Annual Report

North Dakota
Air Quality Monitoring
Data Summary
1995

North Dakota Department of Health
Division of Environmental Engineering

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North Dakota Air Quality Monitoring Data Summary 1995

April 1996

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EXECUTIVE SUMMARY

The North Dakota Department of Health operated thirteen ambient and two special purpose air quality monitoring sites and industry operated 17 source-specific air quality monitoring sites. The data from these sites indicated that the quality of the ambient air in North Dakota is generally good.

There were no sulfur dioxide, nitrogen dioxide, ozone , hydrogen sulfide, or particulate matter exceedances of either the State or Federal standards measured during the year.

The State began collecting particulate matter (<2.5 microns) and 5-minute sulfur dioxide data to begin preparing for potential Federal standards. Either of both proposed standards could be added to the existing Federal and State ambient air quality standards.

INTRODUCTION

The North Dakota Department of Health, Environmental Health Section, Division of Environmental Engineering, henceforth known as the Department, has the primary mission of protecting the health and welfare of North Dakotans from the harmful effects of air pollution. The Department ensures that the ambient air quality in North Dakota is better than the levels required by the State and Federal Ambient Air Quality Standards[1,2] and the "Prevention of Significant Deterioration of Air Quality Rules."[3] To address this responsibility, the Department operates a network of ambient air quality monitors.

In addition to the Department's ambient air quality monitors, five industrial sources of air pollutants operated air quality monitoring sites within each source's immediate sphere of influence. The site locations selected are based on computer modeling and prevailing wind directions.

This report provides an overview of air quality monitoring activities conducted by the Department and industry during the 12-month period beginning January 1, 1995, and ending December 31, 1995. The report includes data summaries for the monitored pollutants and significant changes that occurred to the monitoring program during the year.

NETWORK DESCRIPTION

Department Sites

During 1995, the Department operated 15 air quality monitoring sites. Thirteen were ambient monitoring sites and two were special purpose monitoring (SPM) sites. The SPM sites were a site in the Whiskey Joe oil field located near the Theodore Roosevelt National Park - South Unit and a site near the AMOCO Refinery in Mandan. Table 1 lists the Department's monitoring sites active during the year.

In general, the Department's ambient air quality monitoring (AAQM) sites obtain air quality data that satisfy four objectives: 1) to determine representative concentrations in areas of high population density (urban or population oriented monitoring); 2) to determine general background concentration levels; 3) to measure highest concentrations expected to occur in an area covered by an individual site; and 4) to determine representative impacts on ambient air quality levels near significant sources.

The Department's ambient air quality monitoring network normally does not include "source-specific" monitoring; i.e., monitoring a single, specific source. However, the Mandan - Refinery site was established to collect source-specific maximum 5-minute peak and hourly sulfur dioxide averages.

The Department, in issuing Permits to Construct and Permits to Operate for major sources, may require these sources to operate air quality monitoring programs to assess a source's impact on local air quality.

Industry Sites

Industry operated 17 source-specific air quality monitoring sites during the year. Table 2 lists the industry networks and monitoring sites active during the year.

In general, the industry air quality monitoring sites obtain data at locations that are expected to show high concentrations of pollution from a specific source. These source-specific site locations are selected using computer dispersion modeling programs and annual wind patterns. The distance a monitoring site is located from a source is determined by the primary pollutant being monitored.

Figure 1 displays both Department and industry monitoring sites. If an industry has more than one site, only the general location within the county is indicated.

TABLE 1

State AAQM Network Description

Site Name	Type Station	Parameter Monitored[1]	Operating Schedule	Monitoring Objective[2]	Spatial Scale[2]	Date Site Began
1 Beulah Residential[3]	SLAMS	PM_{10} SO_2, NO_2, O_3, MET	6th Day cont.	Population Exposure Population Exposure	Neighborhood Urban	12/95 4/80
2 Bismarck Commercial[4]	SLAMS	PM_{10}	6th Day	Population	Neighborhood	4/85
3 Bismarck Residential[5]	SLAMS	PM_{10} $PM_{2.5}$	6th Day 6th Day	Population Exposure Population Exposure	Neighborhood Neighborhood	7/95 7/95
4 Dickinson Residential	SLAMS	PM_{10}	6th Day	Population Exposure	Neighborhood	7/89
5 Dunn Center - Rural	SLAMS	SO_2, MET	cont.	General Background	Regional	10/79
6 Fargo Commercial[6]	NAMS	PM_{10} PM_{10}	6th Day 6th Day	Population Exposure Collocated SSI	Neighborhood N/A	6/85
7 Fargo Residential[7]	SLAMS	PM_{10} PM_{10} SO_2, NO_2, O_3, MET	6th Day 6th Day cont.	Population Exposure Collocated SSI Population Exposure	Neighborhood N/A Regional	8/95 8/95
8 Grand Forks - Commercial	SLAMS	PM_{10}	6th Day	Population Exposure	Neighborhood	7/89
9 Hannover - Rural	SLAMS	SO_2, NO_2, O_3, MET	cont.	General Background	Regional	10/84
10 Mandan - Refinery[8]	SPM	SO2, MET	cont.	Source Impact	Neighborhood	12/95
11 Sharon	SLAMS	SO_2, NO_X O_3, MET PM_{10}	cont. 6th Day	General Background	Regional	7/94
12 TRNP(NU) - Rural	SLAMS	SO_2, O_3, H_2S, MET	cont.	General Background	Regional	2/80
13 Whiskey Joe[9]	SPM	SO2, H2S, MET	cont.	Source Impact	Neighborhood	7/95
14 Williston - Commercial[10]	SLAMS	PM_{10}	6th Day	Population Exposure	Neighborhood	5/85
15 Williston Residential[11]	SLAMS	PM_{10}	6th Day	Population Exposure	Neighborhood	8/95

1. MET refers to meteorological and indicates wind speed and wind direction monitoring equipment.
2. Not applicable to MET.
3. PM_{10} began December 11.
4. Shut down July 24.
5. Began July 20.
6. Shut down August 24
7. Began August 24.
8. Began December 14.
9. Began July 27.
10. Shut down August 16.
11. Began August 16.

TABLE 2

Industry AAQM Network Description

Company	Site Name	Parameter Monitored[1]	Operating Schedule	Monitoring Objective[2]	Spatial Scale[2]	Date Site Began
1 Amerada Hess Corporation	TIOGA #1	SO_2	cont.	Source	Neighborhood	7/87
	TIOGA #2	H_2S, MET	cont.	Source	Neighborhood	7/87
	TIOGA #3	SO_2	cont.	Source	Neighborhood	11/87
2 Coteau Properties Company[3]	COTEAU #5	PM_{10}	6th Day	Source	Neighborhood	5/93
	COTEAU #6	PM_{10}	6th Day	Source	Neighborhood	5/93
	COTEAU #7	PM_{10}	6th Day	Source	Neighborhood	5/93
	COTEAU #8	PM_{10}	6th Day	Source	Neighborhood	5/93
3 Dakota Gasification Company	DGC #11[4]	SO_2	cont.	Source	Neighborhood	7/84
	DGC #12	SO_2, NO_2, MET	cont.	Source	Neighborhood	1/80
	DGC #13[5]	H_2S	cont.	Source	Neighborhood	2/85
	DGC #14	SO_2	cont.	Source	Neighborhood	1/89
	DGC #15[4]	SO_2, NO_2	cont.	Source	Neighborhood	1/80
	DGC #16[6]	SO_2	cont.	Source	Neighborhood	10/95
	DGC #17[6]	SO_2, NO_2	cont	Source	Neighborhood	10/95
4 Koch Hydrocarbon Company	KOCH #3	SO_2, MET	cont.	Source	Neighborhood	11/94
	KOCH #4	H_2S, MET	cont.	Source	Neighborhood	5/94
5 W. H. Hunt Estate	HUNT #5	SO_2, H_2S, MET	cont.	Source	Neighborhood	11/92

1. MET refers to meteorological and indicates wind speed and wind direction monitoring equipment.
2. Not applicable to meteorological parameters.
3. Terminated on June 30.
4. Shut down September 30.
5. Shut down August 31.
6. Began October 1.

