	Northern Border Pipeline Co.	Station #4	138	0.16%	3805300014
17	Northern Sun (Division of ADM)	Oil Seed Processing	130	0.15%	3807300001
18	ADM Corn Processing	Walhalla	111	0.13%	3806700004
19	Bear Paw Energy, L.L.C.	Tree Top	104	0.12%	3800700019

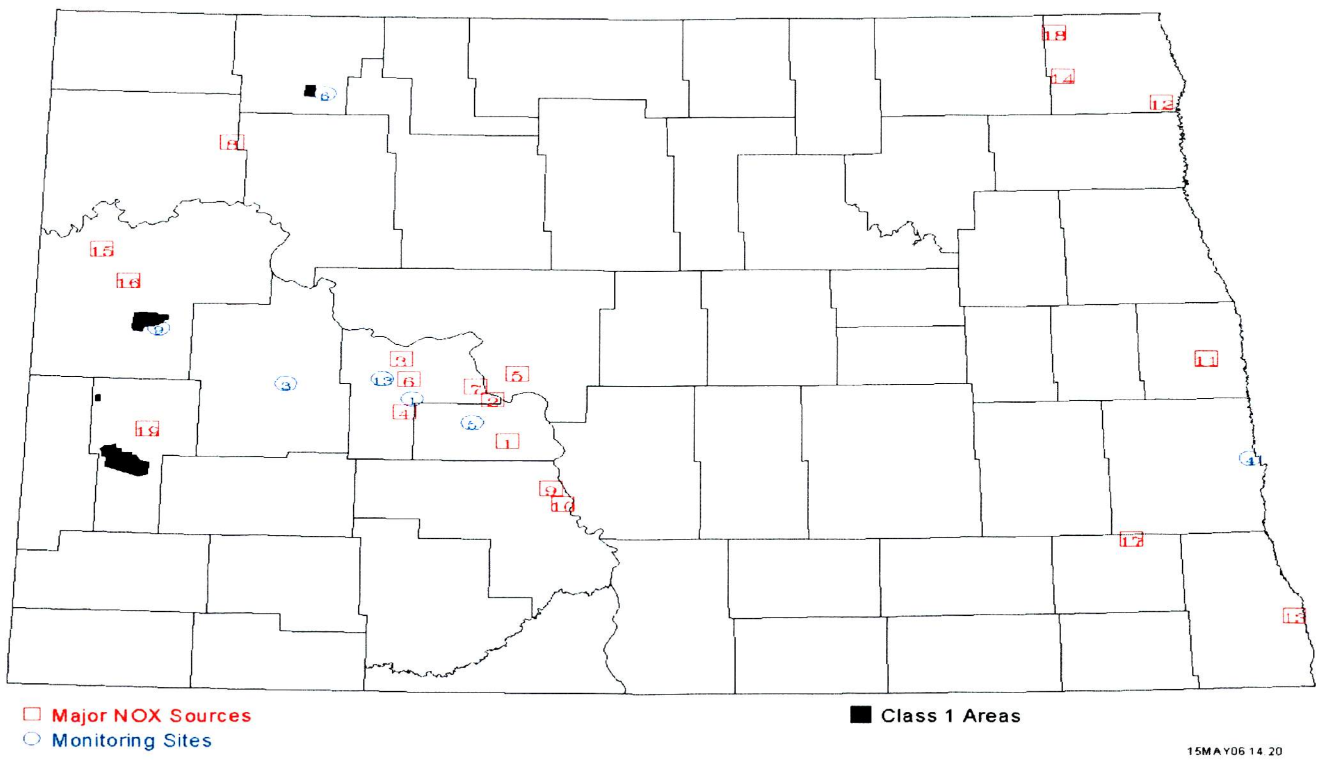


Figure 7 Major Nitrogen Dioxide Sources

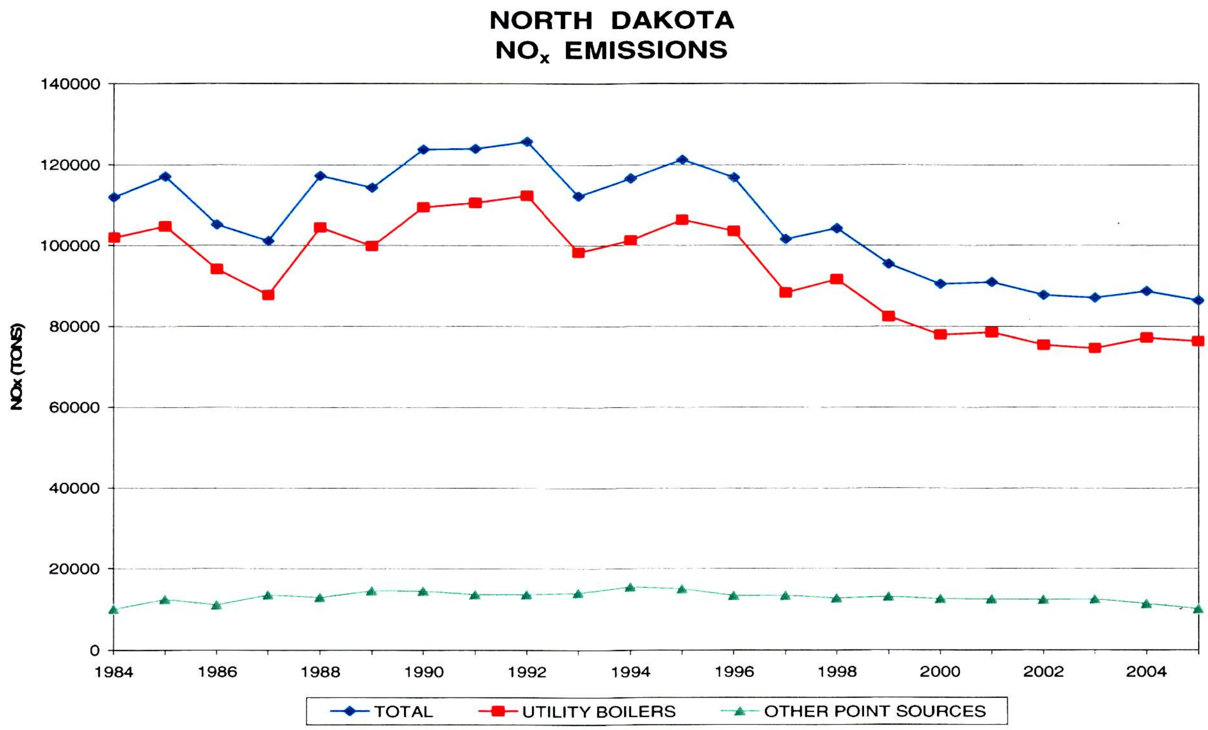


Figure 7A Annual Nitrogen Dioxide Emissions

TABLE 6

COMPARISON OF AIR QUALITY DATA WITH
THE NORTH DAKOTA AMBIENT AIR QUALITY STANDARDS *

POLLUTANT : Nitrogen Dioxide (PPB)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MAXIMA 1 - HOUR 1ST MM/DD:HH	MAXIMA 1 - HOUR 2ND MM/DD:HH	ARITH MEAN	% >MDV
Beulah - North	2005	JAN-DEC	8208	27 01/21:12	25 05/02:21	2.5	90.2
Bismarck Residential	2005	OCT-DEC	2080	36 12/20:08	36 12/21:07	8.4	100.0
DGC #12	2005	JAN-DEC	8598	35 03/05:18	32 05/02:21	2.6	90.1
DGC #17	2005	JAN-DEC	8460	34 10/15:18	31 03/02:09	2.2	82.8
Dunn Center	2005	JAN-DEC	8607	14 03/16:09	11 01/05:16	1.3	69.6
Fargo NW	2005	JAN-DEC	8207	50 02/22:20	44 03/02:21	5.6	89.6
Hannover	2005	JAN-DEC	8251	34 02/25:15	29 08/29:22	1.9	71.7
Lostwood NWR	2005	JAN-DEC	8663	24 12/18:02	22 12/18:01	1.4	49.6
Short Creek, ND	2005	JAN-DEC	8628	21 03/31:06	20 10/14:03	1.8	84.2
TRNP - NU	2005	JAN-DEC	8684	9 02/07:22	9 10/28:15	1.1	73.0

The maximum 1-hour concentration is 50 ppb at Fargo NW on 02/22:20

* The air quality standards are:
STATE - 53 ppb maximum annual arithmetic mean.

