NORTH DAKOTA STATE DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL ENGINEERING

AMBIENT AIR QUALITY MONITORING
ANNUAL NETWORK REVIEW
1988

March 1988

TABLE OF CONTENTS

LIST OF TABLES

LIST OF MAPS

1.0 INTRODUCTION

1.0.1 Background

The North Dakota State Department of Health, Division of Environmental Engineering, has the primary goal of protecting the health and welfare of North Dakotans from the detrimental effects of air pollution. As such, the Division of Environmental Engineering has the responsibility to ensure 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 Environmental Engineering operates and maintains a network of ambient air quality monitors and requires some of the 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 Environmental

Engineering 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 (1) to determine if the system meets the monitoring objectives defined in Appendix D to 40 CFR 58, and (2) to identify needed modifications to the network such as termination or relocation of unnecessary stations or establishment of new stations 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 stations 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 those annual requirements.

1.0.2 Goals and Objectives

The locations of sites in a monitoring program are established to meet certain objectives. The May 10, 1979, Federal Register (40 CFR 58), "Air Quality Monitoring, Data Reporting, and Surveillance Provisions", as amended, has specified a minimum of four basic moni-

toring objectives. These basic monitoring objectives are as follows:

1. To determine the highest pollutant[1/] 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 of sources.

4. To determine the general/background concentration levels.

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

---

1/ "Pollutant" is used interchangeably with "air contaminant" in this document.

dimensions of the air parcel nearest a monitoring station throughout which actual pollutant concentrations are reasonably similar. The goal in siting stations 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 below:

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 4.0 to 50.0 km. (Usually requires more than one site for definition.)

Regional Scale - rural areas of reasonably homogeneous geography covering from tens to hundreds of km.

The relationship 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 (sometimes urban)
Population	Neighborhood, urban
Source Impact	Micro, middle, neighborhood
General/Background	Neighborhood, 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

The use of this physical basis for locating stations allows for an objective approach, ensures compatibility among stations, and provides a physical basis for the interpretation and application of data. The annual review process involves an examination of existing stations to evaluate their monitoring objectives and spatial scale and, if necessary, the sites are deleted, added or modified. Further details on network design can be found in Appendix D to 40 CFR 58.

1.0.3 Siting

As can be gathered from the prior discussion, each air contaminant has certain characteristics which must be taken into account when siting monitoring equipment. These characteristics may result from variations in the number and type of sources and emissions in question, reactivity of a particular pollutant with other constituents in the air, local site influences such as terrain and land use, and climatology. The State AAQM network is currently designed to provide air quality

data for two basic conditions: (1) population oriented monitoring and (2) background monitoring.

Population oriented monitoring is not a major consideration in this State because of our relatively sparse population and becomes a factor mainly in regard to PM_{10} monitoring. All PM_{10} monitoring in populated areas is done on a "neighborhood" spatial scale. On the other hand, background stations are chosen to determine concentrations of air contaminants in areas remote from urban sources and generally are sited according to a "regional" spatial scale. Once general locations are established, all monitoring stations are sited in accordance with the specific probe siting criteria specified in Appendix E to 40 CFR 58.

1.0.4 Monitoring Methods

All sampler/analyzers used by the North Dakota Department of Health for PM_{10}, SO_2, NO_2 and O_3 monitoring are reference/equivalent equipment as listed below:

Parameter	Sampler/Analyzer
PM_{10}	Size-Selective High-Volume Sampler
SO_2	EQSA-0276-009 "Thermo Electron Model 43 Pulsed Fluorescence SO_2 Analyzer"
NO_2	RFNA-0777-022 "Bendix Model 8101-C Oxides of Nitrogen Analyzer"
O_3	RFOA-1075-004 "Meloy Model OA350-2R Ozone Analyzer" or RFOA-1075-003 "Meloy Model OA325-2R Ozone Analyzer"

In addition to the parameters measured above, the Department also conducts monitoring for hydrogen sulfide (H_2S) and TSP. The samplers/analyzers used for the determination of these parameters are noted below:

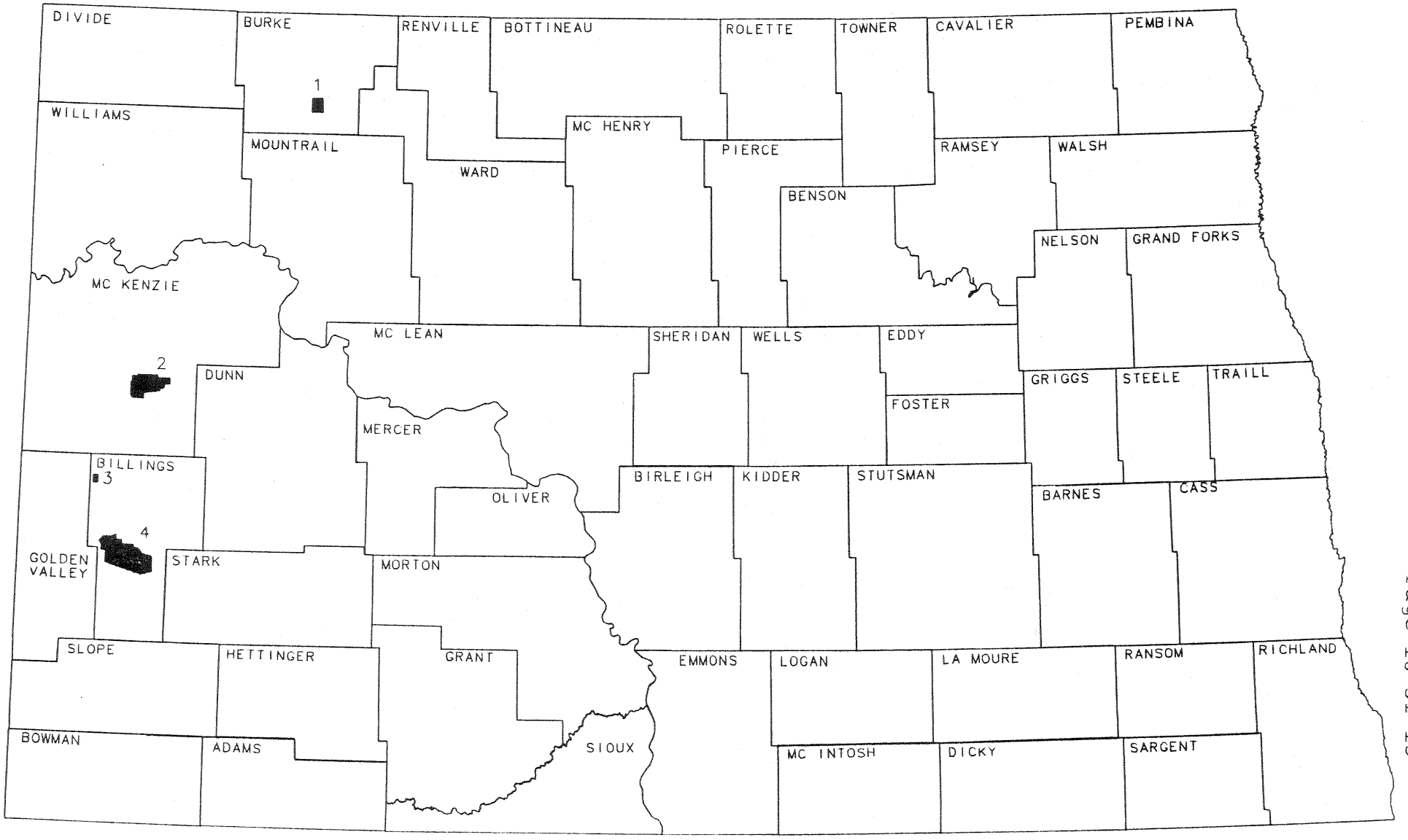
Parameter	Sampler/Analyzer
H_2S	Thermo Electron Model 43/340 converter - automated H_2S to SO_2 conversion with pulsed fluorescence analysis (Also known as Model 45)
TSP	High-Volume Sampler

1.0.5 PSD Areas

On December 5, 1974, the U.S. EPA, promulgated the Prevention of Significant Deterioration of Air Quality (PSD) Regulations to prevent deterioration of air quality in areas of any state where the air is cleaner than the National Ambient Air Quality Standards. Subsequently, the entire State of North Dakota was designated a Class II PSD area.