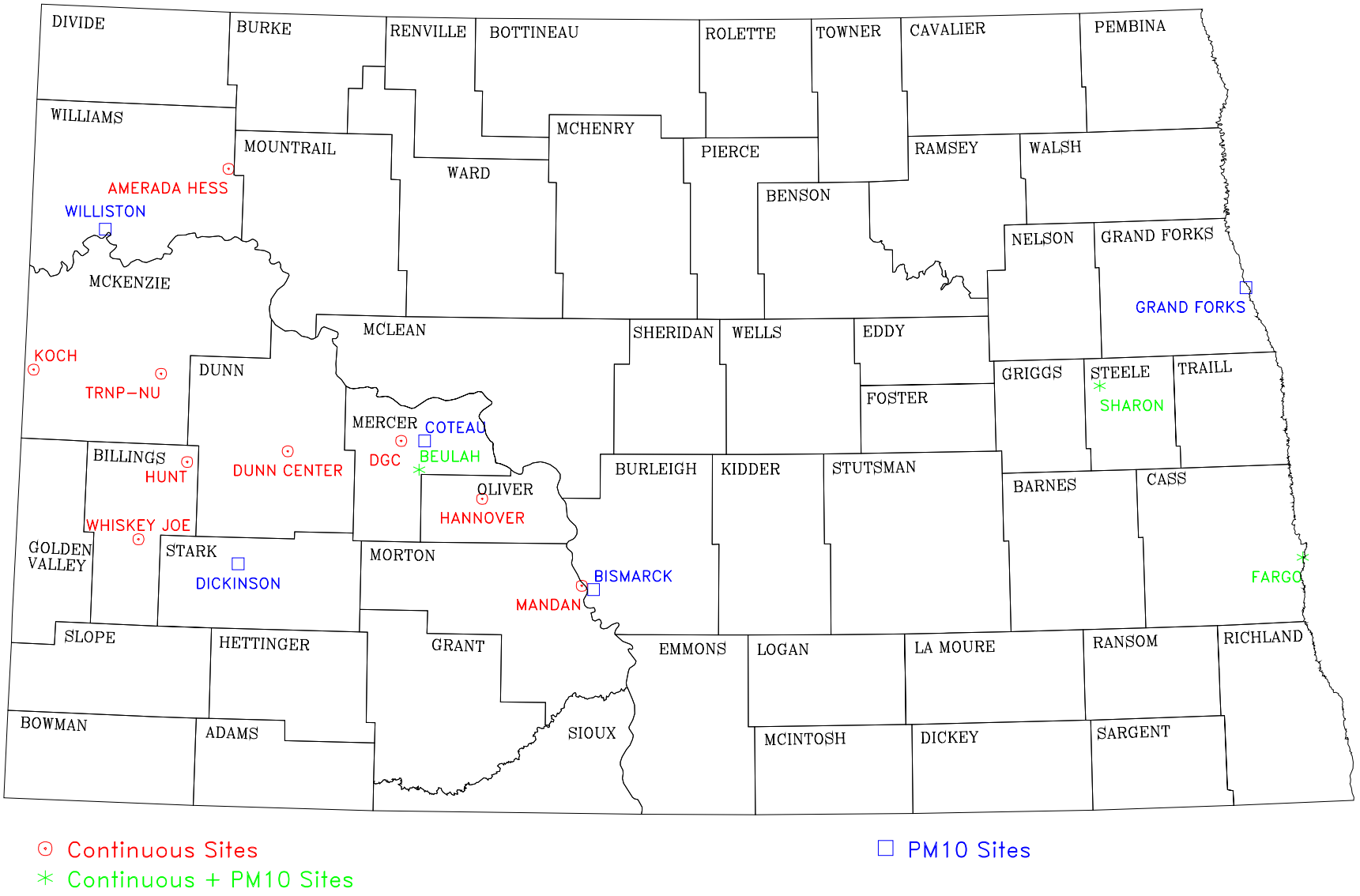


Figure 1 North Dakota Air Quality Monitoring Network

NETWORK CHANGES

Department Changes

The Fargo Commercial, Bismarck Commercial, and Williston Commercial PM_{10} monitoring sites were moved from the rooftops to new residential locations that provide a better indication of population exposure to particulate matter. The Fargo samplers were moved August 24, Bismarck was moved July 24, and Williston was moved August 16. A particulate matter (< 10 micron) sampler (PM_{10}) sampler was added to the Beulah monitoring site on December 11.

In Bismarck, a particulate matter (< 2.5 microns) sampler ($PM_{2.5}$) was added to the Bismarck Residential site when the site was established. The data will be used for comparison to the PM_{10} data and establish an expected range for $PM_{2.5}$ data.

A monitoring site was established on the northeast boundary of the Theodore Roosevelt National Park - South Unit (TRNP-SU) in the Whiskey Joe oil field. The Park Service had some concerns about potential exceedances of the prevention of significant deterioration standards in the park. Also, the Department was experiencing problems with several oil well operators maintaining equipment at the oil wells in good working order.

A new site was established northeast of Mandan, southeast of the AMOCO Refinery, to collect SO_2 data for comparison to the proposed Federal 5-minute maximum SO_2 standard. Both 5-minute maximum and 1-hour average data are collected.

Industry Changes

Coteau Properties terminated monitoring on June 30: monitoring requirements in their permit to operate had been satisfied.

Dakota Gasification Company (DGC) terminated one site and moved two sites to new locations. DGC #13, an H_2S site, was terminated August 31. DGC #11 was moved to the new site DGC #16 and DGC #15 was moved to the new site DGC #17. The move was effective October 1 for both sites.

RESULTS - DATA SUMMARIES

Introduction

The ambient and source-specific air quality data collected during the year at monitoring sites operated by the Department and industry are summarized in tables for the following pollutants; sulfur dioxide (SO_2), SO_2 5-minute maximum, nitrogen dioxide (NO_2), hydrogen sulfide (H_2S), ozone (O_3), inhalable $PM_{2.5}$ particulates ($PM_{2.5}$), and inhalable PM_{10} particulates (PM_{10}).

The summaries for gaseous pollutants contain maximum concentrations, month/day/hour of each maximum, arithmetic means, and the percentage of readings greater than the minimum detectable value (MDV) for the analytical method used for each parameter. Where applicable, the number of times a State standard was exceeded is indicated. The concentrations for gaseous pollutants are reported in parts per billion (ppb).

The $PM_{2.5}$ and PM_{10} summaries contain the three highest 24-hour average concentrations, month/day of each maxima, annual arithmetic mean, and the number of times the 24-hour standard was exceeded, if any, and an asterisk (*) if the annual standard is exceeded. The concentrations are reported in micrograms per cubic meter ($\mu g/m^3$).

For statistical purposes, pollutant concentrations less than the minimum detectable value (MDV) for the analytical method used are assigned a value equal to one-half the MDV. The MDV for SO_2, H_2S, and NO_2 is 2 ppb; O_3 is 4 ppb; and, $PM_{2.5}$ and PM_{10} is 4 $\mu g/m^3$. Annual means are calculated for SO_2, NO_2, H_2S, $PM_{2.5}$, and PM_{10}, however, only those means with more than 75 percent of the data greater than the MDV are unbiased calculations.

As part of the statistical evaluation, the data recovery rate (NUM OBS) is evaluated to determine if the data recovery complies with the State's required 80 percent data recovery rate. A continuous analyzer operating less than 7008 hours during the year may achieve at least an 80 percent data recovery for the period operated, however, it does not meet the 80 percent data recovery for the year. Each analyzer at a site not meeting the 80 percent data recovery for the year is flagged in the "NUM OBS" column by placing "***" underneath the number of observations. Particulate matter samplers must collect at least 48 samples for the year to meet the 80 percent data recovery rate.

Ozone is an exception to the flagging procedures outlined above. Ozone monitoring is required from May 1 through September 30. However, to provide complete quarters of data for the second and third quarters, the analyzers are run from March 1 through September 30. Three sites, Fargo Residential, Hannover and Sharon, are run year-round.

Sulfur Dioxide

Sulfur dioxide was monitored at 18 sites. Eight sites were run by the Department and ten by industry.

The 1-hour State standard (273 ppb) was not exceeded during the year. The maximum 1-hour concentration was 146 ppb at the DGC #11 Site.

The 3-hour Federal secondary standard (500 ppb) was not exceeded during the year. The maximum 3-hour average concentration was 101 ppb at the DGC #11 Site.

The 24-hour State standard (99 ppb) was not exceeded during the year. The maximum 24-hour concentration was 35 ppb at the Mandan - Refinery Site.

Among those sites that collected at least 80 percent of the possible data for the year, the maximum annual arithmetic mean was 4.1 ppb at the DGC #12 Site. For the remaining sites, the maximum arithmetic mean was 11.8 ppb at the Mandan - Refinery Site, which began operation December 14.

The sulfur dioxide data are summarized in Table 3.