FEDERAL - 53 ppb annual arithmetic mean.

2.2.4 Network Analysis

The nine largest NO_2 sources in the state are within 45 miles of the Beulah and Hannover monitoring sites. Figures 8 and 9 show the trends for the state operated sites for 1980 - 2005. Since the industry operated sites are placed for maximum concentrations, trends are not considered.

With the exception of Beulah in 1981, the percentage of data greater than the MDV, shown in Figure 8, was reasonably stable until 1993. The significant increase in the percentage of detectable concentrations is contrary to the quantity of NO_2 emitted. Figure 7A show an increasing, but slow, trend in NO2 emissions from 1984 until 1992. From 1993 until present, there has been a decreasing trend in NO2 emissions. A possible explanation for Hannover is the analyzer was changed in March 1992 from a Meloy 8101C to a TECO 42. However, the analyzer change did not produce a discreet jump: the increase was seen at both the Beulah and Hannover sites. A possible conclusion is the increase in detectable NO_2 concentrations is real and not the result of equipment changes. Another possibility and more likely, is a change in the wind flow patterns. In 2000, Dunn Center and Hannover were the only sites that had a decrease in the number of hourly averages less than the minimum detectable value.

An interesting note is the significant decrease in the percentage of data above the minimum detectable value for 2005. Three possibilities have been considered. First, is the change from WTC to ESC data loggers? During the brief period both systems were running together, they produced identical averages. Therefore, the data logger conversion is not likely. Second, is there was an actual decrease in the quantity of detectable NO_2 in the ambient air. This is a possible cause. However, the actual NO2 emissions (Figure 7A) do not support this dramatic a decrease. Finally, and the most plausible cause, is simply a change in the meteorology. This will be tracked over the next few years.