The Clean Air Act Amendments of 1977 established a list of Federally mandated Class I PSD areas. Special emphasis is placed on these areas with regard to the known and anticipated types of air contaminants and their predicted effects. The areas in North Dakota which were included on this list were the Theodore Roosevelt National Park (TRNP) (North Unit, South Unit and Elkhorn Ranch) and the Lostwood National Wilderness Area. These areas are shown on Map 1.

PSD – CLASS I AREAS



1 LOSTWOOD

2 TRNP – NU

3 ELKHORN RANCH

4 TRNP – SU

MAP 1

Section: 1.0
Revision: 1
Date: 2/23/88
Page 10 of 15

23MAR87

1.0.6 North Dakota AAQM Network

Currently, the Department operates and maintains 10 AAQM sites around the State. Nine are fixed SLAMS/NAMS sites and one is a special purpose monitoring (SPM) site. Table 1 lists the types of stations and parameters monitored and Map 2 shows the approximate network site locations.

1.0.7 Industrial Monitoring

Industrial sources which are required to implement source specific monitoring programs must develop their monitoring program in cooperation with the Department. Parameters to be monitored are governed by expected pollutant emissions. Specific locations for the various monitors are based upon computer generated air dispersion modeling predictions, published guidelines and agency judgments. To ensure quality data, all industrial air quality monitoring networks in the State must meet the requirements of Appendix B of 40 CFR 58. As manpower and resources allow, performance audits are

TABLE 1

AAQM NETWORK DESCRIPTION

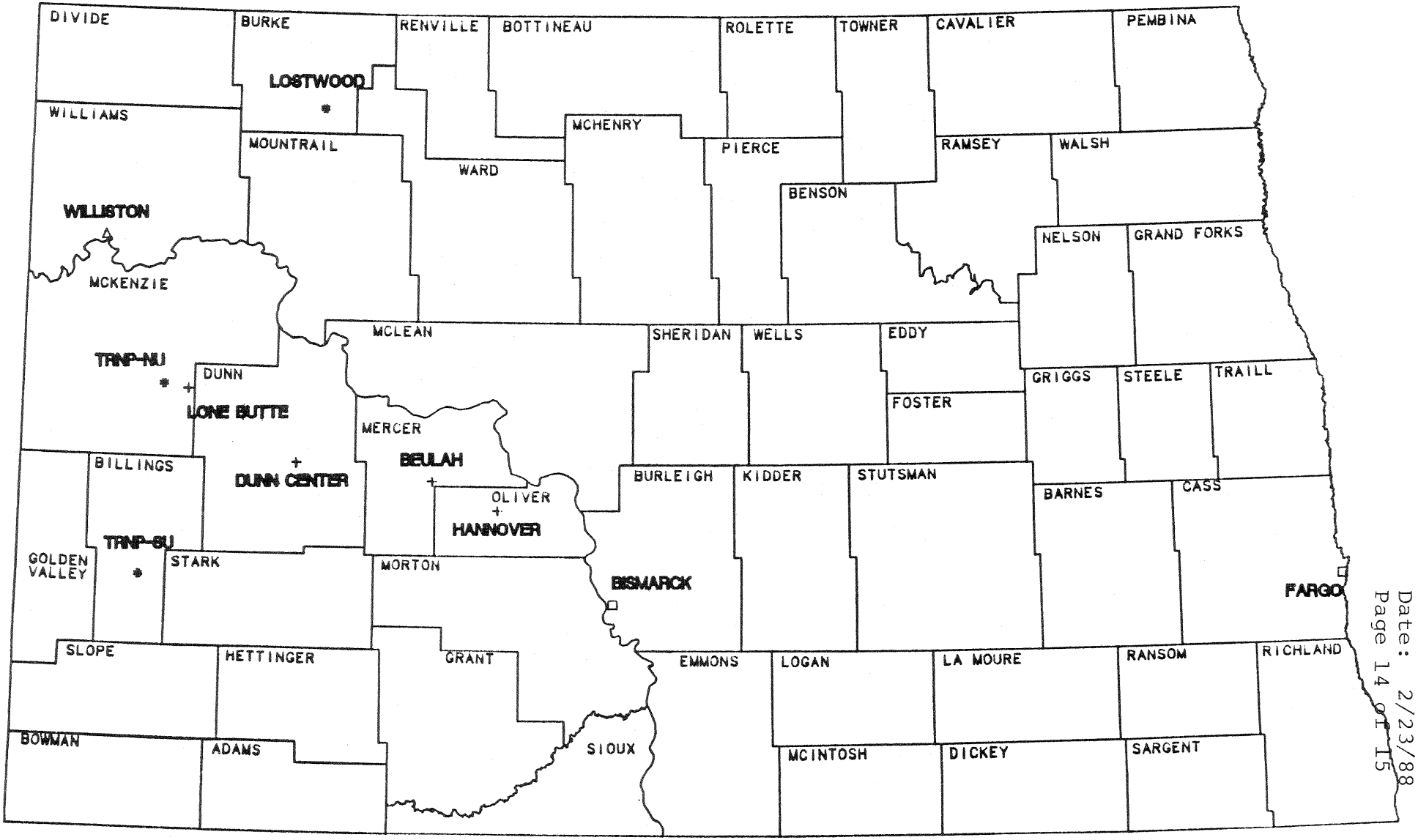
Site	Type Station	SAROAD I.D. No.	Parameter Monitored	Ref/Equiv. Method Designation No.	Operating Schedule	Monitoring Objective	Spatial Scale	Date Site Began	Date Q.A. Began
1 Fargo-Commercial	NAMS	350400001F01	TSP	Hi-Vol	6th Day	Population Exposure	Neighborhood	1/84	5/80
			PM_{10}	SSI	6th Day	Population Exposure	Neighborhood	6/85	6/85
Fargo-Commerical Dup.		350400001F09	PM_{10}	SSI	6th Day	Collocated SSI	N/A		
2 Beulah-Residential	SLAMS	350760001F01	SO_2	EQSA-0276-009	cont.	Population Exposure	Neighborhood	4/80	7/80
			NO_2	RFNA-0777-022	cont.	Population Exposure	Neighborhood	6/80	7/80
			Met	N/A	cont.	N/A	N/A	4/80	7/80
3 Bismarck-Commercial	SLAMS	350100001F01	TSP	Hi-Vol	6th Day	Population Exposure	Neighborhood	1/57	5/80
			PM_{10}	SSI	6th Day	Population Exposure	Neighborhood	4/85	4/85
Bismarck-Commercial Dup.		350100003F09	TSP	Hi-Vol	6th Day	Collocated hi-vol	N/A	10/79	5/80
4 Dunn Center-Rural	SLAMS	350340003F03	SO_2	EQSA-0276-009	cont.	General Background	Regional	10/79	5/80
			NO_2	RFNA-0777-022	cont.	General Background	Regional	10/79	5/80
			O_3	RFDA-1075-003	cont.	General Background	Regional	10/79	5/80
			Met	N/A	cont.	N/A	N/A	10/79	5/80
5 Hannover-Rural	SLAMS	350860002F05	SO_2	EQSA-0276-009	cont.	General Background	Regional	10/84	10/84
			NO_2	RFNA-0777-022	cont.	General Background	Regional	11/85	11/85
			O_3	RFDA-1075-003	cont.	General Background	Regional	5/85	5/85
			Met	N/A	cont.	N/A	N/A	10/84	10/84
6 Lostwood-Rural	SLAMS	350180001F03	PM_{10}	SSI	6th Day	General Background	Regional	1/87	1/87
			SO_2	EQSA-0276-009	cont.	General Background	Regional	1/86	1/86
			NO_2	None	cont.	General Background	Regional	12/87	12/87
			H_2S	N/A	cont.	N/A	N/A	1/86	1/86
			Met	N/A	cont.	N/A	N/A	1/86	1/86

TABLE 1 (Cont.)