TABLE 3

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

POLLUTANT : Sulfur Dioxide (ppb)

				MAXIMA									
				1 - HOUR		3 - HOUR		24 - HOUR					
LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	1ST MM/DD/HH	2ND MM/DD/HH	1ST MM/DD/HH	2ND MM/DD/HH	1ST MM/DD	2ND MM/DD	ARITH MEAN	1HR #>273	24HR #>99	% >MDV
AMERADA HESS - TIOGA #1	1995	JAN-DEC	8684	58 03/26/01	50 07/25/15	25 12/10/20	23 03/26/02	7 12/10	6 02/17	1.4			12.3
AMERADA HESS - TIOGA #3	1995	JAN-DEC	8685	85 12/07/22	49 01/27/23	38 01/27/23	34 12/07/23	15 11/02	11 01/27	2.1			22.5
BEULAH	1995	JAN-DEC	8711	74 07/05/07	72 07/05/09	55 07/05/08	37 04/16/11	13 01/25	12 07/05	2.8			41.7
DGC #11	1995	JAN-SEP	6500 ***	146 08/20/15	122 05/09/10	101 05/09/11	88 05/09/08	30 05/09	15 08/20	3.7			60.4
DGC #12	1995	JAN-DEC	8645	108 08/20/09	104 01/07/12	69 01/07/14	65 01/01/14	23 01/07	22 02/11	4.1			57.2
DGC #14	1995	JAN-DEC	8704	143 10/24/10	120 10/14/11	85 10/24/11	83 07/15/11	21 08/09	20 10/24	2.9			46.4
DGC #15	1995	JAN-SEP	6443 ***	96 06/13/08	88 08/06/20	53 05/17/14	48 05/17/11	18 05/17	17 06/13	3.3			58.8
DGC #16	1995	OCT-DEC	1919 ***	61 10/20/12	55 10/16/07	42 10/20/14	37 10/16/08	11 10/16	10 12/22	3.1			52.5
DGC #17	1995	OCT-DEC	1876 ***	96 12/11/08	80 10/20/12	54 12/12/11	42 12/12/14	25 12/12	10 12/11	2.5			34.8
DUNN CENTER	1995	JAN-DEC	8544	28 12/16/14	27 11/26/09	20 12/21/23	19 03/04/05	8 12/21	6 03/04	1.3			10.5
FARGO - RESIDENTIAL	1995	AUG-DEC	2941 ***	25 09/23/06	16 09/23/21	15 09/09/05	14 09/02/02	9 09/03	7 09/10	1.8			24.3
HANNOVER	1995	JAN-DEC	8696	96 07/13/11	92 08/26/19	55 06/13/11	50 03/05/14	19 07/13	16 08/26	2.5			26.3
KOCH - MGP #3	1995	JAN-DEC	7609	92 09/11/11	53 09/12/11	31 09/11/11	18 09/12/11	8 09/11	6 09/12	1.4			12.7
LITTLE KNIFE #5	1995	JAN-DEC	8716	31 12/15/03	31 12/15/04	28 12/15/05	16 04/07/11	12 12/15	6 12/16	1.3			13.2
MANDAN - REFINERY	1995	DEC-DEC	297 ***	115 12/23/18	115 12/25/22	99 12/23/20	79 12/24/05	35 12/24	27 12/23	11.8			48.5
SHARON	1995	JAN-DEC	8691	16 01/30/01	13 01/30/02	13 01/30/02	9 01/30/05	4 01/18	4 02/18	1.2			10.4
TRNP - NU	1995	JAN-DEC	6972 ***	23 12/18/04	17 04/07/10	15 04/07/11	14 12/18/05	6 12/11	5 12/21	1.2			7.2
WHISKEY JOE	1995	JUL-DEC	3723 ***	28 11/26/14	26 10/23/19	20 08/26/20	18 08/26/14	9 08/26	7 08/23	1.7			19.6

* 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.

Sulfur Dioxide 5-Minute Average

Sulfur dioxide 5-minute averages are collected at the Mandan - Refinery Site and began operation on December 14.

The maximum 5-minute average was 209 ppb. The proposed federal standard is expected to be at least 600 ppb.

The sulfur dioxide 5-minute data is presented in Table 4.

TABLE 4

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

POLLUTANT : SO2 5-Minute Averages (ppb)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	5 - M I N U T E M A X I M A 1ST	DATE MM/DD/HH	2ND	DATE MM/DD/HH	3RD	DATE MM/DD/HH	# HOURS >600	% >MDV
MANDAN - REFINERY	1995	DEC-DEC	295	209	12/25/22	174	12/23/18	165	12/23/15	0	49.5

* The proposed air quality standards for SO2 5-minute averages are:

STATE - 600 ppb not to be exceeded.

FEDERAL - 600 ppb not to be exceeded.

Nitrogen Dioxide

Nitrogen dioxide was monitored at seven sites. Four were run by the Department and three by industry.

The maximum 1-hour concentration was 114 ppb at the DGC #15 Site.

The State annual standard (50 ppb) was not exceeded for the year. The maximum annual mean of those sites collecting at least 80 percent of the possible data for the year was 4.0 ppb at the Beulah Site. For the remaining sites, the maximum mean was 7.4 ppb at the Fargo Residential site, which began operation August 24.

The nitrogen dioxide data are summarized in Table 5.

TABLE 5

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	1995	JAN-DEC	8700	40 01/29/21	36 04/10/20	4.0	71.7
DGC #12	1995	JAN-DEC	8611	56 06/28/12	41 01/19/11	3.8	91.0
DGC #15	1995	JAN-SEP	6430 ***	114 04/13/07	91 05/04/04	5.6	88.1
DGC #17	1995	OCT-DEC	1407 ***	24 12/16/01	21 12/16/02	3.5	92.2
FARGO RESIDENTIAL	1995	AUG-DEC	2943 ***	43 12/30/00	42 10/12/17	7.4	86.1
HANNOVER	1995	JAN-DEC	7991	30 03/16/03	30 03/16/04	2.5	52.6
SHARON	1995	JAN-DEC	8688	16 01/11/23	16 12/13/22	1.6	25.8

* The air quality standards are:

STATE - 50 ppb maximum annual arithmetic mean.

FEDERAL - 53 ppb annual arithmetic mean.

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

Hydrogen Sulfide

Hydrogen sulfide was monitored at six sites. Two sites were run by the Department and four by industry.

The 1-hour State standard (200 ppb) was not exceeded during the year. The maximum 1-hour concentration was 192 ppb at the Whiskey Joe site.

The 24-hour State standard (100 ppb) was not exceeded during the year. The maximum 24-hour average concentration was 45 ppb at the Whiskey Joe site.

The 3-month State standard (20 ppb) was not exceeded during the year. The maximum 3-month average concentration was 7 ppb at the Whiskey Joe site.

The hydrogen sulfide data are summarized in Table 6.

TABLE 6

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

POLLUTANT : Hydrogen Sulfide (ppb)

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 3 - MONTH 1ST MM	MAXIMA 3 - MONTH 2ND MM	ARITH MEAN	1HR #>200	24HR #>100	% MDV
AMERADA HESS - TIOGA #2	1995	JAN-DEC	8450	172 04/11/22	79 01/25/23	14 04/11	11 05/01	3 04	3 06	1.9			18.3
DGC #13	1995	JAN-AUG	5593 ***	33 08/26/17	30 01/09/05	13 08/26	9 07/29	4 08	3 07	2.3			42.6
KOCH - MGP #4	1995	JAN-DEC	7176	147 11/07/11	98 11/07/10	16 11/07	7 11/02	2 08	2 12	1.6			18.5
LITTLE KNIFE #5	1995	JAN-DEC	8715	168 09/11/19	116 11/13/15	18 11/04	15 12/31	6 11	6 12	3.9			47.3
TRNP - NU	1995	JAN-DEC	8710	33 01/25/06	30 01/25/07	10 01/25	5 12/27	1 01	1 12	1.1			4.0
WHISKEY JOE	1995	JUL-DEC	3262 ***	192 10/29/19	187 09/21/19	45 09/13	35 09/01	7 10	6 11	5.2			20.3

* The State air quality standards are:

1) 10 ppm maximum instantaneous (ceiling) concentration not to be exceeded.
2) 200 ppb maximum 1-hour average concentration not to be exceeded more than once per month.
3) 100 ppb maximum 24-hour average concentration not to be exceeded more than once per year.
4) 20 ppb maximum arithmetic mean concentration averaged over three consecutive months.

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

Ozone

Ozone was monitored at five State run sites . Two sites operated only during the second and third quarters. This extends one month longer than the defined peak ozone season (May-September) for the State. Three sites, Fargo Residential, Hannover and Sharon, have been selected to collect data the entire year. This data will be used to determine more accurate nitrogen dioxide concentrations in air quality impact analysis.

The Fargo Residential site began operation August 24.

The 1-hour State and Federal standard (120 ppb) was not exceeded during the year. The maximum 1-hour concentration was 73 ppb at the Sharon Site.

The ozone data are summarized in Table 7.