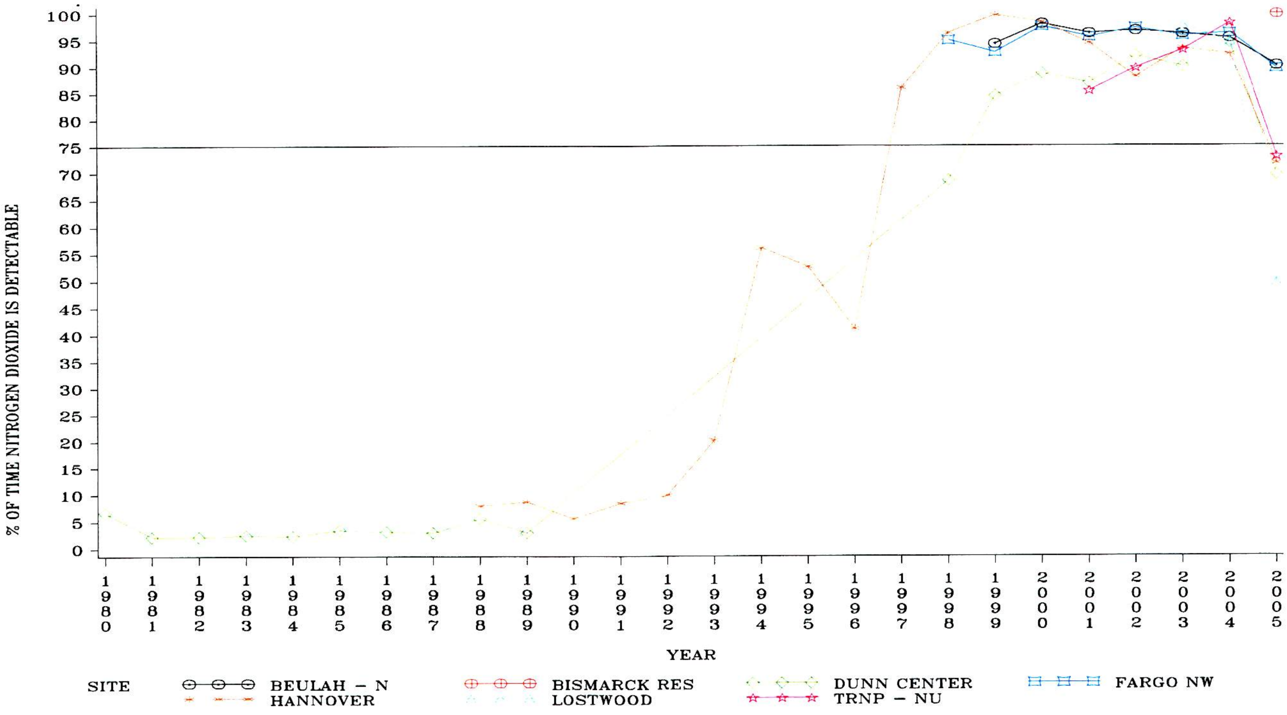


Figure 8 Percentage of Time NO_2 Detectable

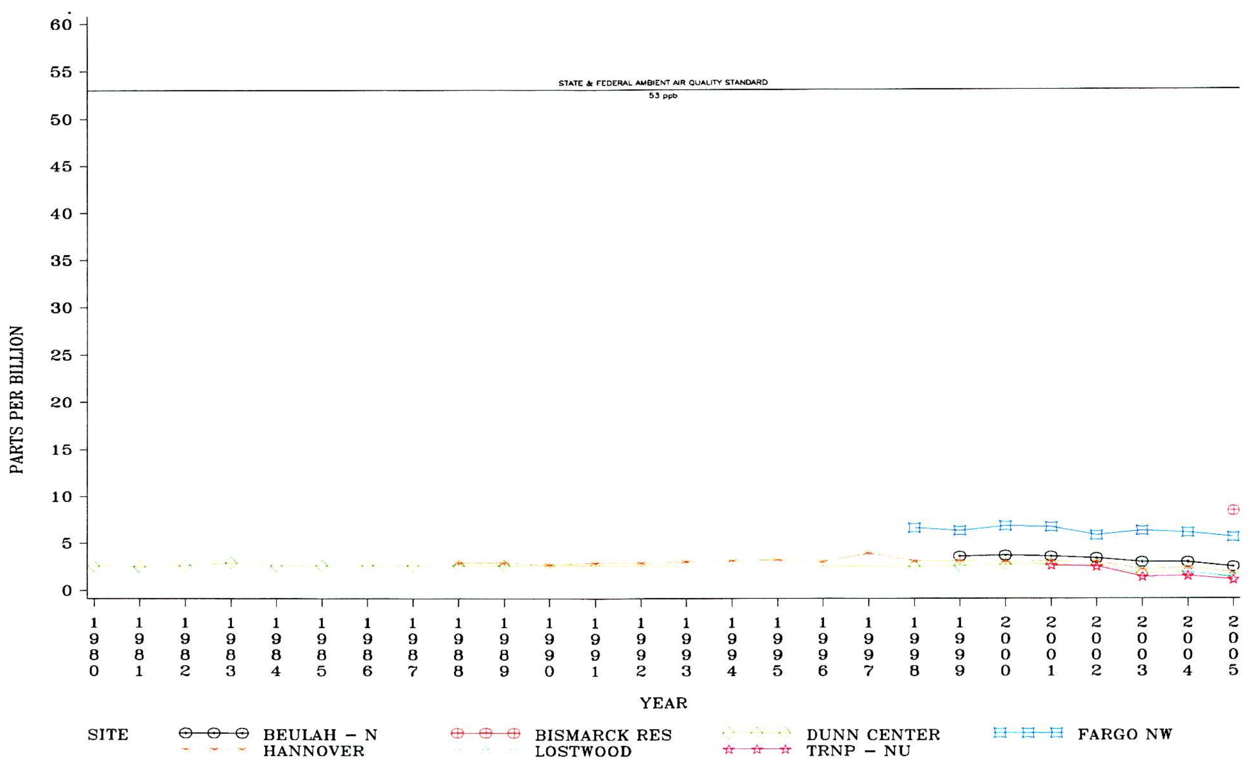


Figure 9 NO_2 Annual Average Concentrations

2.3 Ozone

Unlike most other pollutants, ozone (O_3) is not emitted directly into the atmosphere but results from a complex photochemical reaction between volatile organic compounds (VOC), oxides of nitrogen (NO_x), and solar radiation. Both VOC and NO_x are emitted directly into the atmosphere from sources within the State. Since solar radiation is a major factor in O_3 production, O_3 concentrations are known to peak in summer months. 40 CFR 58 defines the O_3 monitoring season for North Dakota as May 1 through September 30. However, O_3 analyzers at all sites collect data year round for use in dispersion modeling.

2.3.1 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 7. Figure 10 shows the approximate locations of these facilities.

2.3.2 Area Sources

Point sources contribute only part of the total VOC and NO_x emissions. The remaining emissions are attributed to mobile sources in urban areas. The EPA has specified design criteria for selecting NAMS locations for O_3 as any urbanized area having a population of more than 200,000. North Dakota has no urbanized areas large enough to warrant population-oriented monitoring.

TABLE 7

Major VOC Sources
(> 100 TPY)
2005

#	Company	Source	Pollutant Emission	Percentage of Total Emissions	Facility ID
1	Tesoro Refining and Marketing Company	Tesoro Mandan Refinery	496	17.30%	3805900003
2	Dakota Gasification Co.	Plant	475	16.57%	3805700013
3	Northern Sun (Division of ADM)	Oil Seed Processing	247	8.62%	3807300001
4	ADM Corn Processing	Walhalla	203	7.08%	3806700004
5	Basin Electric Power Cooperative	Leland Olds Station	184	6.42%	3805700001
6	Basin Electric Power Cooperative	Antelope Valley Station	162	5.65%	3805700011
7	Great River Energy	Coal Creek Station	155	5.41%	3805500017
8	Minnkota Power Cooperative, Inc.	M R Young Station 1 & 2	154	5.37%	3806500001
9	DMI Industries	Manufacturer of Large Metal Wind Towers	152	5.30%	3801700122
10	ADM Processing	Velva	146	5.09%	3804900005
11	Otter Tail Power Company	Coyote	137	4.78%	3805700012
12	Minn-Dak Farmers Cooperative	Wahpeton Plant	134	4.67%	3807700026
13	Hood Packaging Corporation	Grand Forks Facility	122	4.26%	3803500052
14	Great River Energy	Stanton Station	100	3.49%	3805700004