AAQM NETWORK DESCRIPTION

Site	Type Station	SAROAD I.D. No.	Parameter Monitored	Ref/Equiv. Method Designation No.	Operating Schedule	Monitoring Objective	Spatial Scale	Date Site Began	Date Q.A. Began
7 TRNP(NU)-Rural	SLAMS	350700002F03	PM_{10}	SSI	6th Day	General Background	Regional	1/87	1/87
			SO_2	EQSA-0276-009	cont.	General Background	Regional	2/80	6/80
			O_3	RFDA-1075-003	cont.	General Background	Regional	11/82	11/82
			H_2S	N/A	cont.	N/A	N/A	5/80	6/80
			Met	N/A	cont.	N/A	N/A	2/80	6/80
8 TRNP(SU)-Rural	SLAMS	350080002F03	PM_{10}	SSI	6th Day	General Background	Regional	10/86	10/86
			SO_2	EQSA-0276-009	cont.	General Background	Regional	2/80	6/80
			H_2S	N/A	cont.	N/A	N/A	10/85	10/85
			Met	N/A	cont.	N/A	N/A	3/80	6/80
9 Williston-Commercial	SLAMS	351360001F01	PM_{10}	SSI	6th Day	Population Exposure	Neighborhood	5/85	5/85
10 Lone Butte-Rural	SPM	350700004F05	SO_2	EQSA-0276-009	cont.	Source Impact	Neighborhood	12/83	12/83
			H_2S	N/A	cont.	N/A	N/A	12/83	12/83
			Met	N/A	cont.	N/A	N/A	12/83	12/83

AMBIENT AIR QUALITY MONITORING SITES



+ CONTINUOUS ONLY * CONTINUOUS W/ PM10 Δ PM10 ONLY □ PM10 & TSP

MAP 2

3MAR88 10:34

conducted by this Department on each industrial monitoring network to assure the quality of the data.

Specific information on industrial ambient air quality monitoring sites is included in Appendix A.

2.0 MONITORED POLLUTANTS

2.0.1 Total Suspended Particulate

EPA recently replaced the total suspended particulate (TSP) standards with a standard for inhalable particulates (PM_{10}). The State still has standards for TSP; however, it has been recommended that the State follow the lead of EPA and adopt the same inhalable particulate standards and rescind the TSP standards. The State is currently in the process of amending the States rules and amending the State Implementation Plan (SIP) to reflect those changes. Until those proposals are adopted, we will continue to monitor for TSP. The State TSP monitoring sites are listed in Table 1 and shown on Map 2.

2.0.2 Inhalable Particulates

Due to the potential health effects of fine, inhalable particulates (IP), EPA promulgated an inhalable particulate standard and sampling procedure to replace the total suspended particulate (TSP) standards and

procedures. The standard addresses only those particles that are 10 micrometers or smaller in aerodynamic diameter and are designated as PM_{10}.

2.0.2.1 Sources

The State is in the process of developing an inventory of PM_{10} sources. The inventory will not be completed and the results available until about June 1989. Until that inventory is completed, there is little that can be said about the "major" sources of PM_{10} in the State. Based on monitoring data, however, it would appear as though there are a greater number of sources of PM_{10} in the urban areas than in the rural areas.

2.0.2.2 Monitoring Network

The initial PM_{10} monitoring network was established in 1985 at Bismarck, Dickinson, Dunn Center, Fargo, Grand Forks, Williston, and Woodworth. All but the Dunn Center and Woodworth sites were operated on an every second day schedule; those two were operated

every sixth day. However, based on approximately 1-1/2 years of actual PM_{10} data, no exceedances were observed, and it was determined that every second day sampling was not necessary. As a result of that determination, one sampler was taken from Bismarck, Dickinson, Grand Forks, and Williston to replace TSP (high-volume) samplers at Minot, TRNP-NU, Lostwood, and Beulah. A spare PM_{10} sampler replaced the TSP sampler at TRNP-SU in October 1986. Two PM_{10} samplers were left at Fargo for a collocated PM_{10} NAMS site.

In August 1987, we transferred seven PM_{10} samplers to the State of Montana, which left us with seven PM_{10} samplers. The PM_{10} monitoring sites and the number of PM_{10} samplers located at those sites are listed in Table 2, and the approximate locations are shown on Map 2.

2.0.3 Sulfur Dioxide

Coal, oil, and gas development in the west and west-central portions of North Dakota has produced a number

TABLE 2
PM_{10} SITES

Name	No. of Samplers	Operational Date
Bismarck	1	April 1, 1985
Fargo	2*	August 27, 1985
Lostwood	1	January 7, 1987
TRNP-NU	1	January 6, 1987
TRNP-SU	1	October 22, 1986
Williston	1	June 14, 1985

*These are collocated.

of sources of sulfur dioxide (SO_2). These sources include coal-fired steam 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 has become one of this Department's major concerns in regard to ambient air quality monitoring.

2.0.3.1 Major Point Sources

The major point sources of SO_2 (>100 TPY) are listed in Table 3 along with their emission rates as calculated from the most recent (1986) emissions inventory. Map 3 shows the approximate locations of these facilities.

2.0.3.2 Other Sources

The western part of the State has a number of potential sources of SO_2 associated with the development of oil and gas. These sources include individual oil/gas wells, oil storage facilities, and compressor stations. Emissions from such

TABLE 3

MAJOR SO_2 SOURCES

#	Name of Company	Type of Source	Location	County	SO_2 Emissions Ton/Year
1	American Crystal Sugar Co.	Sugar Beet Processing Plant	Drayton	Pembina	729.7
2	American Crystal Sugar Co.	Sugar Beet Processing Plant	Hillsboro	Traill	776.8
3	Amoco Oil Company	Oil Refinery	Mandan	Morton	4982.3
4	ANG Coal Gasification Co.	Synthetic Fuel Plant	Beulah	Mercer	29830.9
5	Basin Electric Power Cooperative	Steam Electric Gen. Facility	Beulah	Mercer	12904.0
6	Basin Electric Power Cooperative	Steam Electric Gen. Facility	Stanton	Mercer	13155.0
7	Cities Service	Natural Gas Processing Plant	Lignite	Burke	860.8
8	Dawn Enterprises	Ethanol Plant	Walhalla	Pembina	123.2
9	Kerr-McGee Corporation	Natural Gas Processing Plant	Arnegard	McKenzie	205.4
10	Koch Hydrocarbon Company	Natural Gas Processing Plant	McKenzie Co.	McKenzie	2705.0

TABLE 3 cont.