TABLE 7

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

POLLUTANT : Ozone (ppb)

LOCATION	YEAR	SAMPLING PERIOD	DAYS SAMPLED	NUM OBS	1 - H O U R M A X I M A 1ST	DATE MM/DD/HH	2ND	DATE MM/DD/HH	3RD	DATE MM/DD/HH	# HOURS >120	% >MDV
BEULAH	1995	APR-SEP	183	4365	62	4/14/14	61	6/11/14	61	6/15/16	0	98.3
FARGO - RESIDENTIAL	1995	AUG-DEC	125	2445	46	9/25/15	44	9/28/13	42	9/27/14	0	90.8
HANNOVER	1995	JAN-DEC	365	8695	61	6/ 4/10	61	6/11/16	61	6/12/12	0	99.9
SHARON	1995	JAN-DEC	365	8655	73	6/ 3/11	67	6/13/17	67	6/16/15	0	100.0
TRNP - NU	1995	APR-SEP	183	4242	64	6/20/16	62	6/16/13	62	6/26/15	0	99.9

* The air quality standards for ozone are:

STATE - 120 ppb not to be exceeded more than once per year.

FEDERAL - 120 ppb with no more than one expected exceedance per year

Inhalable $PM_{2.5}$ Particulates

A $PM_{2.5}$ particulate sampler was added to the Bismarck Residential site on July 20. The maximum 24-hour average concentration was 25.9 $\mu g/m^3$ on July 20.

There is no standard for $PM_{2.5}$. The data is collected to help the Department prepare for the new standard by providing an indication of what concentration range to expect.

The inhalable $PM_{2.5}$ data are summarized in Table 8.

TABLE 8

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

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

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MIN	MAX 24-HOUR 1ST MM/DD	MAX 24-HOUR 2ND MM/DD	MAX 24-HOUR 3RD MM/DD	ARITH MEAN	% >MDV
Bismarck Residential	1995	JUL-DEC	27 ***	1.1	25.9 07/20	23.4 12/29	14.6 09/30	9.5	96.3

* No standard is currently in effect.

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

Inhalable PM_{10} Particulates

Inhalable PM_{10} particulate concentrations were monitored at fourteen sites. Ten were run by the Department and four by industry.

The 24-hour State and Federal standard (150 $\mu g/m^3$) was not exceeded during the year. The maximum 24-hour concentration was 78.3 $\mu g/m^3$ at the Sharon Site.

The annual State and Federal standard (50 $\mu g/m^3$) was not exceeded. The maximum annual mean for sites collecting at least 80 percent of the possible data for the year was 17.6 $\mu g/m^3$ at the Grand Forks Site. For the remaining sites, the maximum annual arithmetic mean was 19.2 $\mu g/m^3$ at the Bismarck site, which terminated July 24.

The Fargo Residential, Bismarck Residential, and Williston Residential sites began operation on August 24, July 24, and August 16, respectively.

The inhalable particulate (PM_{10}) data are summarized in Table 9

TABLE 9

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 24-HOUR 1ST MM/DD	2ND MM/DD	3RD MM/DD	ARITH MEAN	#>150	AM>50	% >MDV
BEULAH	1995	NOV-DEC	9 ***	0.9	18.1 11/17	17.2 12/29	14.5 12/05	12.2			88.8
BISMARCK	1995	JAN-JUL	33 ***	5.2	36.8 07/20	36.1 06/26	34.5 06/20	19.2			100.0
BISMARCK RESIDENTIAL	1995	JUL-DEC	26 ***	5.8	30.2 12/29	24.6 09/30	22.3 10/12	14.9			100.0
COTEAU #5	1995	JAN-JUN	29 ***	2.9	31.8 01/27	27.7 06/02	25.9 01/09	12.3			86.2
COTEAU #6	1995	JAN-JUN	28 ***	1.9	25.0 06/14	21.6 06/20	19.2 06/02	10.8			89.2
COTEAU #7	1995	JAN-JUN	30 ***	3.0	39.7 06/26	33.0 06/08	26.6 01/27	13.2			90.0
COTEAU #8	1995	JAN-JUN	25 ***	2.5	20.3 01/27	15.6 05/27	15.2 01/09	9.6			92.0
DICKINSON RES	1995	JAN-DEC	57	2.0	40.2 06/26	30.9 08/19	29.3 08/07	12.0			92.9
FARGO	1995	JAN-AUG	38 ***	3.4	56.1 07/20	40.4 01/27	38.2 06/14	18.9			97.3
FARGO - RESIDENTIAL	1995	AUG-DEC	21 ***	4.6	48.9 10/12	45.6 09/12	28.3 12/29	18.8			100.0
GRAND FORKS	1995	JAN-DEC	61	4.7	50.1 07/20	40.4 06/02	38.4 06/20	17.6			100.0
SHARON	1995	JAN-DEC	54	1.1	78.3 08/31	48.4 07/20	31.9 06/02	13.1			88.8
WILLISTON	1995	JAN-AUG	32 ***	5.8	42.4 06/26	33.2 07/20	25.9 08/07	16.1			100.0
WILLISTON RESIDENTIAL	1995	AUG-DEC	21 ***	6.0	27.7 09/30	23.6 12/17	23.0 08/31	13.5			100.0

* The STATE and FEDERAL air quality standards are:

1) 150 $\mu g/m^3$ maximum averaged over a 24-hour period with no more than one expected exceedance per year.
2) 50 $\mu g/m^3$ expected annual arithmetic mean.

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

SUMMARY AND CONCLUSIONS

The State of North Dakota has relatively clean air and is in compliance with all ambient air quality standards. A summary for each pollutant is provided below.

Sulfur Dioxide

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 - 146 ppb (53.5%); 3-hour - 101 ppb (20.2%); 24-hour - 35 ppb (35.4%); annual (partial year) - 11.8 ppb (48.3%); annual (full year) - 4.1 ppb (17.8%).

Sulfur Dioxide 5-Minute Averages

There is no standard currently in effect. The maximum 5-minute average was 209 ppb.

Nitrogen Dioxide

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 (partial year) - 7.4 ppb (14.8%); annual (full year) - 4.0 ppb (8.0%).

Hydrogen Sulfide

There were no exceedances of any of the standards. The maximum concentrations and the maximum concentrations expressed as a percentage of the applicable standard are as follows: 1-hour - 192 ppb (96%); 24-hour - 45 ppb (45%); 3-month - 7 ppb (32.6%).

Ozone

Neither the State nor Federal standard was exceeded during the year. The maximum concentration and the maximum concentration expressed as a percentage of the applicable standard is 73 ppb (60.8%).

Inhalable $PM_{2.5}$ Particulates

There is no standard currently in effect. The maximum 24-hour average concentration was 25.9 $\mu g/m^3$.

Inhalable PM_{10} Particulates

Neither the State nor Federal standards were exceeded during the year. The maximum concentrations and the maximum concentrations expressed as a percentage of the applicable standard are as follows: 24-hour - 78.3 $\mu g/m^3$ (52.2%); annual (partial year) - 19.2 $\mu g/m^3$ (38.4%); annual (full year) - 13.1 $\mu g/m^3$ (26.2%).

REFERENCES

REFERENCES

1 Environmental Protection Agency, May 1977. Quality Assurance Handbook for Air Pollution Measurement Systems Volume II, Ambient Air Specific Methods (as amended), EPA-600/4-77-027a, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

2 Environmental Protection Agency, May 10, 1979. Title 40, Code of Federal Regulations, Part 58 (as amended), United States Government Printing Office, Superintendent of Documents, Washington, DC.

3 Environmental Protection Agency, August 7, 1980. Prevention of Significant Deterioration, Title 40, Code of Federal Regulations, Part 52 (as amended), United States Government Printing Office, Washington, DC.

APPENDICES

APPENDIX 1

NORTH DAKOTA AND FEDERAL AMBIENT AIR QUALITY STANDARDS

STANDARDS

In general, air pollutants are divided into two classes: primary pollutants such as SO_2, CO, NO_2, H_2S, $PM_{2.5}$, and PM_{10}; and secondary pollutants which are formed as the result of a chemical reaction. Sources of primary pollutants include power plants, natural gas processing plants, oil wells, oil refineries, asphalt plants, factories, wind blown dirt, automobiles, fireplaces and incinerators. Secondary pollutants result from a primary pollutant undergoing a chemical reaction; for example, ozone is formed as a result of a photochemical reaction between hydrocarbons (HC) and oxides of nitrogen (NO_x).

The North Dakota Ambient Air Quality Standards are established to protect public health and welfare.

Table A1-1 presents the current North Dakota Ambient Air Quality Standards. Table A1-2 presents the Federal Ambient Air Quality Standards. State standards must be as stringent as (but may be more stringent than) the Federal Standards.