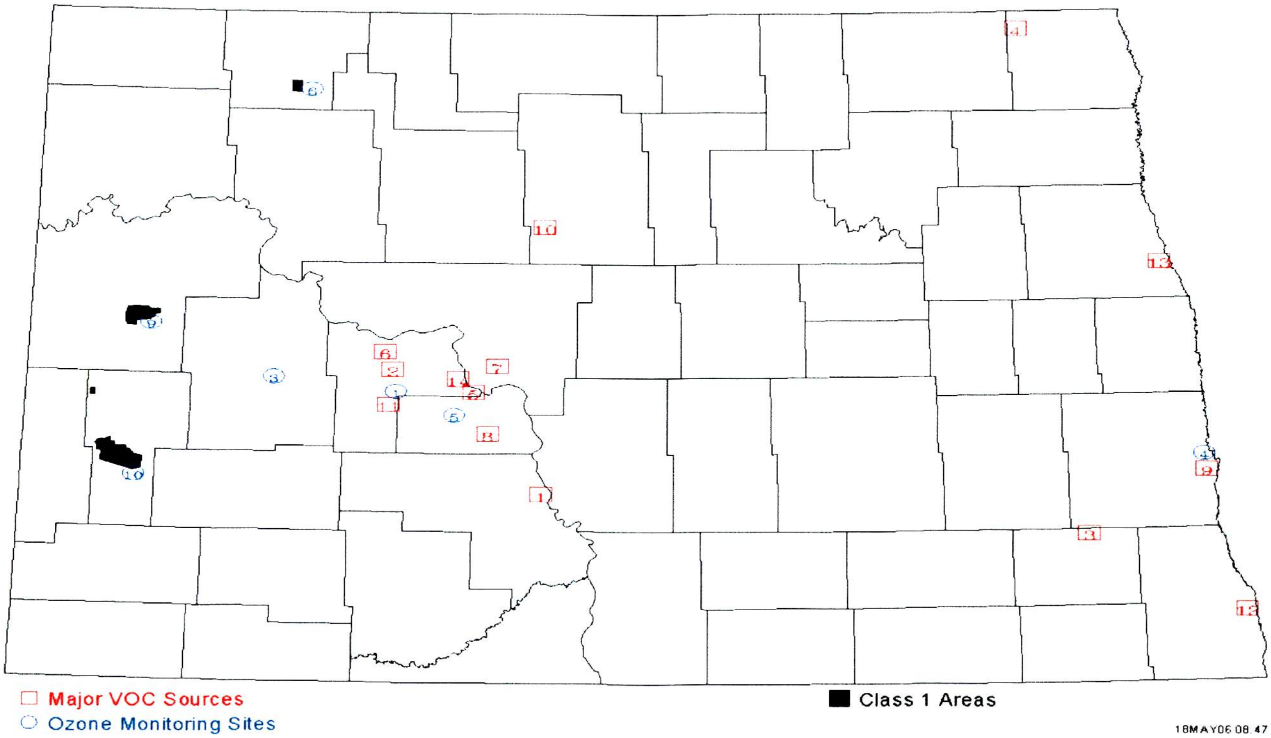


Figure 10 Major VOC Sources

TABLE 8

COMPARISON OF AIR QUALITY DATA WITH
THE NORTH DAKOTA AMBIENT AIR QUALITY STANDARDS *

POLLUTANT : Ozone (PPB)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MAXIMA 1 - HOUR 1ST MM/DD	1 - HOUR 2ND MM/DD	8 - HOUR 1ST MM/DD	8 - HOUR 2ND MM/DD	8 - HOUR 3RD MM/DD	8 - HOUR 4TH MM/DD	1HR #>120	8HR #>80
Beulah - North	2005	JAN-DEC	8668	62 07/06	62 06/02	58 05/06	57 08/07	57 05/03	57 07/06		
Bismarck Residential	2005	OCT-DEC	2083	42 10/27	40 10/16	38 10/27	38 10/28	36 10/15	32 10/13		
Dunn Center	2005	JAN-DEC	8421	74 06/01	68 06/02	57 05/06	56 05/05	54 05/03	54 04/04		
Fargo NW	2005	JAN-DEC	8614	72 07/10	69 06/03	65 06/18	64 07/10	62 09/10	58 04/08		
Hannover	2005	JAN-DEC	8668	64 04/21	61 05/06	59 05/05	59 04/17	58 05/03	58 05/06		
Lostwood NWR	2005	JAN-DEC	8689	64 08/07	63 09/09	57 09/09	55 04/17	55 04/16	51 04/04		
TRNP - NU	2005	JAN-DEC	8704	72 06/01	63 06/02	60 09/03	58 05/05	58 08/06	56 04/16		
TRNP - SU	2005	JAN-DEC	8271	78 06/01	65 09/16	62 08/06	62 04/04	59 08/07	59 07/23		

The maximum 1-hour concentration is 78 ppb at TRNP - SU on 06/01
The 4th highest 8-hour concentration is 59 ppb at TRNP - SU on 07/23

* The air quality standards for ozone are:
STATE - 120 ppb not to be exceeded more than once per year.

FEDERAL Standards -
1) 120 ppb maximum 1-hour concentration with no more than one expected exceedance per year.
2) Fourth highest daily maximum 8-hour averages for a 3-year period not to exceed 80 ppb.

*** Less than 80% of the possible samples (data) were collected.

2.3.3 Monitoring Network

The state currently has eight continuous ozone analyzers in operation. See Table 1 for locations. Table 8 presents the 2005 8-hour data summaries. Figure 11 shows the 4th highest 8-hour averages by month for 2005.

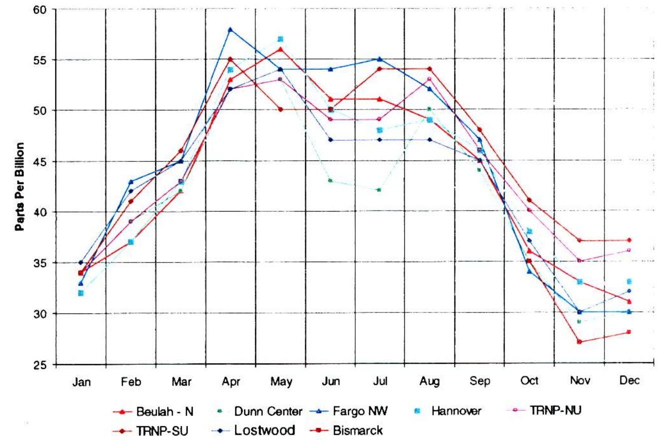


Figure 11
Monthly 4th Highest Ozone Concentrations

2.3.4 Network Analysis

Only three of the eight monitoring sites are in an area not significantly influenced by VOC sources (see Figure 10). Beulah and Hannover are within 45 miles of seven of the ten major VOC sources in the state. Lostwood NWR, TRNP - NU and TRNP-SU are located in a Class I area surrounded by oil fields. Bismarck Residential and Fargo NW are located in population centers and influenced by city traffic. 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 12 shows a significant similarity among the 4th maximum 8-hour concentrations. Since 1980, there have been only four 8-hour averages collect higher than 70 ppb and none of these exceeded 80 ppb. Another, even stronger, indication of a uniform ozone distribution is the 8-hour concentrations: for all sites, the difference between the highest 8-hour average and 4th highest average is 14 ppb (see Table 8).

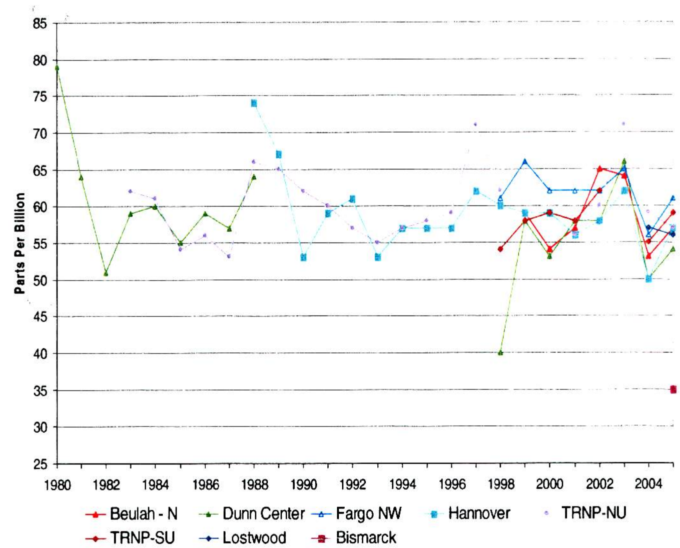


Figure 12
Annual 4th Highest Ozone Concentrations

2.4 Inhalable Particulates

The inhalable particulate standards are designed to protect against those particulates that can be inhaled deep into the lungs and cause respiratory problems. The major designation for inhalable particulates is PM. Within this designation are two subgroups: PM_{10} and $PM_{2.5}$. The PM_{10} particulates have an aerodynamic diameter less than or equal to a nominal 10 microns and are designated as PM_{10}. The $PM_{2.5}$ particulates have an aerodynamic diameter less than or equal to a nominal 2.5 microns and are designated as $PM_{2.5}$.

2.4.1 Sources

The major PM_{10} point sources (>100 TPY) are listed in Table 9 along with their emissions as calculated from the most recent emissions inventory reports. 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 13A 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 DGC, oil refineries, natural gas processing plants, and agricultural processing plants.

2.4.2 Monitoring Network

The State operates one manual PM_{10} sampler, five continuous PM_{10} analyzers, five manual $PM_{2.5}$ samplers, eight continuous $PM_{2.5}$ analyzers, and three speciation samplers. Tables 10 and 12 show the manual and continuous PM_{10} particulate data summaries, respectively. Tables 11 and 13 show the FEM and continuous $PM_{2.5}$ data summaries, respectively.