MAJOR SO_2 SOURCES

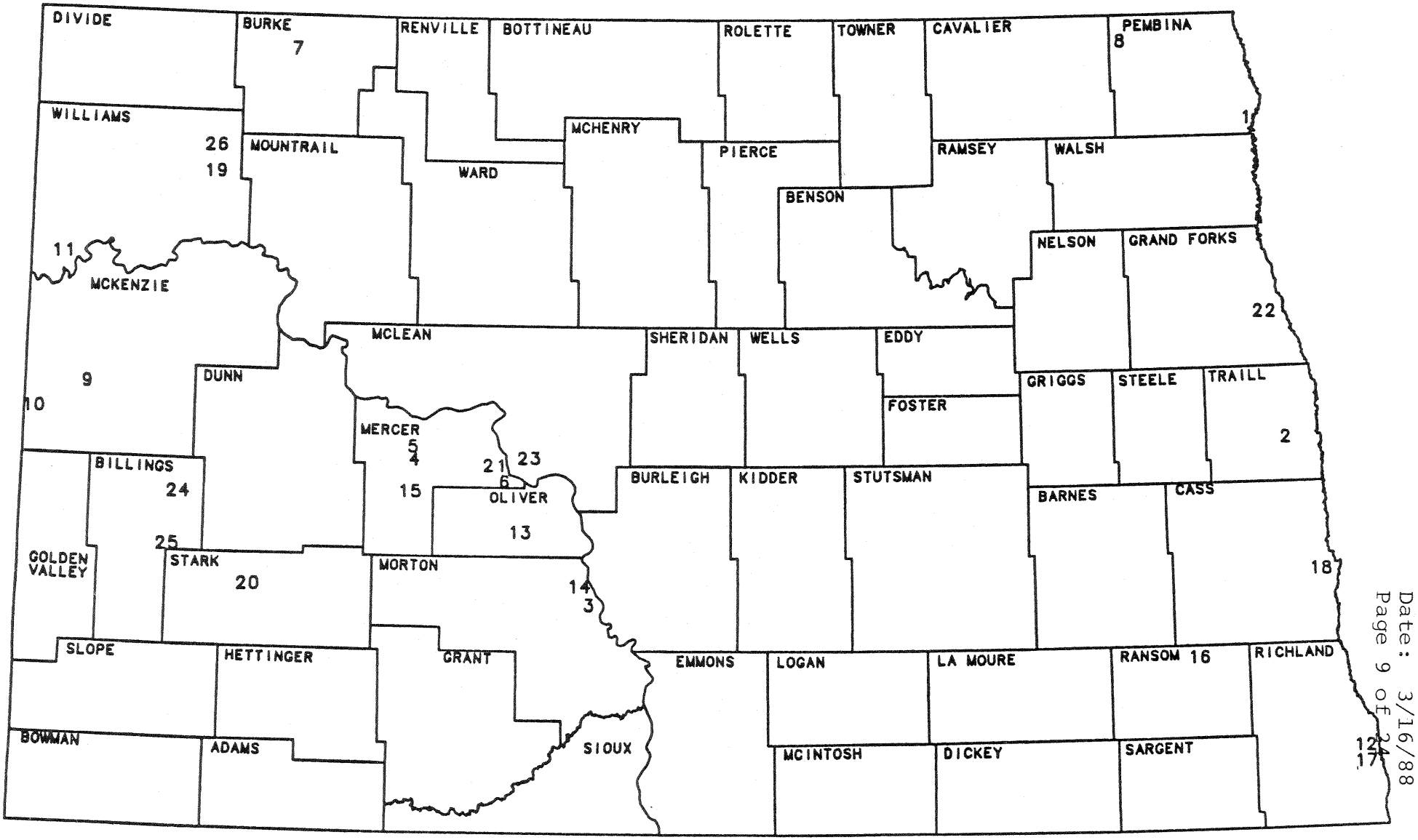
#	Name of Company	Type of Source	Location	County	SO_2 Emissions Ton/Year
11	Koch Hydrocarbon Company	Natural Gas Processing Plant	Trenton	Williams	837.0
12	Minn-Dak Farmers Coop.	Sugar Beet Processing Plant	Wahpeton	Richland	315.8
13	Minnkota Power Coop.	Steam Electric Gen. Facility	Center	Oliver	33620.0
14	Montana Dakota Utilities	Steam Electric Gen. Facility	Mandan	Morton	3050.0
15	Montana Dakota Utilities (Coyote Station)	Steam Electric Gen. Facility	Beulah	Mercer	15540.0
16	National Sun Industries, Inc.	Sunflower Processing Plant	Enderlin	Ransom	280.6
17	ND State School of Science	Heating Plant	Wahpeton	Richland	151.0
18	North Dakota State University	Heating Plant	Fargo	Cass	295.0
19	Phillips Petroleum Co.	Natural Gas Processing Plant	Tioga	Williams	10383.5
20	Royal Oak Enterprises	Charcoal Briquetting Plant	Dickinson	Stark	3771.9

TABLE 3 cont.

MAJOR SO_2 SOURCES

#	Name of Company	Type of Source	Location	County	SO_2 Emissions Ton/Year
21	United Power Association	Steam Electric Gen. Facility	Stanton	Mercer	10881.3
22	University of North Dakota	Heating Plant	Grand Forks	Grand Forks	266.0
23	UPA/CPA	Steam Electric Gen. Facility	Underwood	McLean	39417.2
24	Warren Petroleum Company	Natural Gas Processing Plant	Grassy Butte	McKenzie	1483.0
25	Western Gas Processors, Ltd.	Natural Gas Processing Plant	Fairfield	Billings	1059.1
26	Western Gas Processors, Ltd.	Natural Gas Processing Plant	McGregor	Williams	768.0

MAJOR SULFUR DIOXIDE SOURCES



MAP 3

Section: 2.0
Revision: 1
Date: 3/16/88
Page 9 of 24

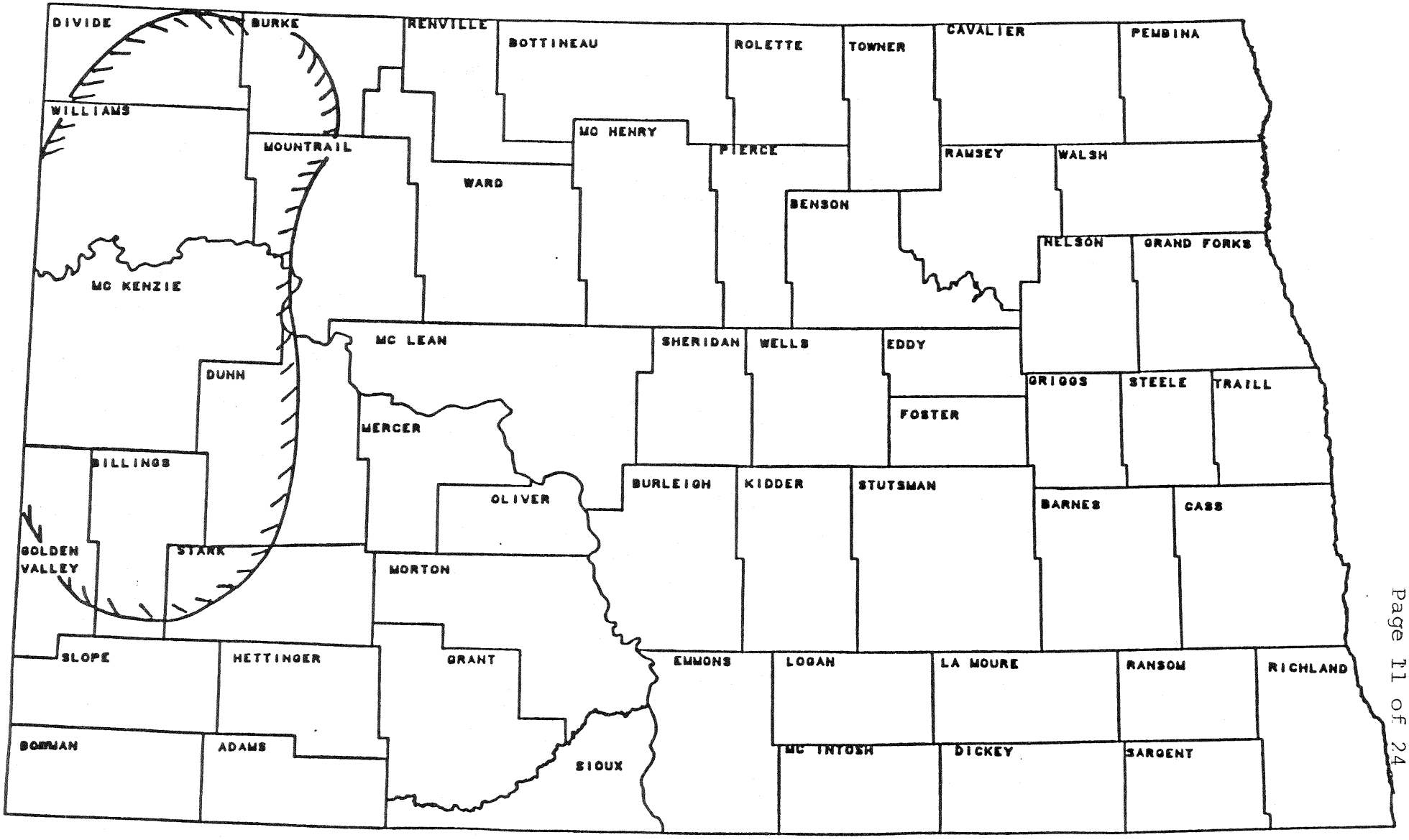
2MAR88 10:40

sources can create two problems. First, these sources may directly emit significant amounts of hydrogen sulfide (H_2S) to the ambient air (which will be addressed later); and second, flaring of the H_2S from these sources can create significant concentrations of SO_2 in the ambient air. Map 4 indicates the area of primary concern for such sources in western North Dakota.