TABLE A1-1
North Dakota
Ambient Air Quality Standards

Air Contaminants	Standards (Maximum Permissible Concentrations)	
Inhalable Particulate (PM_{10})	50	micrograms per cubic meter of air, expected annual arithmetic mean micrograms per cubic meter of air maximum 24-hour average concentration with no more than one expected exceedance per year
	150	
Sulfur Dioxide	0.023	parts per million (60 micrograms per cubic meter of air), maximum annual arithmetic mean concentration
	0.099	parts per million (260 micrograms per cubic meter of air), maximum 24-hour average concentration
	0.273	parts per million (715 micrograms per cubic meter of air), maximum 1-hour average concentration
Hydrogen Sulfide	10.0	parts per million (14 milligrams per cubic meter of air), maximum instantaneous (ceiling) concentration not to be exceeded
	0.20	parts per million (280 micrograms per cubic meter of air), maximum 1-hour average concentration not to be exceeded more than once per month
	0.10	parts per million (140 micrograms per cubic meter of air), maximum 24-hour average concentration not to be exceeded more than once per year
	0.02	parts per million (28 micrograms per cubic meter of air), maximum arithmetic mean concentration averaged over three consecutive months
Carbon Monoxide	9	parts per million (10 milligrams per cubic meter of air), maximum 8-hour concentration not to be exceeded more than once per year
	35	parts per million (40 milligrams per cubic meter of air), maximum 1-hour concentration not to be exceeded more than once per year
Ozone	0.12	parts per million (235 micrograms per cubic meter of air), maximum 1-hour concentration not to be exceeded more than once per year
Nitrogen Dioxide	0.05	parts per million (100 micrograms per cubic meter of air), maximum annual arithmetic mean
Lead	1.5	micrograms per cubic meter of air, maximum arithmetic mean averaged over a calendar quarter

TABLE A1-2
Federal Ambient Air Quality Standards

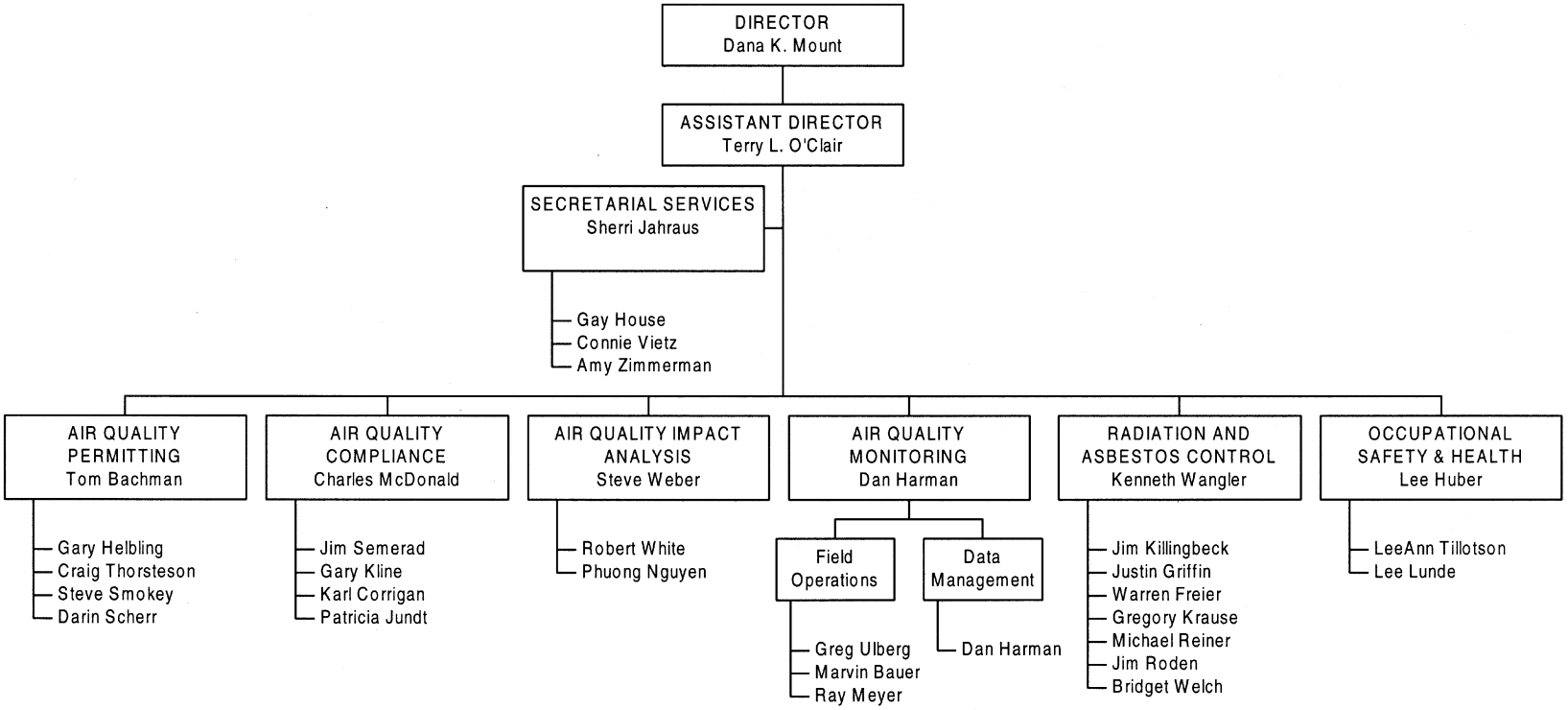
Pollutant	Description	Primary	Secondary
PM_{10}	Expected annual arithmetic mean.	50 $\mu g/m^3$	50 $\mu g/m^3$
	Maximum 24-hour average concentration with no more than one expected exceedance per year.	150 $\mu g/m^3$	150 $\mu g/m^3$
SO_2	Annual arithmetic mean.	0.03 ppm (80 $\mu g/m^3$)	-
	Maximum 24-hour concentration not to be exceeded more than once per year.	0.14 ppm (365 $\mu g/m^3$)	-
	Maximum 3-hour concentration not to be exceeded more than once per year.	-	0.5 ppm (1300 $\mu g/m^3$)
CO	8-hour concentration not to be exceeded more than once per year.	9 ppm (10 $\mu g/m^3$)	-
	1-hour average concentration not to be exceeded more than once per year.	35 ppm (40 $\mu g/m^3$)	-
O_3	1-hour average concentration with no more than one expected exceedance per year.	0.12 ppm (235 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$)
NO_2	Annual arithmetic mean.	0.053 ppm (100 $\mu g/m^3$)	0.053 ppm (100 $\mu g/m^3$)
Pb	Maximum arithmetic mean averaged over a calendar quarter.	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$

APPENDIX 2

AIR QUALITY PERSONNEL
ORGANIZATIONAL CHART

The following organizational chart for the Division of Environmental Engineering shows the organization of the Air Pollution Control Program.

NORTH DAKOTA DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL ENGINEERING



A2-1 Environmental Engineering Organizational Chart

APPENDIX 3

WIND DATA

The wind speed and wind direction data from the 13 sites that collected wind data during the year are summarized in Tables A3-1 through A3-13. Wind bar charts and wind star charts for these stations are shown in Figures A3-1 through A3-26. There is no minimum detectable value for wind direction; however, the Department uses 1 mph for the minimum detectable value for wind speed.

The Fargo Residential and Whiskey Joe wind data summaries are based on limited periods of observation.

1995 Amerada Hess — TIOGA #2 Wind Data Summary

Table A3-1

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.02	0.23	1.02	2.19	0.79	0.14	0.02	0.00	0.00	0.00	385	9.8	4.41
NNE	0.05	0.10	0.48	0.79	0.66	0.09	0.00	0.00	0.00	0.00	190	10.4	2.18
NE	0.06	0.14	0.50	0.74	0.30	0.21	0.00	0.00	0.00	0.00	170	9.7	1.95
ENE	0.06	0.17	1.28	1.80	0.95	0.30	0.01	0.00	0.00	0.00	399	10.0	4.57
E	0.16	1.39	6.64	2.71	1.45	0.63	0.00	0.00	0.00	0.00	1134	7.8	12.98
ESE	0.13	1.65	2.82	1.76	1.67	0.76	0.11	0.00	0.00	0.00	777	9.1	8.90
SE	0.32	0.92	1.74	2.36	1.58	0.30	0.05	0.00	0.00	0.00	634	9.1	7.26
SSE	0.22	0.70	1.50	1.55	1.19	0.16	0.00	0.00	0.00	0.00	464	8.9	5.31
S	0.19	0.55	1.19	0.58	0.26	0.07	0.00	0.00	0.00	0.00	249	6.7	2.85
SSW	0.18	0.35	0.97	0.90	0.22	0.05	0.00	0.00	0.00	0.00	234	7.2	2.68
SW	0.17	0.45	1.10	1.19	0.18	0.02	0.00	0.00	0.00	0.00	272	7.1	3.11
WSW	0.17	0.68	1.60	1.47	0.56	0.15	0.06	0.06	0.00	0.00	414	8.4	4.74
W	0.13	0.77	2.32	3.11	1.43	0.56	0.15	0.07	0.00	0.00	746	10.0	8.54
WNW	0.13	0.92	4.17	3.09	2.59	1.14	0.53	0.10	0.00	0.00	1106	10.9	12.66
NW	0.09	0.66	2.90	2.98	2.62	1.65	0.53	0.07	0.00	0.00	1004	12.1	11.49
NNW	0.03	0.27	1.52	2.34	1.52	0.52	0.15	0.02	0.00	0.00	557	11.2	6.38
%TOT	2.1	9.9	31.8	29.6	18.0	6.7	1.6	0.3	0.0	0.0			100.00