TABLE 9

Major PM_{10} Sources
(> 100 TPY)
2005

#	COMPANY	SOURCE	PM10	Percent of Total Emissions	Facility ID
1	Basin Electric Power Cooperative	Antelope Valley Station	736	25.28%	3805700011
2	Otter Tail Power Company	Coyote	299	10.27%	3805700012
3	American Crystal Sugar	Drayton Plant	279	9.58%	3806700003
4	Basin Electric Power Cooperative	Leland Olds Station	265	9.10%	3805700001
5	Dakota Gasification Co.	Plant	259	8.90%	3805700013
6	American Crystal Sugar	Hillsboro Plant	254	8.73%	3809700019
7	Great River Energy	Coal Creek Station	198	6.80%	3805500017
8	Tesoro Refining and Marketing Co.	Tesoro Mandan Refinery	140	4.81%	3805900003
9	Minnkota Power Cooperative, Inc.	M R Young Station 1 & 2	137	4.71%	3806500001
10	North Dakota Mill	Grain Elevator and Wheat Milling Facility	126	4.33%	3803500071
11	Great River Energy	Stanton Station	118	4.05%	3805700004
12	Minn-Dak Farmers Cooperative	Wahpeton Plant	100	3.44%	3807700026

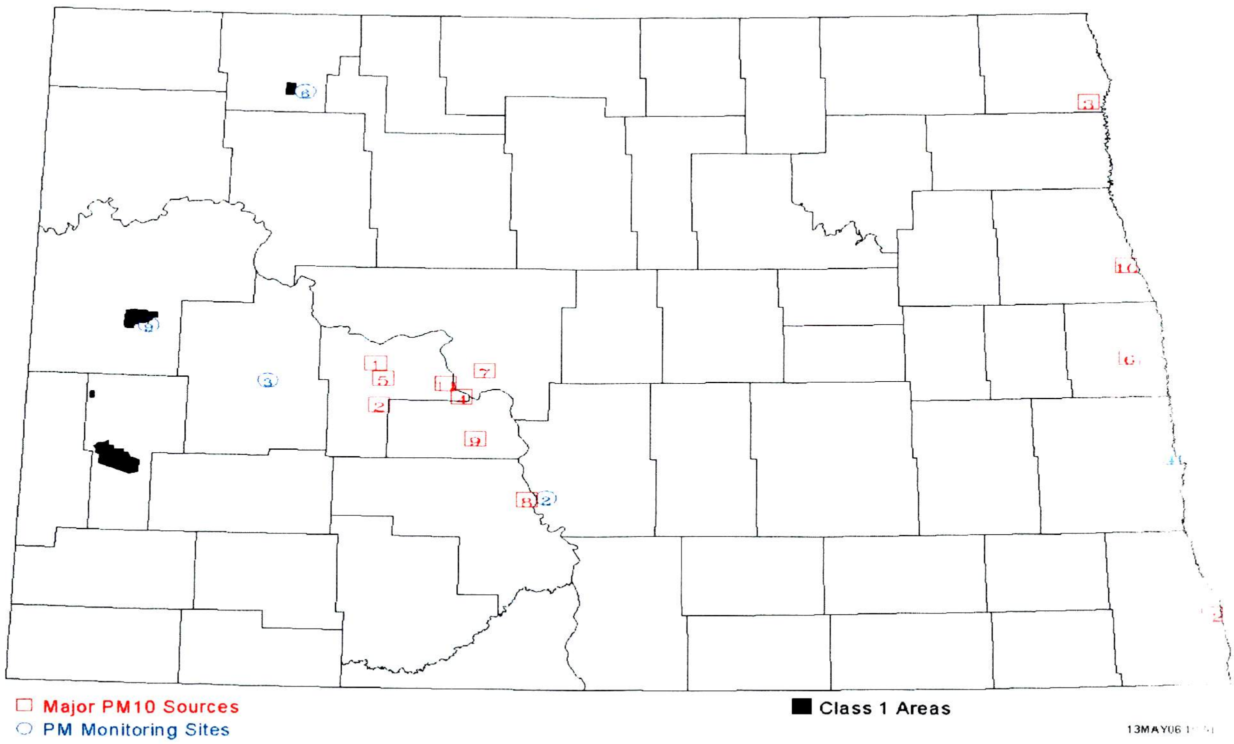


Figure 13 Major PM_{10} Sources

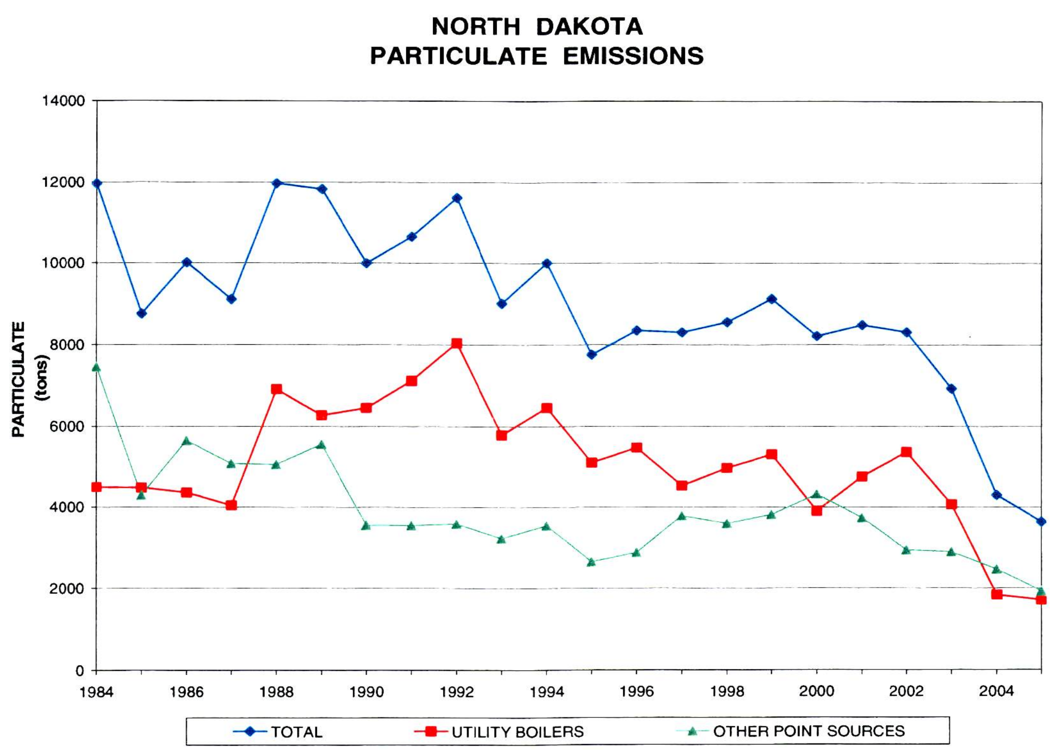


Figure 13A Annual PM Emissions

TABLE 10

COMPARISON OF AIR QUALITY DATA WITH
THE NORTH DAKOTA AMBIENT AIR QUALITY STANDARDS *

POLLUTANT: Inhalable PM_{10} Particulates ($\mu g/m^3$)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MIN	MAXIMA 1ST MM/DD	MAXIMA 2ND MM/DD	MAXIMA 3RD MM/DD	ARITH MEAN	#>150	AM>50	% >MDV
Bismarck Residential	2005	JAN-SEP	44	6.0	43.0 04/04	40.0 08/02	38.0 07/09	17.3			100.0

The maximum 24-hour concentration is 43.0 µg/m3 at Bismarck Residential on 04/04

* The STATE and FEDERAL air quality standards are:
1) 150 µg/m3 maximum averaged over a 24-hour period with no more than one expected exceedance per year.
2) 50 µg/m3 expected annual arithmetic mean.