2.0.3.3 Monitoring Network

The SO_2 monitoring sites are listed in Table 4 and Map 1 shows their approximate location. As can be seen, these monitoring sites are concentrated in the vicinity of the oil and gas development in western North Dakota and the coal-fired steam electrical generating plants in the central part of the State. The SO_2 network does not address the multiple sources located in the Red River Valley of eastern North Dakota, but these sources are relatively small (the sum of their SO_2 emissions accounts for less than 2% of the total SO_2 emissions reported in Table 3).

MAJOR OIL/GAS DEVELOPMENT AREA



MAP 4

TABLE 4

CONTINUOUS MONITORING SITES*

Name	Pollutant Monitored	Type Station
1. Theodore Roosevelt National Park - North Unit	SO_2 H_2S O_3	SLAMS
2. Theodore Roosevelt National Park - South Unit	SO_2 H_2S	SLAMS
3. Dunn Center	SO_2 NO/NO_2 O_3	SLAMS
4. Beulah	SO_2 NO/NO_2	SLAMS
5. Lostwood Wilderness Area	SO_2 H_2S NO/NO_2	SLAMS
6. Lone Butte	SO_2 H_2S	SPM
7. Hannover	SO_2 NO/NO_2 O_3	SLAMS

*All continuous sites have wind measuring equipment.

2.0.4 Hydrogen Sulfide

Although no Federal Ambient Air Quality Standards exist for hydrogen sulfide (H_2S), the State of North Dakota has adopted a 1-hour H_2S standard. H_2S emissions in the State stem almost totally from the oil and gas operations in the western part of the State and principally from the area outlined on Map 4. Flares and treater stacks associated with oil/gas wells, oil storage tanks, compressor stations, pipeline risers, and natural gas processing plants are all potential sources of H_2S emissions.

2.0.4.1 Monitoring Network

There are four monitoring sites for H_2S emissions. These are the TRNP-NU and TRNP-SU sites, the Lostwood site, and the Lone Butte site (locations 1, 2, 5, and 6 in Table 4).

2.0.5 Nitrogen Oxides

Nitrogen oxides (NO_x) is the term used to represent both nitric oxide (NO) and nitrogen dioxide (NO_2). In North Dakota the primary sources of NO_x are the coal-fired steam electrical generating plants and automobiles and other internal combustion engine sources. NO_2 is formed when NO is oxidized in the ambient air.

2.0.5.1 Point Sources

Most major point sources of NO_x in North Dakota are associated with large coal burning steam 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. The major stationary point sources (>100 TPY) of NO_x, as calculated from the most recent (1986) emission inventory, are listed in Table 5. Map 5 shows the approximate locations of these facilities.

TABLE 5

MAJOR NO_x SOURCES

#	Name of Company	Type of Source	Location	County	NO_x Emissions Ton/Year
1	American Crystal Sugar Co.	Sugar Beet Processing Plant	Drayton	Pembina	347.7
2	American Crystal Sugar Co.	Sugar Beet Processing Plant	Hillsboro	Pembina	132.2
3	Amoco Oil Company	Oil Refinery	Mandan	Morton	940.8
4	ANG Coal Gasification Co.	Synthetic Fuel Plant	Beulah	Mercer	3027.5
5	Basin Electric Power Cooperative	Steam Electric Gen. Facility	Beulah	Mercer	9142.0
6	Basin Electric Power Cooperative	Steam Electric Gen. Facility	Stanton	Mercer	9641.0
7	Cities Service	Natural Gas Processing Plant	Lignite	Burke	273.0
8	Koch Exploration Company	Compressor Station	Alexander	McKenzie	153.0
9	Koch Hydrocarbon Company	Compressor Station	Goats Pass	Billings	216.0
10	Koch Hydrocarbon Company	Compressor Station	Rawson	McKenzie	176.0

TABLE 5 cont.

MAJOR NO_x SOURCES

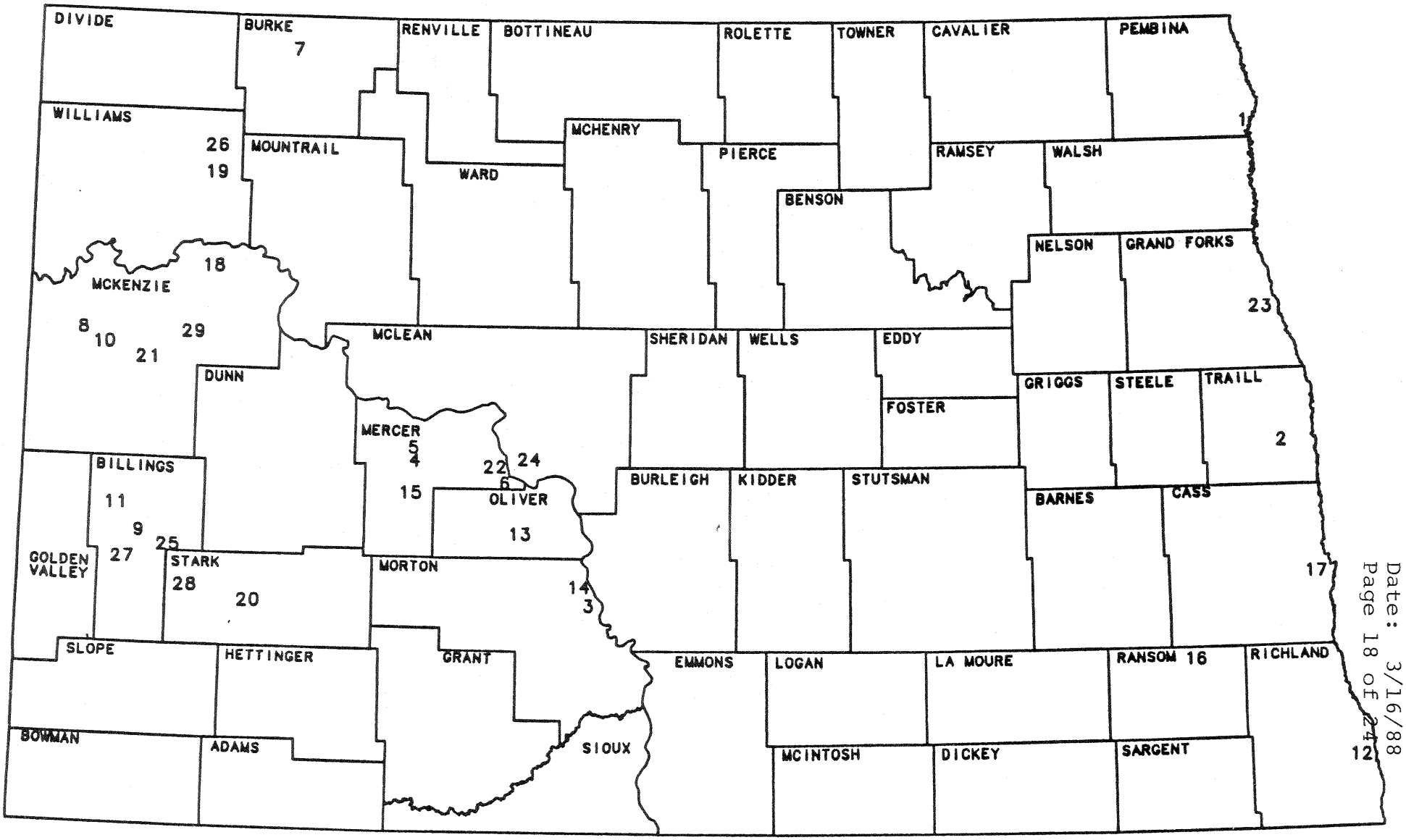
#	Name of Company	Type of Source	Location	County	NO_x Emissions Ton/Year
11	Koch Hydrocarbon Company	Compressor Station	Tree Top	Billings	128.0
12	Minn-Dak Farmers Coop.	Sugar Beet Processing Plant	Wahpeton	Richland	698.7
13	Minnkota Power Coop.	Steam Electric Gen. Facility	Center	Oliver	18723.0
14	Montana Dakota Utilities	Steam Electric Gen. Facility	Mandan	Morton	859.0
15	Montana Dakota Utilities (Coyote Station)	Steam Electric Gen. Facility	Beulah	Mercer	10360.0
16	National Sun Ind., Inc.	Sunflower Processing Plant	Enderlin	Ransom	221.6
17	North Dakota State University	Heating Plant	Fargo	Cass	115.1
18	Phillips Petroleum Co.	Compressor Station	Hawkeye	McKenzie	387.5
19	Phillips Petroleum Co.	Natural Gas Processing Plant	Tioga	Williams	619.3
20	Royal Oak Enterprises	Charcoal Briquetting Plant	Dickinson	Stark	626.5

TABLE 5 cont.