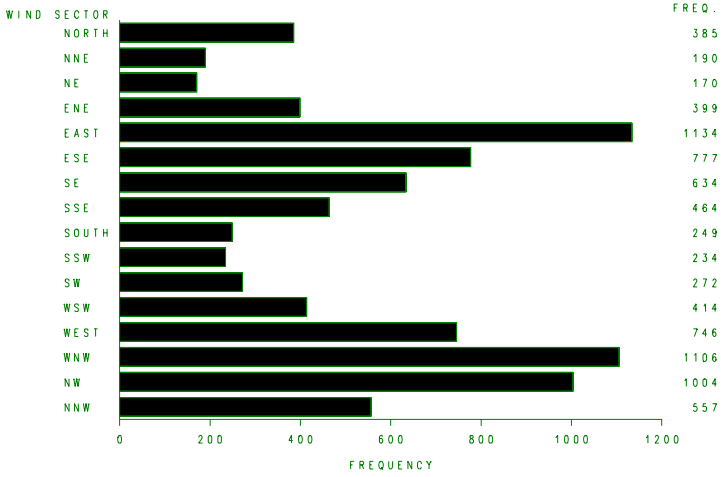


Figure A3-1

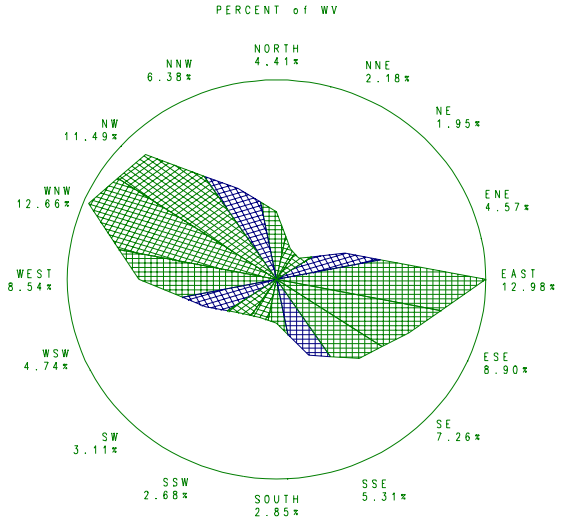


Figure A3-2

1995 DGC #12 Wind Data Summary

Table A3-3

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.02	0.33	1.18	1.61	1.15	0.17	0.01	0.00	0.00	0.00	377	9.8	4.48
NNE	0.05	0.28	1.04	0.84	0.71	0.30	0.02	0.00	0.00	0.00	274	9.9	3.25
NE	0.05	0.42	1.22	1.25	0.55	0.40	0.02	0.00	0.00	0.00	329	9.7	3.91
ENE	0.07	0.56	1.61	0.78	0.43	0.23	0.02	0.00	0.00	0.00	312	8.0	3.70
E	0.08	0.65	2.59	1.73	1.13	0.88	0.01	0.00	0.00	0.00	596	9.6	7.08
ESE	0.07	0.61	2.79	3.23	1.78	0.51	0.00	0.00	0.00	0.00	757	9.5	8.99
SE	0.06	0.43	1.86	2.64	1.82	0.43	0.13	0.00	0.00	0.00	620	10.5	7.36
SSE	0.04	0.33	1.67	2.30	2.15	0.45	0.02	0.00	0.00	0.00	587	10.8	6.97
S	0.06	0.32	1.32	1.26	0.95	0.36	0.01	0.00	0.00	0.00	360	10.0	4.27
SSW	0.04	0.38	1.15	1.04	0.91	0.15	0.05	0.00	0.00	0.00	314	9.6	3.73
SW	0.05	0.59	2.34	2.17	0.70	0.13	0.01	0.00	0.00	0.00	505	8.1	6.00
WSW	0.06	0.66	3.86	4.70	0.89	0.14	0.00	0.00	0.00	0.00	869	8.3	10.32
W	0.05	0.42	1.53	2.05	0.99	0.52	0.12	0.02	0.00	0.00	480	10.4	5.70
WNW	0.01	0.42	1.03	1.32	1.79	1.52	0.81	0.19	0.00	0.00	597	15.4	7.09
NW	0.05	0.26	1.00	2.17	2.66	1.88	1.29	0.31	0.05	0.00	814	16.2	9.66
NNW	0.06	0.31	1.13	2.49	2.11	0.78	0.45	0.15	0.01	0.00	632	13.0	7.50
%TOT	0.8	7.0	27.3	31.6	20.7	8.8	3.0	0.7	0.1	0.0			100.00

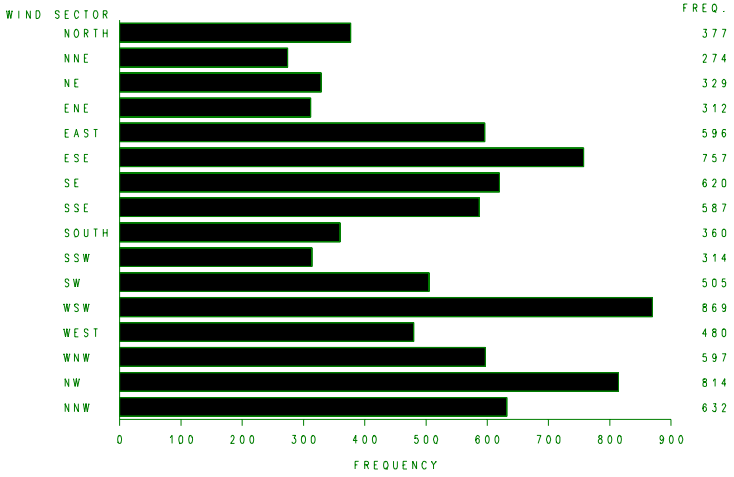


Figure A3-5

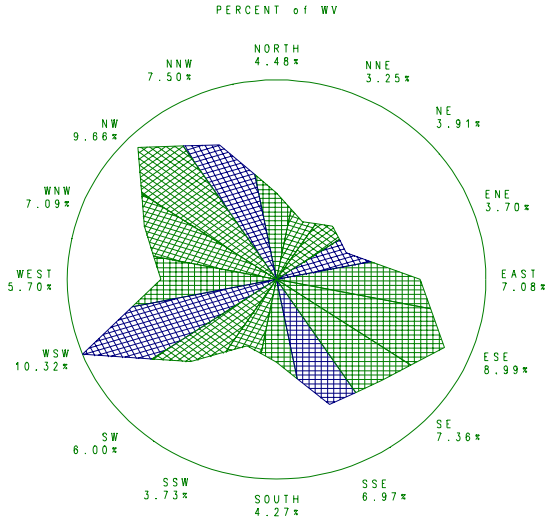


Figure A3-6

1995 Dunn Center Wind Data Summary

Table A3-4

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.09	0.21	1.60	1.83	1.22	0.14	0.01	0.00	0.00	0.00	435	9.6	5.12
NNE	0.02	0.33	1.69	0.87	0.55	0.32	0.00	0.00	0.00	0.00	322	9.0	3.79
NE	0.04	0.35	1.80	1.46	0.73	0.33	0.13	0.00	0.00	0.00	411	9.6	4.83
ENE	0.02	0.41	2.00	1.11	0.56	0.20	0.00	0.00	0.00	0.00	366	8.2	4.30
E	0.08	0.61	2.11	1.25	0.92	0.39	0.00	0.00	0.00	0.00	455	8.7	5.35
ESE	0.06	0.66	2.40	1.34	0.92	0.46	0.04	0.00	0.00	0.00	499	9.1	5.87
SE	0.14	1.06	3.67	2.99	1.67	0.51	0.02	0.00	0.00	0.00	855	8.8	10.06
SSE	0.16	1.14	2.28	2.31	1.52	0.22	0.01	0.00	0.00	0.00	650	8.5	7.65
S	0.27	0.98	1.36	1.99	1.09	0.15	0.00	0.00	0.00	0.00	497	8.4	5.85
SSW	0.26	0.68	0.95	0.84	0.22	0.06	0.00	0.00	0.00	0.00	256	6.5	3.01
SW	0.27	0.96	1.34	0.68	0.22	0.02	0.00	0.00	0.00	0.00	298	5.7	3.51
WSW	0.24	1.60	1.61	0.91	0.31	0.15	0.00	0.00	0.00	0.00	409	6.1	4.81
W	0.11	1.91	3.53	2.00	1.12	0.62	0.13	0.00	0.00	0.00	800	8.2	9.41
WNW	0.08	0.69	2.53	2.18	1.18	1.07	0.39	0.06	0.01	0.00	696	11.2	8.19
NW	0.06	0.34	1.83	3.67	3.33	2.06	0.85	0.13	0.00	0.00	1043	13.9	12.27
NNW	0.05	0.33	1.79	2.21	1.16	0.34	0.11	0.01	0.00	0.00	510	10.1	6.00
%TOT	2.0	12.3	32.5	27.6	16.7	7.0	1.7	0.2	0.0	0.0			100.00