*** Less than 80% of the possible samples (data) were collected.

TABLE 11

COMPARISON OF AIR QUALITY DATA WITH
THE NORTH DAKOTA AMBIENT AIR QUALITY STANDARDS *

POLLUTANT: FRM $PM_{2.5}$ Particulates ($\mu g/m^3$)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MIN	MAXIMA 1ST MM/DD	MAXIMA 2ND MM/DD	MAXIMA 3RD MM/DD	ARITH MEAN	#>150	AM>50	% >MDV
Beulah - North	2005	JAN-DEC	61	0.2	18.8 04/04	18.5 03/23	13.0 02/27	5.5			93.4
Bismarck Residential	2005	JAN-DEC	117	1.4	22.5 04/04	18.7 11/27	16.9 09/10	6.5			98.3
Fargo NW	2005	JAN-DEC	118	0.3	25.2 09/10	23.2 01/31	22.6 08/02	7.5			95.8
TRNP - NU	2005	JAN-DEC	60	1.2	14.9 03/23	12.3 05/10	10.5 04/04	4.6			90.0
TRNP - SU	2005	JAN-DEC	60	1.1	12.4 03/23	10.6 08/08	10.5 04/04	4.3			88.3

The maximum 24-hour concentration is 25.2 µg/m3 at Fargo NW on 09/10

* The ambient air quality standards are:
FEDERAL Standards -
1) 24-hour: 3-year average of 98th percentiles not to exceed 65 µg/m3.
2) Annual: 3-year average not to exceed 15µg/m3.

Table 12

COMPARISON OF AIR QUALITY DATA WITH
THE NORTH DAKOTA AMBIENT AIR QUALITY STANDARDS *

POLLUTANT: Continuous PM_{10} ($\mu g/m^3$)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MAXIMA 1-HOUR 1ST MM/DD:HH	MAXIMA 1-HOUR 2ND MM/DD:HH	MAXIMA 24-HOUR 1ST MM/DD	MAXIMA 24-HOUR 2ND MM/DD	MAXIMA 24-HOUR 3RD MM/DD	MAXIMA 24-HOUR 4TH MM/DD	MEAN	24HR #>150	AM>50
Bismarck Residential	2005	OCT-DEC	2195	84.0 11/28:06	55.0 12/18:14	30.3 10/29	28.4 10/27	27.8 10/28	26.8 10/26	10.5		
Dunn Center	2005	JAN-DEC	7097	216.0 05/06:10	202.0 03/06:13	82.8 05/06	41.6 05/05	36.0 04/25	32.8 04/08	11.0		
Fargo NW	2005	JAN-DEC	8610	243.0 08/15:21	185.0 07/13:08	58.1 09/30	55.0 09/10	51.5 07/13	49.8 10/28	17.1		
Lostwood NWR	2005	JAN-DEC	8686	192.0 11/02:11	191.0 09/10:17	39.0 05/24	31.1 09/30	30.9 04/08	30.9 05/06	10.0		
TRNP - NU	2005	JAN-DEC	8701	151.0 09/10:14	136.0 09/10:13	35.3 05/06	29.7 08/30	29.2 09/10	26.3 07/09	9.1		

The highest 24-hour concentration is 82.8 µg/m3 at Dunn Center on 05/06
The highest Annual Mean concentration is 9.1 µg/m3 at TRNP - NU

* The STATE and FEDERAL air quality standards are:
1) 150 µg/m3 maximum averaged over a 24-hour period with no more than one expected exceedance per year
2) 50 µg/m3 expected annual arithmetic mean.

*** Less than 80% of the possible samples (data) were collected.

Table 13

COMPARISON OF AIR QUALITY DATA WITH
THE NORTH DAKOTA AMBIENT AIR QUALITY STANDARDS *

POLLUTANT : Continuous $PM_{2.5}$ ($\mu g/m^3$)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MAXIMA 1-HOUR 1ST MM/DD:HH	MAXIMA 1-HOUR 2ND MM/DD:HH	MAXIMA 24-HOUR 1ST MM/DD	MAXIMA 24-HOUR 2ND MM/DD	MAXIMA 24-HOUR 3RD MM/DD	MAXIMA 24-HOUR 4TH MM/DD	MEAN	1HR #>150	24HR #>65
Beulah - North	2005	JAN-DEC	8666	116.0 01/21:14	89.5 09/10:15	21.4 09/10	19.9 08/27	19.7 08/30	19.3 07/09	[illegible]3		
Bismarck Residential	2005	OCT-DEC	2082	41.8 12/18:14	37.0 10/15:00	17.5 10/29	10.9 10/12	8.8 12/18	8.3 10/28	[illegible].2		
Dunn Center	2005	JAN-DEC	8314	58.7 07/16:18	58.4 09/10:14	13.1 08/27	13.1 04/17	10.9 05/06	10.5 07/16	[illegible].2		
Fargo NW	2005	JAN-DEC	8609	90.7 08/15:21	84.5 07/13:08	25.0 08/02	24.9 07/13	23.6 07/11	21.6 09/10	[illegible].3		
Hannover	2005	JAN-DEC	8264	450.0 09/20:08	104.3 03/17:16	23.7 09/20	16.8 04/18	16.5 09/09	16.3 04/04	[illegible].5		
Lostwood NWR	2005	JAN-DEC	8608	115.2 05/24:13	96.5 05/24:15	32.8 05/24	18.1 08/26	13.9 09/09	13.9 07/09	3.2		
TRNP - NU	2005	JAN-DEC	8000	74.6 09/10:13	55.4 09/10:14	10.6 09/10	10.0 10/26	9.9 05/07	9.4 05/06	2.7		
TRNP - SU	2005	JAN-DEC	8162	90.8 09/10:13	63.8 08/08:06	16.7 08/08	14.4 09/10	14.1 05/06	13.4 08/16	5.8		

The highest 24-hour concentration is 32.8 µg/m3 at Lostwood NWR on 05/24
The highest Annual Mean concentration is 5.8 µg/m3 at TRNP - SU

* The ambient air quality standards are:
FEDERAL Standards -
1) 24-hour: 3-year average of 98th percentiles not to exceed 65 µg/m3.
2) Annual: 3-year average not to exceed 15 µg/m3.

2.4.3 PM_{10} Network Analysis

Since PM_{10} and smaller particles are of concern mainly because of their health effects. The primary purpose for the continuous PM_{10} analyzers is to be used with the continuous $PM_{2.5}$ analyzers to determine the PM Coarse fraction. This data will be used in preparing for the new PM_{Coarse} ambient standard EPA is proposing. A continuous analyzer was added to the Bismarck Residential site effective October 1.

2.4.4 $PM_{2.5}$ Network

The manual $PM_{2.5}$ network currently has five sites. Bismarck, Fargo and Beulah are non-CORE required sites. Bismarck and Fargo operate on a 1-in-3 day schedule while Beulah, TRNP - SU and TRNP - NU operate on a 1-in-6 day schedule. Continuous $PM_{2.5}$ analyzers (TEOMs) have been installed at Beulah, Dunn Center, Fargo, Hannover, Lostwood NWR, TRNP-NU, and TRNP-SU.

The intent of the TEOMs is to begin using these analyzers as the primary data source and use a FEM sampler only for quality assurance purposes. Our initial work to compare the TEOM data with the manual sampler data has not met with much success. In a comparison of the manual and continuous data collected through 2003, there was good correlation in the summer and poor correlation in the winter. The conclusion was that in the summer the manual samplers and the TEOMs were both losing the volatiles. Using the Fargo speciation sulfate and nitrate data, manual and continuous $PM_{2.5}$ data as a foundation, when the speciation sulfates and nitrates were added to the TEOM data, the correlation, slope and intercept were within the range required to use the TEOM as an acceptable replacement for the manual samplers. The Short Creek site TEOM, which runs at 40°C, showed a reasonable correlation for all four seasons as well as the entire year. With this information in hand, EPA Region 8 agreed to allow North Dakota to run the $PM_{2.5}$ TEOMS at 40°C. This temperature change was made around during the last week of December 2004 and the first week of January 2005.