MAJOR NO_x SOURCES

#	Name of Company	Type of Source	Location	County	NO_x Emissions Ton/Year
21	True Oil Company	Natural Gas Processing Plant	Watford City	McKenzie	261.2
22	United Power Association	Steam Electric Gen. Facility	Stanton	Mercer	6678.0
23	University of North Dakota	Heating Plant	Grand Forks	Grand Forks	204.0
24	UPA/CPA	Steam Electric Gen. Facility	Underwood	McLean	28635.0
25	Western Gas Processors, Ltd.	Natural Gas Processing Plant	Fairfield	Billings	203.2
26	Western Gas Processors	Natural Gas Processing Plant	McGregor	Williams	165.4
27	Western Gas Processors, Ltd.	Compressor Station	Mystery Creek	Billings	267.4
28	Williston Basin Interstate Pipeline	Compressor Station	Belfield	Stark	195.2
29	Williston Gas Company	Compressor Station	Demicks Lake	McKenzie	113.9

MAJOR NITROGEN OXIDE SOURCES



MAP 5

Section: 2.0
Revision: 1
Date: 3/16/88
Page 18 of 24

2MAR88 11:23

2.0.5.2 Area Sources

As indicated earlier, a second major source of oxides of nitrogen is attributed to sources in urban areas, specifically automobile emissions. The EPA has specified a design criteria requiring nitrogen dioxide NAMS monitoring in urbanized areas with populations greater than 1,000,000. North Dakota has no significant urbanized areas with regard to oxides of nitrogen; in fact, the entire population of the State is less than 1,000,000.

2.0.5.3 Monitoring Network

The Department currently operates four $NO/NO_2/NO_x$ analyzers in the State. These are located at Dunn Center, Beulah, Lostwood, and Hannover (sites 3, 4, 5 and 7 in Table 4).

2.0.6 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 to September 30. However, we operate the O_3 analyzers from April 1 to September 30 in order to collect two full quarters of data.

2.0.6.1 Point Sources

Table 6 lists the major point sources of VOC emissions in the State (>100 TPY). Map 6 shows the approximate locations of these facilities.

2.0.6.2 Area Sources

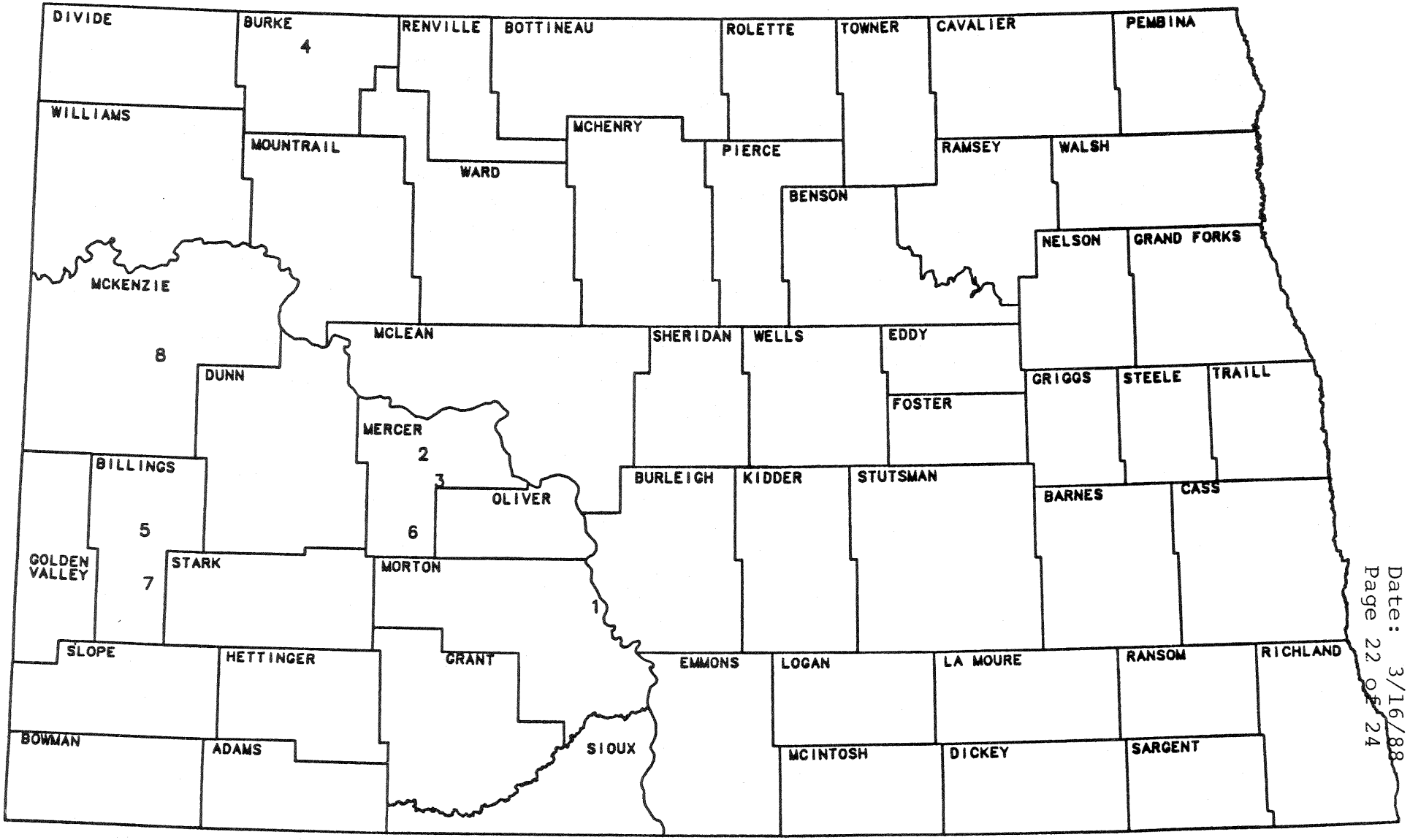
Point sources contribute only part of the total VOC and NO_x emissions. The remaining emissions are attributed to mobile sources in urban areas. The EPA has specified a design criteria for selecting

TABLE 6

MAJOR VOC SOURCES

#	Name of Company	Type of Source	Location	County	VOC Emissions Ton/Year
1	Amoco Oil Company	Oil Refinery	Mandan	Morton	601.0
2	ANG Coal Gasification Co.	Synthetic Fuel Plant	Beulah	Mercer	551.1
3	Basin Electric Power Cooperative	Steam Electric Gen. Facility	Beulah	Mercer	205.0
4	Cities Service	Natural Gas Processing Plant	Lignite	Burke	106.4
5	Koch Hydrocarbon Company	Compressor Station	Goats Pass	Billings	102.0
6	Minnkota Power Coop.	Steam Electric Gen. Facility	Center	Oliver	169.0
7	Texaco Pipeline Company	Gas Terminal	Fryburg	Billings	252.2
8	True Oil Company	Natural Gas Processing Plant	Watford City	McKenzie	102.0

MAJOR VOC SOURCES



MAP 6

2MAR88 14:11

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 monitoring for ozone.

2.0.6.3 Monitoring Network

The State currently has three continuous ozone analyzers in operation. These are at Dunn Center (#3 - Table 4), Hannover (#7 - Table 4) and at Theodore Roosevelt National Park - North Unit (#1 - Table 4).