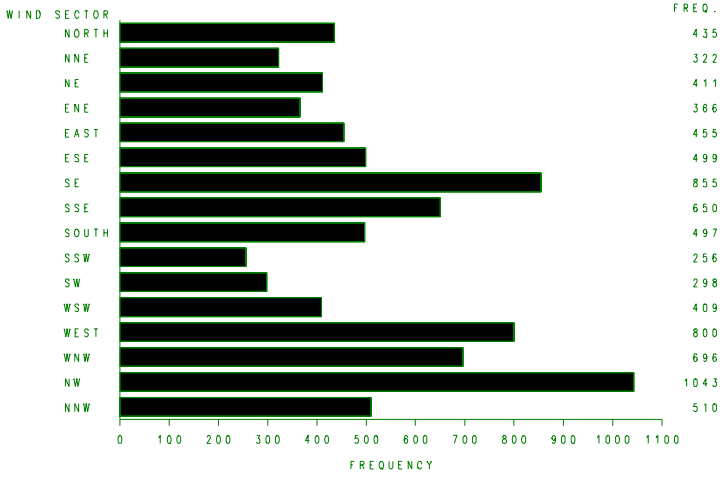


Figure A3-7

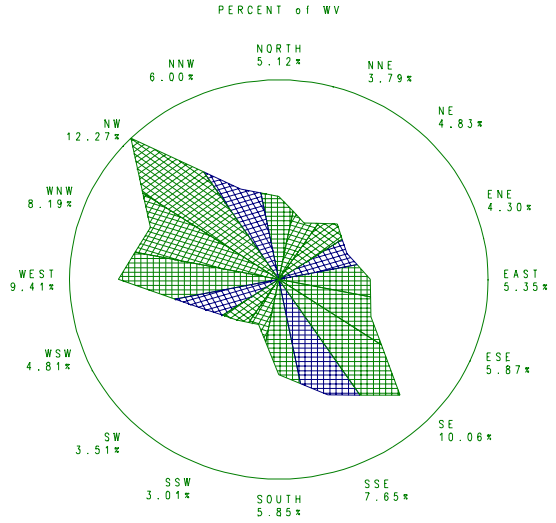


Figure A3-8

1995 Fargo Residential Wind Data Summary

Table A3-5

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.20	0.85	5.07	4.94	2.10	0.07	0.00	0.00	0.00	0.00	391	8.4	13.22
NNE	0.07	0.85	2.77	0.91	0.14	0.00	0.00	0.00	0.00	0.00	140	5.9	4.73
NE	0.07	1.05	1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71	3.8	2.40
ENE	0.34	1.32	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79	3.1	2.67
E	0.30	1.35	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68	2.8	2.30
ESE	0.30	1.49	1.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	84	3.3	2.84
SE	0.51	2.60	3.99	0.95	0.03	0.00	0.00	0.00	0.00	0.00	239	4.6	8.08
SSE	0.10	1.72	5.11	3.89	0.61	0.00	0.00	0.00	0.00	0.00	338	7.0	11.43
S	0.24	0.91	3.35	3.15	0.24	0.00	0.00	0.00	0.00	0.00	233	7.0	7.88
SSW	0.07	0.68	2.54	1.56	0.14	0.00	0.00	0.00	0.00	0.00	147	6.6	4.97
SW	0.20	1.39	1.69	0.74	0.00	0.00	0.00	0.00	0.00	0.00	119	4.8	4.02
WSW	0.07	0.57	1.39	0.37	0.07	0.00	0.00	0.00	0.00	0.00	73	5.5	2.47
W	0.03	0.85	1.59	0.81	0.10	0.00	0.00	0.00	0.00	0.00	100	6.0	3.38
WNW	0.24	1.05	1.86	1.93	1.12	0.34	0.07	0.00	0.00	0.00	195	8.8	6.59
NW	0.07	0.85	2.94	2.91	2.43	1.01	0.00	0.00	0.00	0.00	302	10.4	10.21
NNW	0.10	1.01	4.16	4.40	2.57	0.54	0.00	0.00	0.00	0.00	378	9.1	12.78
%TOT	2.9	18.5	40.4	26.6	9.5	2.0	0.1	0.0	0.0	0.0			100.00

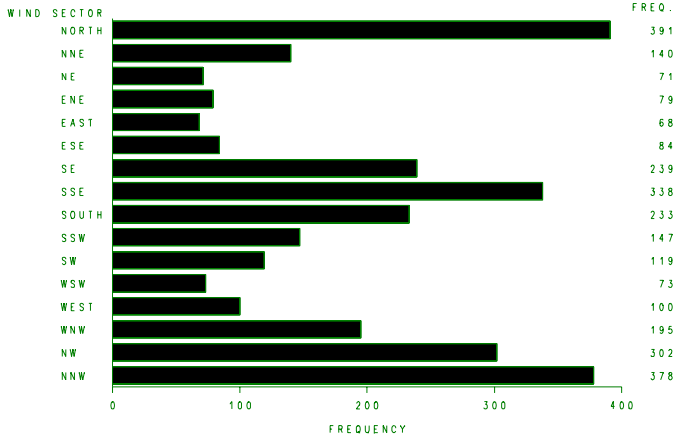


Figure A3-9

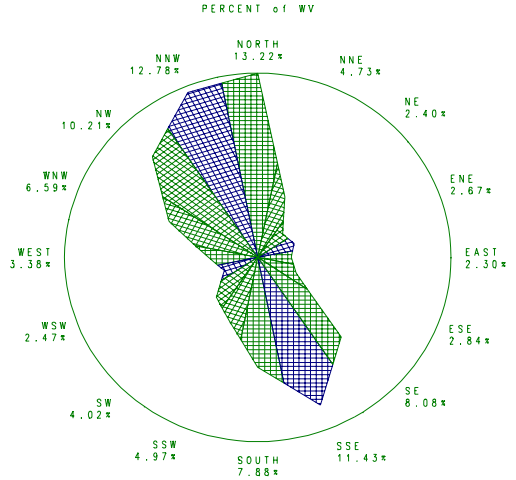


Figure A3-10

1995 Hannover Wind Data Summary

Table A3-6

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.06	0.27	1.01	1.92	1.95	1.00	0.19	0.04	0.01	0.00	542	12.9	6.46
NNE	0.02	0.19	1.01	1.11	1.05	0.51	0.23	0.00	0.00	0.00	346	12.3	4.12
NE	0.01	0.20	0.81	1.12	0.67	0.37	0.43	0.01	0.00	0.00	304	12.8	3.62
ENE	0.02	0.12	0.88	1.01	0.69	0.25	0.31	0.05	0.00	0.00	280	12.4	3.34
E	0.01	0.11	0.76	1.00	0.60	0.64	0.11	0.00	0.00	0.00	271	12.3	3.23
ESE	0.00	0.05	0.67	0.88	0.66	0.44	0.07	0.00	0.00	0.00	232	12.2	2.77
SE	0.00	0.07	0.79	1.41	1.56	1.41	0.79	0.14	0.00	0.00	517	16.1	6.16
SSE	0.01	0.05	0.79	2.24	2.56	2.24	0.80	0.14	0.01	0.00	742	16.0	8.84
S	0.01	0.10	1.41	3.59	4.21	2.44	1.43	0.21	0.05	0.00	1128	15.5	13.44
SSW	0.06	0.10	1.06	2.07	1.70	1.12	0.31	0.00	0.00	0.00	539	13.1	6.42
SW	0.04	0.08	0.44	1.12	0.88	0.32	0.12	0.00	0.00	0.00	252	12.7	3.00
WSW	0.01	0.06	0.50	1.18	1.69	0.92	0.14	0.00	0.00	0.00	378	14.3	4.51
W	0.02	0.08	0.68	1.38	1.81	1.23	0.54	0.07	0.00	0.00	488	15.2	5.82
WNW	0.05	0.12	0.75	1.51	1.84	1.45	0.79	0.15	0.00	0.00	559	15.8	6.66
NW	0.13	0.36	1.50	2.60	2.31	1.85	1.16	0.76	0.07	0.00	901	15.9	10.74
NNW	0.13	0.21	0.85	2.36	3.19	1.95	1.26	0.68	0.21	0.00	911	17.3	10.86
%TOT	0.6	2.2	13.9	26.5	27.4	18.2	8.7	2.3	0.4	0.0			100.00