The result of the change to 40°C had mixed results. Two sites, Painted Canyon and Short Creek had very good statistics for the comparison. The table below presents the statistics calculated using the formulas in the proposed 40 CFR 58 changes.

Table 14
$PM_{2.5}$ FEM vs. TEOM Comparison

Site	Painted Canyon	Short Creek	Fargo NW	TRNP – NU	Beulah – North
Slope	1.02	0.89	0.51	0.32	0.64
Intercept	1.45	-1.09	2.13	2.68	3.88
Pearson r	0.8388	0.9048	0.5856	0.5309	0.6438
Data Pairs	38	21	68	14	48

The results are disappointing. The results for Painted Canyon were good news as a result of the temperature change. At this point, the next step is to review the results on a seasonal basis and compare them to the 50°C seasonal results. We will perform this analysis again next year with two years of data.

2.4.5 Speciation Network

Speciation samplers are installed in Bismarck, TRNP - NU, and a National Trends Network sampler in Fargo. The goal of the two state-selected sites is to supplement the data collected by the two IMPROVE samplers: TRNP - SU and Lostwood NWR. With the combined data, it is expected the Department will be able to make a better assessment of the current visibility and track improvement over time. The data collected by these samplers are added to the AQS database by RTI.

2.5 Carbon Monoxide

Many large urban areas in the United States have problems attaining the NAAQS for carbon monoxide (CO) where the primary source of CO is automobiles. North Dakota does not have sufficient population 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 TPY of CO.

2.5.1 Sources

The major stationary CO sources (>100 TPY) are listed in Table 15 along with their emissions as calculated from the most recent emissions inventories reported to the department. Figure 20 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 SO_2 and NO_x. However, the corresponding CO levels from these sources are considerably lower.

2.5.2 Monitoring Network

Carbon monoxide monitoring in North Dakota was terminated March 31, 1994, after 5 years of operation. The conclusion drawn from the data was that North Dakota did not have a CO problem. 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 their traffic planning program.

TABLE 15

Major CO Sources
(> 100 TPY)
2005

#	COMPANY	SOURCE	CO	Percent of Total Emissions	Facility ID
1	Great River Energy	Coal Creek Station	1,936	14.66%	3805500017
2	Dakota Gasification Co.	Plant	1,902	14.41%	3805700013
3	American Crystal Sugar	Hillsboro Plant	1,631	12.35%	3809700019
4	Montana Dakota Utilities Co.	RM Heskett Station	1,357	10.28%	3805900001
5	Basin Electric Power Cooperative	Antelope Valley Station	1,347	10.20%	3805700011
6	Minnkota Power Cooperative, Inc.	M R Young Station 1 & 2	1,096	8.30%	3806500001
7	Basin Electric Power Cooperative	Leland Olds Station	998	7.56%	3805700001
8	Otter Tail Power Company	Coyote	746	5.65%	3805700012
9	Amerada Hess Corporation	Tioga Gas Plant	433	3.28%	3810500004
10	Minn-Dak Farmers Cooperative	Wahpeton Plant	431	3.26%	3807700026
11	American Crystal Sugar	Drayton Plant	351	2.66%	3806700003
12	Tesoro Refining and Marketing Co.	Tesoro Mandan Refinery	282	2.14%	3805900003
13	Northern Sun (Division of ADM)	Oil Seed Processing	241	1.83%	3807300001
14	Great River Energy	Stanton Station	204	1.55%	3805700004
15	Bear Paw Energy, L.L.C.	Alexander	146	1.11%	3805300024
16	ADM Corn Processing	Walhalla	102	0.77%	3806700004

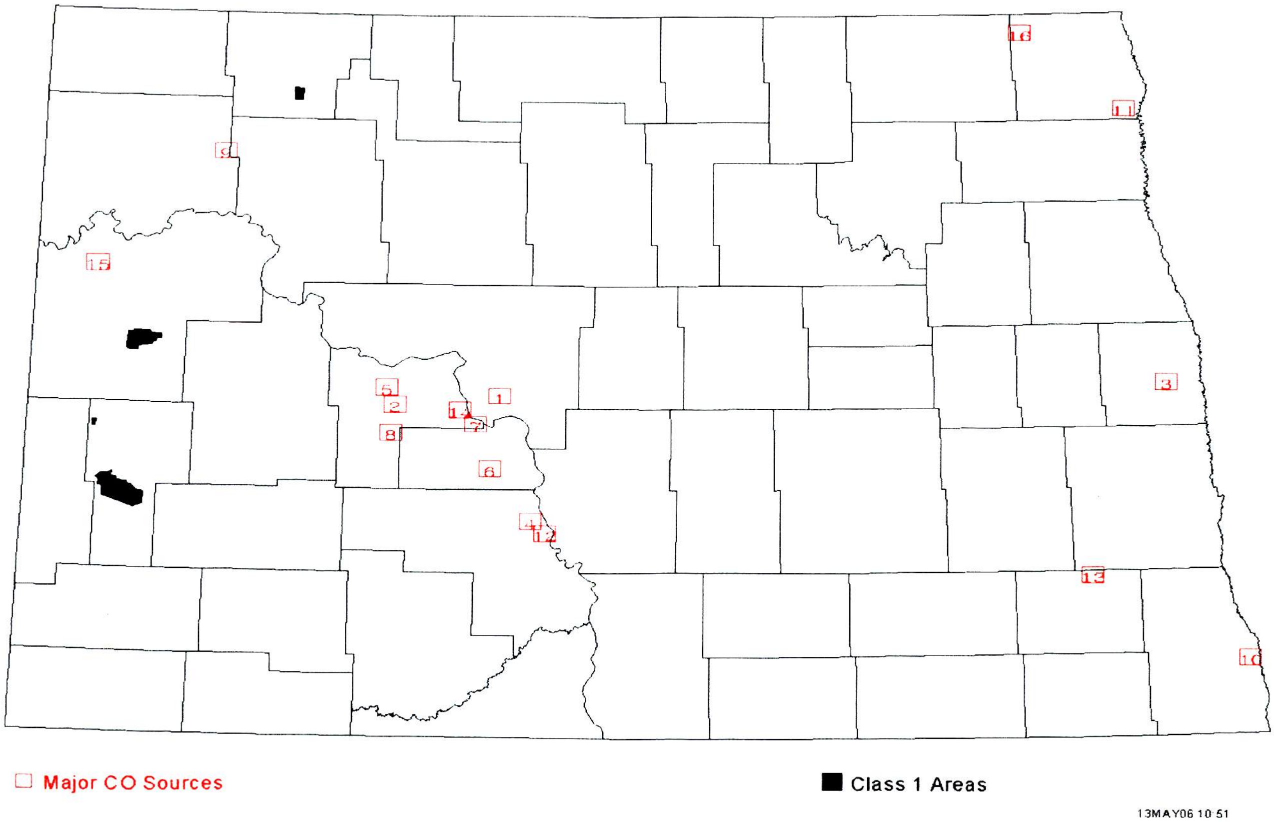


Figure 14 Major CO Sources

2.6 Lead

Through prior sampling efforts, the Department has determined that the State has low lead concentrations (38.6% of the standard) and no significant lead sources. This determination, coupled with the Federal requirement for a NAMS network only in urbanized areas with populations greater than 500,000, resulted in terminating the lead monitoring program effective December 31, 1983. Along with the low monitored concentrations, lead has been completely removed from gasoline since lead monitoring began in 1979.