2.0.7 Carbon Monoxide

Carbon monoxide (CO) has been determined to be generated chiefly by automotive sources. As such, high CO concentrations are generally found near major roadways and intersections which exhibit traffic flow problems and where atmospheric ventilation is poor.

2.0.7.1 Monitoring Network

Computer dispersion modeling and limited ambient air quality monitoring have shown no problems with regard to compliance with the Ambient Air Quality Standards for CO. Additionally, the EPA has specified an urban area with a population density of 500,000 or greater as the primary criteria for identifying and establishing a NAMS CO monitoring network. Therefore, no air quality monitoring for CO is currently being conducted in the State.

2.0.8 Lead

Through prior sampling efforts, the Department has determined that the State of North Dakota does not have any significant sources of lead. This determination, coupled with the Federal requirement for a NAMS network only in urbanized areas with populations greater than 500,000, resulted in the termination of the lead monitoring program effective January 1, 1984.

3.0 MONITORING SITE EVALUATION

As was stated in section 1.0.1, one of the purposes of this document is to identify needed modifications to the network. That purpose is achieved through this monitoring site evaluation.

3.0.1 Total Suspended Particulate Monitoring Sites

With the increased importance being placed on the inhalable particulate (PM_{10}) network and budgetary cutbacks at the State and Federal levels, the number of TSP samplers has been greatly reduced. We anticipate terminating all TSP sampling at the end of 1988.

3.0.2 Inhalable Particulate (PM_{10}) Monitoring Sites

The PM_{10} sites all meet the siting criteria as specified in the PM_{10} regulation. All of the PM_{10} samplers are now operating on an every sixth day schedule. The placement of the PM_{10} samplers should give us a representative sample across the State.

3.0.3 Sulfur Dioxide Monitoring Sites

All SO_2 sites were reviewed for their representativeness, and found to be acceptable. The present sites are located in areas of multiple SO_2 sources; oil and gas development in the western part of the state and coal development in the central part.

Hannover, which suffered electrical damage to almost all of its equipment in November 1986, was reactivated in March 1988.

3.0.4 Hydrogen Sulfide Monitoring Sites

The Lone Butte Portable Monitoring Site was established, primarily, to monitor H_2S emissions in the Lone Butte Oil Field. The oil companies are continuing their efforts to reduce H_2S emissions in that area. The occurrence of violations of the H_2S standards as measured at TRNP-NP has been greatly reduced since we have been working with the oil companies in the Lone Butte field, but there is still a need for continued operation at that location.

3.0.5 Nitrogen Oxides Monitoring Sites

From the data, it is obvious that North Dakota does not have a large problem with nitrogen oxides. The Dunn Center site has very low hourly and annual values for both NO and NO_2. However, if one looks at the percentage of values being measured that are greater than the minimum detectable, there has been an increasing trend from one year to the next over the last several years. Dunn Center is our baseline station for PSD considerations.

The site at Beulah is interesting in that it is located in the heart of the coal-burning industry area. As such, one would expect to find the maximum concentrations of nitrogen oxides there. The full potential has not been realized for this site because modification of the plants in the area has not been completed. The Department believes that an NO_x analyzer should continue operating at Beulah at least for the near term.

The Hannover site is downwind for the prevailing winds from the major sources at Beulah and is also centrally located with respect to four other major NO_x sources located to the east of the Beulah area. Evaluation of past data from the Hannover site shows that both the NO_x and NO_2 levels are slightly lower than for Beulah, but higher than Dunn Center. The Hannover site was reactivated in March 1988.

The U.S. Fish and Wildlife Service has installed an NO_x analyzer at the Lostwood site. The measured levels of NO_x at that site do show some apparent influence from the power plant at Estavan, Saskatchewan.

3.0.6 Ozone Monitoring Sites

Ozone levels in the State are quite low with maximum observed values running slightly over half the standard. We are operating the O_3 analyzers only between April 1 and September 30. The Hannover site was reactivated in March 1988.

3.0.7 Summary

The evaluation of the monitoring sites is summarized in the following table (Table 7).

TABLE 7

MONITORING SITE EVALUATION

Site	Parameter	Meets Needs	Modification Needed	New Site Needed	Parameter Not Needed	Date Deleted
Beulah Residential	PM_{10}				X	7/87
	SO_2	X				
	NO_2	X				
	MET	X				
Bismarck Commercial	TSP	X				
	SO_4				X	10/87
	NO_3				X	10/87
	PM_{10}	X				
Dickinson Commercial	TSP				X	7/87
	SO_4				X	7/87
	NO_3				X	7/87
	PM_{10}				X	7/87
Dunn Center Rural	TSP				X	6/87
	SO_4				X	6/87
	NO_3				X	6/87
	PM_{10}				X	6/87
	SO_2	X				
	NO_2	X				
	O_3	X				
	MET	X				
Fargo Commercial	TSP	X				
	SO_4				X	10/87
	NO_3				X	10/87
	PM_{10}	X				
Grand Forks Commercial	TSP				X	8/87
	SO_4				X	8/87
	NO_3				X	8/87
	PM_{10}				X	8/87
Hannover Rural	SO_2	X				
	NO_2	X				
	O_3	X				
	MET	X				

Site	Parameter	Meets Needs	Modification Needed	New Site Needed	Parameter Not Needed	Date Deleted
Lostwood Rural	PM_{10}	X				
	SO_2	X				
	H_2S	X				
	NO_2	X				
	MET	X				
Minot Commercial	PM_{10}				X	8/87
Portable Unit (SPM) (Western ND oil/gas Area Network)	SO_2	X		(Additional site being evaluated)		
	H_2S	X				
	MET	X				
TRNP-NU Rural	PM_{10}	X				
	SO_2	X				
	O_3	X				
	H_2S	X				
	MET	X				
TRNP-SU Rural	PM_{10}	X				
	SO_2	X				
	H_2S	X				
	MET	X				
Williston Commercial	TSP				X	8/87
	SO_4				X	8/87
	NO_3				X	8/87
	PM_{10}	X				
Woodworth (Rural)	TSP				X	6/87
	SO_4				X	6/87
	NO_3				X	6/87
	PM_{10}				X	6/87

APPENDIX A
Industrial AAQM Networks

As was previously mentioned, the State's air quality monitoring network presently does not include source specific monitoring. The Department, in issuing Permits to Construct and Permits to Operate to major sources, may require industry to establish air quality monitoring networks to assess each source's impact on air quality. The scope of each industrial monitoring plan is developed on a case-by-case basis between the operator of the source and the Department. Parameters to be measured are determined by analysis of expected/actual pollutant emissions. The location(s) of the various monitors are based on computer generated air dispersion modeling predictions of maximum (worst-case) ground level concentrations and a comparison of these values with the various Ambient Air Quality Standards and PSD increments.

A summary of each industrial monitoring program is provided in Table A. Map A shows the general locations of these industries.

TABLE A

CURRENT INDUSTRIAL AAQM SITES (MAR 1988)

Industry	Site No.	Comments	Parameters Monitored	Started Monitoring	Stopped Monitoring	Parameter/Analyzer	Representative
1 AMERICAN NATURAL GAS	1		H_2S	5-1-83	2-24-85	H_2S/TECO 45	Danny R. Guminski ANG Coal Gas. Co. Great Plains Gas. Associates P.O. Box 1149 Beulah, ND 58523 (701)873-6603
	2		H_2S	3-4-85			
	1	(Contingency)	SO_2	7-7-84		SO_2/TECO 43	
	2	(Contingency)	SO_2	7-7-84	10-18-86		
	3	(Contingency)	SO_2	12-13-86			
2 COTEAU MINE	1		TSP	2-21-80		TSP/Hi-Vol	Ms. Andrea Stomberg 2000 Schafer Street P.O. Box 5500 Bismarck, ND 58502 (701)258-2200
	2	(Collocated) (thru 1-31-83)	TSP	2-21-80	1-31-83		
	2A		TSP	5-1-83	8-14-87		
	3	(Collocated) (Starting 5-1-83)	TSP	7-14-80			
	4		TSP	8-21-87			
3 FALKIRK MINE	1		TSP	9-79	6-29-84	TSP/Hi-Vol	Ms. Andrea Stomberg 2000 Schafer Street P.O. Box 5500 Bismarck, ND 58502 (701)258-2200
	2		TSP	9-79	1-31-83		
	3		TSP	9-79	12-20-80		
	3A		TSP	3-1-81	6-29-84		
	4	Collocated	TSP	7-1-84			
	5		TSP	9-13-81			
	6	Relocated 2-8-87	TSP	9-7-83			
	7		TSP	7-11-84			
	8		TSP	7-11-84			

TABLE A (Cont.)