2.7 Hydrogen Sulfide

Although no Federal Ambient Air Quality Standard exists for hydrogen sulfide (H_2S), the State of North Dakota has developed H_2S standards.

2.7.1 Sources

H_2S emissions of concern stems almost totally from the oil and gas operations in the western part of the State; principally from the green outlined area on Figure 2. 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 or industry H_2S monitoring sites.

2.8 Air Toxics

Currently there are no state or federal air toxics monitoring sites.

2.8.1 Sources

The major air toxics sources are listed in Table 16 and Figure 15 shows the approximate locations of these facilities (the numbers correspond to the source table).

2.8.2 Monitoring Network

Currently there are no state or industry air toxics monitoring sites. The Historic raw data and associated summaries are available in AQS.

Table 16

Major Air Toxics Sources

(>100 TPY)

2005

#	COMPANY	SOURCE	HAPS	Percent of Total Emissions	Facility ID
1	Dakota Gasification Co.	Plant	2,070.2	68.69%	3805700013
2	Northern Sun (Division of ADM)	Oil Seed Processing	303.6	10.07%	3807300001
3	ADM Processing	Velva	292.1	9.69%	3804900005
4	Great River Energy	Stanton Station	123.2	4.09%	3805700004
5	Great River Energy	Coal Creek Station	114.2	3.79%	3805500017
6	Tesoro Refining and Marketing Company	Tesoro Mandan Refinery	110.5	3.67%	3805900003

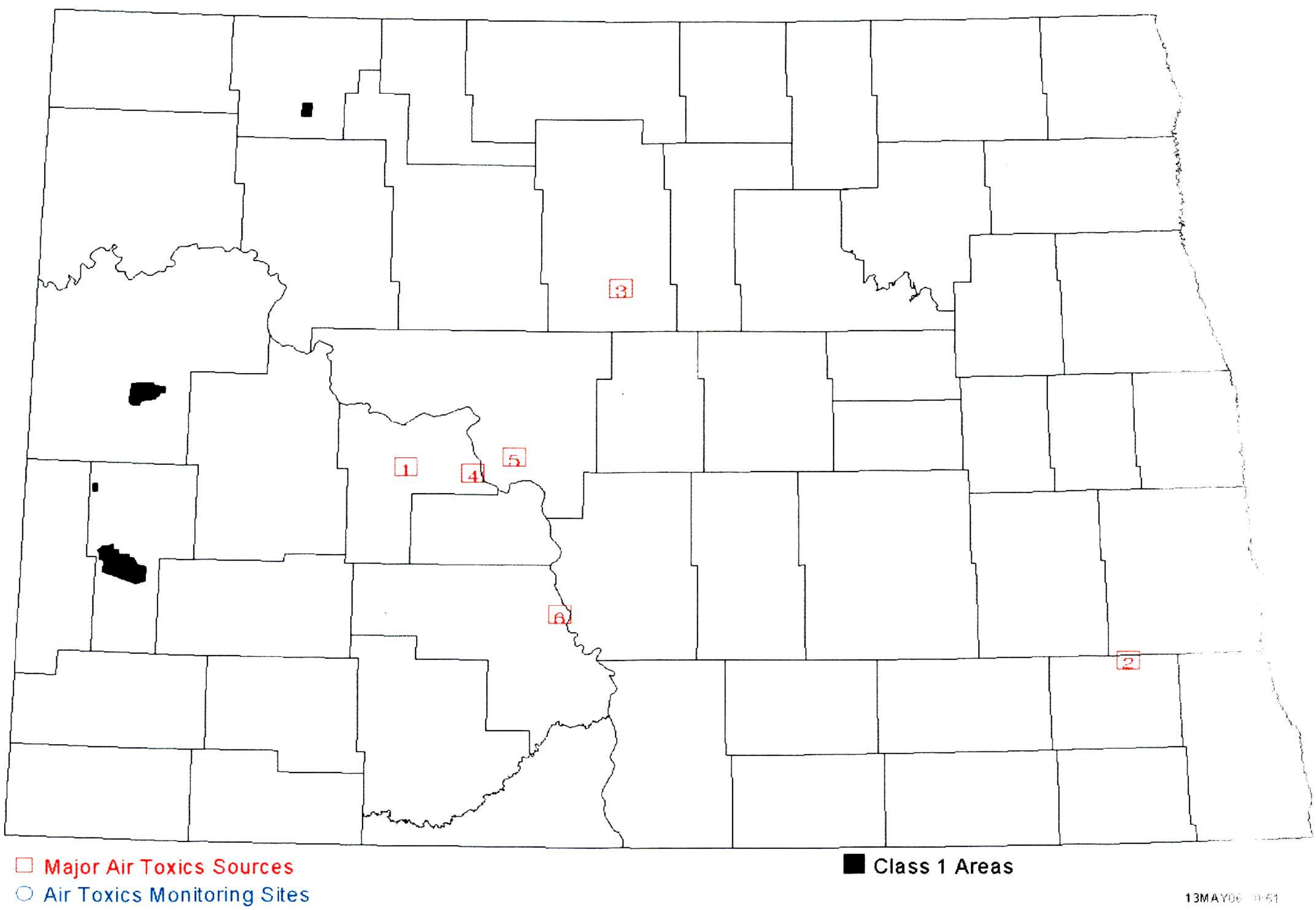


Figure 15 Major Air Toxics Sources

3.0 SUMMARY AND CONCLUSIONS

The North Dakota Ambient Air Quality Monitoring Network is designed to monitor those air pollutants which 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.

3.1 Sulfur Dioxide (SO_2)

Neither the State nor Federal standards were not exceeded at any monitoring site. The maximum concentrations and the maximum concentrations expressed as a percentage of the applicable standard are as follows: 1-hour - 322 ppb (117.9%); 3-hour - 134 ppb (26.8%); 24-hour - 46 ppb (46.5%); annual – 6.0 ppb (20.0%).

There is no SO_2 5-minute standard currently in effect. The maximum 5-minute average was 485 ppb.

3.2 Nitrogen Dioxide (NO_2)

Neither the State nor Federal standards were exceeded at any of the monitoring sites. The maximum concentrations and the maximum concentrations expressed as a percentage of the applicable standard are as follows: annual - 6.1 ppb (11.5%)

3.3 Ozone (O_3)

Neither the State nor Federal standard was exceeded during the year. The 1-hour maximum and highest 4^{th} highest 8-hour concentrations and the concentrations expressed as a percentage of the applicable standard are as follows: 1-hour - 71 ppb (59.2%); highest 4^{th} highest 8-hour - 61 ppb (76.3%).

3.4 Inhalable Particulates

Neither the State nor Federal PM_{10} standards were exceeded during the year. The maximum concentrations and the maximum concentrations expressed as a percentage of the applicable PM_{10} standard are as follows: 24-hour - 73 $\mu g/m^3$ (48.7%); annual - 19.8 $\mu g/m^3$ (39.6%).

The Federal $PM_{2.5}$ standards were not exceeded during the year. The maximum concentrations and maximum concentrations expressed as a percentage of the standard are as follows: 24-hour FRM – 28.1 $\mu g/m^3$ (43.2%); annual FRM - 7.5 $\mu g/m^3$ (50.0%).

3.5 Carbon Monoxide (CO)

No monitoring was conducted.

3.6 Lead

No monitoring was conducted.

3.7 Hydrogen Sulfide

No monitoring was conducted.

3.8 Air Toxics

No monitoring was conducted.