CURRENT INDUSTRIAL AAQM SITES (MAR 1988)

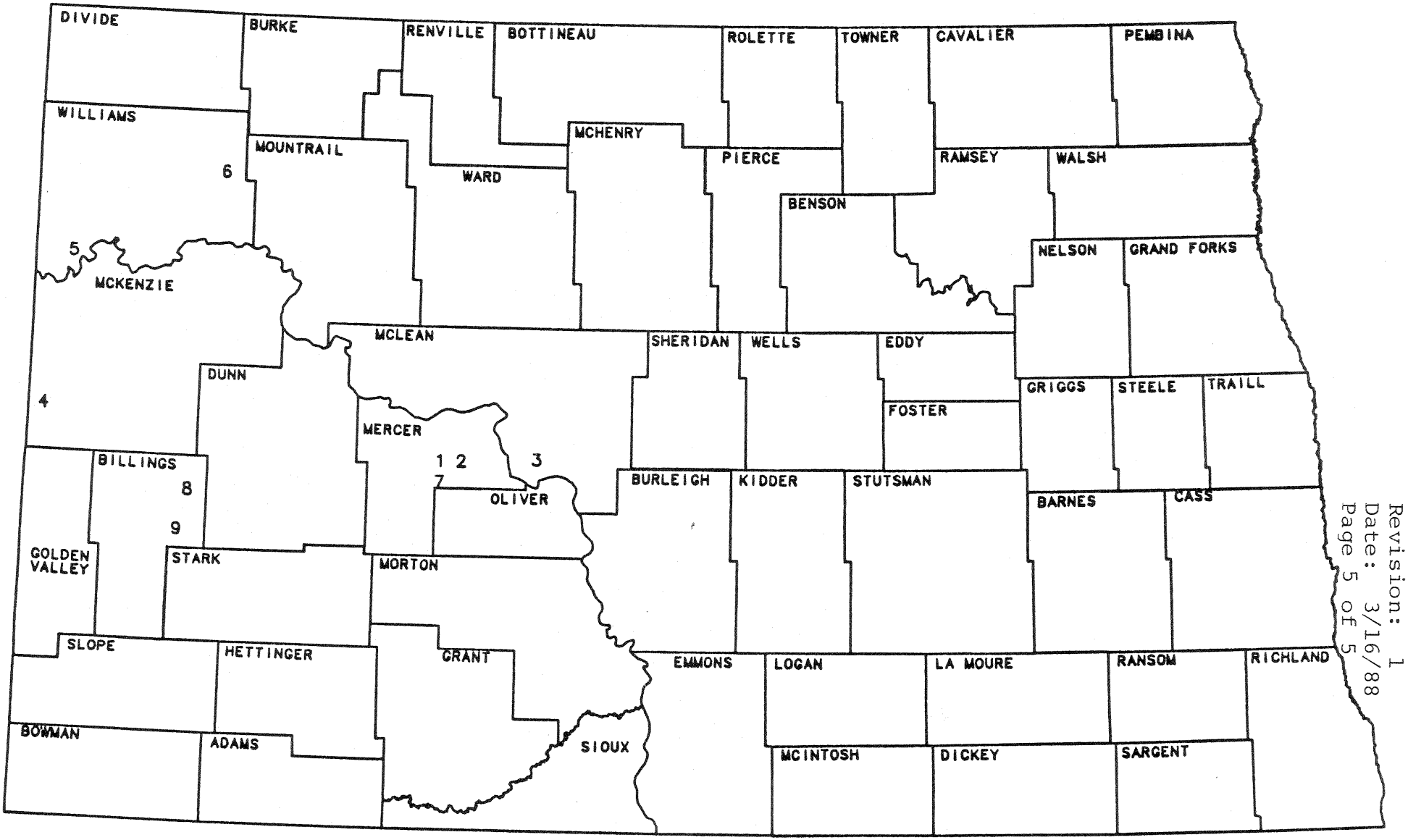
Industry	Site No.	Comments	Parameters Monitored	Started Monitoring	Stopped Monitoring	Parameter/Analyzer	Representative
4 KOCH HYDROCARBON CO. (McKENZIE GAS PLANT)	1		SO_2	7-29-81		SO_2/TECO 43	Robert Viaille
			H_2S	10-07-81		H_2S/TECO 43/340(45)	Box 2256
			WS,WD,TEMP	7-14-81		MET/Climatronics	Wichita, KS 67201
		(Sites 2&3					(316)832-5500
	2	inoperative 7-82 to	H_2S	12-02-81			
	3	4-83)	SO_2	7-29-81	7-14-86		
	3A	WS,WD Added 7-9-87	SO_2,WS,WD	7-15-86			
5 KOCH HYDROCARBON CO. (TRENTON)	1	(At Plant)	H_2S	9-1-81		SO_2/TECO 43	Robert Viaille
			WS,WD,TEMP, DEW Pt.	8-21-81		H_2S/TECO 45	Box 2256
			Solar Rad, PRECIP, Bar Press.			MET/Climatronics	Wichita, KS 67201 (316)832-5500
	2		SO_2	8-21-81	1-1-88		
6 PHILLIPS PETROLEUM CO.	1		SO_2	7-1-87		SO_2/Teco 43	Mr. Tom Davis
	2	MET	H_2S,WS,WD	7-1-87		H_2S/Teco 45A	11 D4 Phillips Bldg.
	3	Installed 12-8-87	SO_2	11-5-87		MET/Unknwn	Bartlesville, OK 74003
						SO_2/ML 8850	(918)661-1468
7 RAMP - Antelope Valley Coyote ANG	1		TSP	8-1-79			
			SO_2,NO/NO_2,O_3			TSP/Hi-Vol	Keith Ganzer
			O_3			SO_2/TECO 43	Basin Elec. Power Co-op.
						NO/NOx/Mon.Labs 8440	1717 E. Interstate Avenue
	2	Collocated	TSP	8-1-79		O_3/Mon.Labs 8410	Bismarck, ND 58501
			SO_2,NO/NO_2, WD,WS,TEMP, Bar.P.,T, SIGMA			MET/Climatronics	(701)223-0441
	3		TSP, SO_2, NO/NO_2	8-1-79			
	4		TSP, SO_2, NO/NO_2,O_3	8-1-79			

TABLE A (Cont)

CURRENT INDUSTRIAL AAQM SITES (MAR 1988)

Industry	Site No.	Comments	Parameters Monitored	Started Monitoring	Stopped Monitoring	Parameter/Analyzer	Representative
RAMP (Cont.)	5		TSP, SO_2, NO/NO_2	8-1-79			
8 WARREN PETROLEUM	1		SO_2	9-28-78	1-1-88	SO_2/Meloy SA285E	Ms. Lynn Reed
	2		SO_2	10-27-78	1-5-87	H_2S/Meloy SA285E	Box 1589
	3	(MET moved from plant to Site 3 on 9-81)	SO_2, H_2S, WS,WD,Bar. P.,TEMP	10-28-78 10-29-78		MET/Weathertronics	Tulsa, OK 74102 (918)560-4119
9 WESTERN GAS PROCESSORS	1	(MET Moved to Site 2 3-9-88)	SO_2 WS,WD,TEMP	7-29-81 7-14-81	3-9-88	SO_2/TECO 43 MET/MET ONE	Bobby Schmitz 10701 Melody Drive
	2		H_2S	3-19-88		H_2S/Teco 45	Northglenn, CO 80234 (303)452-5603
	3		SO_2	3-9-88			

INDUSTRIAL AMBIENT AIR QUALITY MONITORING NETWORK



MAP A