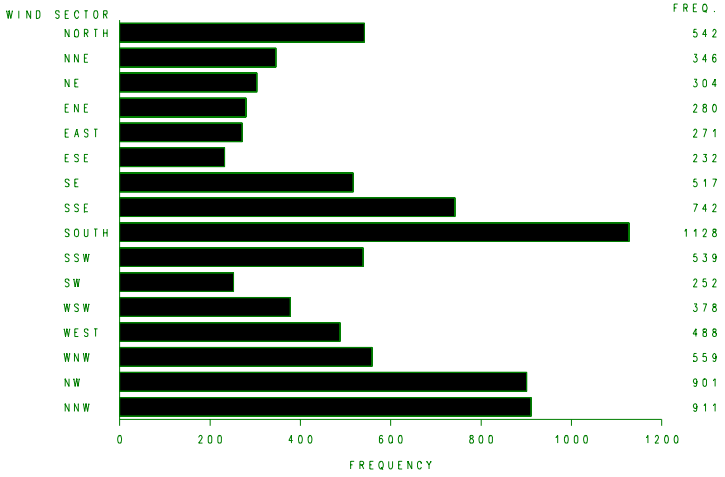


Figure A3-11

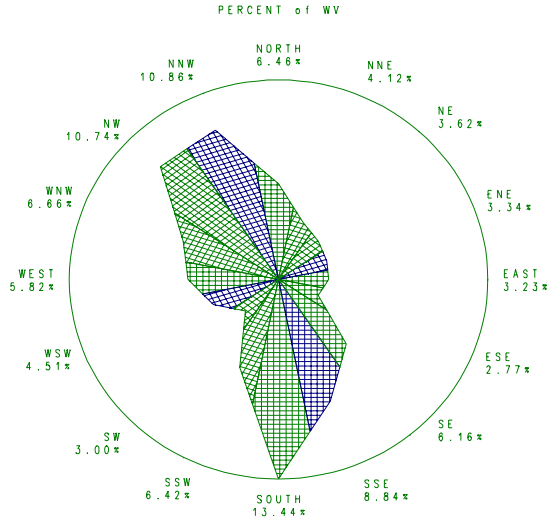


Figure A3-12

1995 Koch — MGP #3 Wind Data Summary

Table A3-7

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.28	0.48	1.26	0.98	0.27	0.00	0.00	0.00	0.00	0.00	244	6.7	3.28
NNE	0.19	0.46	0.82	0.73	0.30	0.00	0.00	0.00	0.00	0.00	185	6.8	2.49
NE	0.20	0.36	0.89	0.65	0.23	0.00	0.00	0.00	0.00	0.00	173	6.6	2.33
ENE	0.24	0.50	0.98	0.95	0.20	0.05	0.00	0.00	0.00	0.00	218	6.8	2.93
E	0.59	1.60	2.29	1.20	0.56	0.22	0.00	0.00	0.00	0.00	480	6.4	6.45
ESE	0.79	3.91	9.09	4.77	1.81	0.60	0.20	0.00	0.00	0.00	1576	7.1	21.19
SE	1.06	3.08	4.14	3.04	1.25	0.24	0.01	0.00	0.00	0.00	954	6.6	12.82
SSE	0.58	1.06	1.30	1.59	0.43	0.08	0.00	0.00	0.00	0.00	375	6.7	5.04
S	0.39	0.71	0.58	0.86	0.44	0.05	0.00	0.00	0.00	0.00	226	7.2	3.04
SSW	0.39	0.42	0.60	0.47	0.30	0.00	0.00	0.00	0.00	0.00	162	6.1	2.18
SW	0.27	0.71	0.74	0.85	0.13	0.01	0.00	0.00	0.00	0.00	202	6.0	2.72
WSW	0.23	0.86	1.26	1.17	0.47	0.11	0.00	0.00	0.00	0.00	305	7.2	4.10
W	0.38	1.42	1.92	1.37	0.99	0.42	0.13	0.01	0.00	0.00	495	8.3	6.65
WNW	0.55	1.69	2.50	1.88	1.94	0.89	0.26	0.03	0.00	0.00	724	9.5	9.73
NW	0.38	1.18	2.62	2.35	2.46	0.79	0.09	0.00	0.00	0.00	735	9.8	9.88
NNW	0.26	0.44	1.81	1.86	0.73	0.08	0.00	0.00	0.00	0.00	385	8.0	5.18
%TOT	6.8	18.9	32.8	24.7	12.5	3.5	0.7	0.0	0.0	0.0			100.00

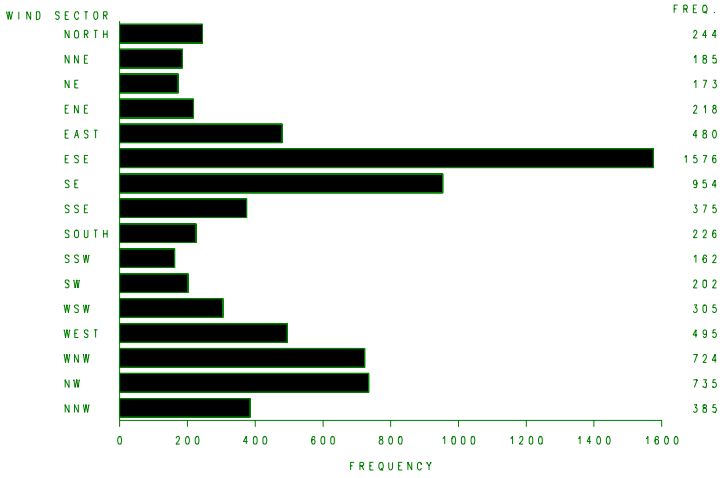


Figure A3-13

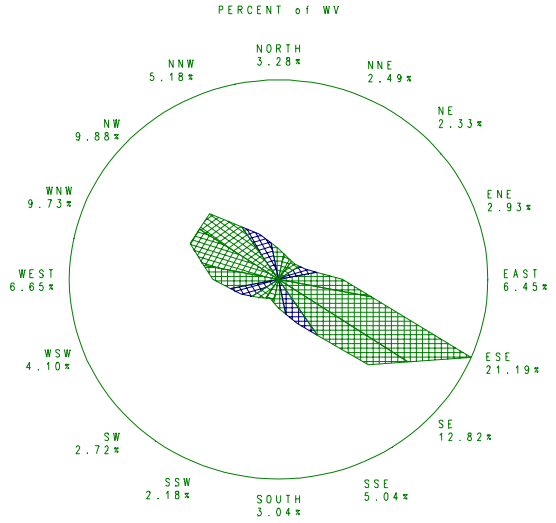


Figure A3-14

1995 Koch — MGP #4 Wind Data Summary

Table A3-8

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.37	1.86	2.43	2.11	0.94	0.10	0.00	0.00	0.00	0.00	626	7.0	7.81
NNE	0.19	0.60	0.90	0.87	0.34	0.10	0.00	0.00	0.00	0.00	240	7.4	3.00
NE	0.24	0.44	0.76	0.54	0.27	0.01	0.00	0.00	0.00	0.00	181	6.6	2.26
ENE	0.25	0.34	0.94	0.44	0.19	0.01	0.00	0.00	0.00	0.00	173	6.1	2.16
E	0.30	0.26	1.02	0.62	0.17	0.05	0.00	0.00	0.00	0.00	195	6.7	2.43
ESE	0.27	0.55	1.36	1.44	1.16	0.15	0.01	0.00	0.00	0.00	396	8.9	4.94
SE	0.76	2.12	3.93	4.03	1.58	0.50	0.26	0.01	0.00	0.00	1058	8.2	13.20
SSE	2.31	8.47	7.36	1.96	0.67	0.07	0.00	0.00	0.00	0.00	1671	4.4	20.85
S	0.75	3.42	2.50	1.00	0.10	0.00	0.00	0.00	0.00	0.00	622	4.1	7.76
SSW	0.22	0.89	0.90	0.40	0.05	0.00	0.00	0.00	0.00	0.00	197	4.8	2.46
SW	0.09	0.61	1.32	0.34	0.01	0.00	0.00	0.00	0.00	0.00	190	5.0	2.37
WSW	0.01	0.37	1.32	0.84	0.09	0.00	0.00	0.00	0.00	0.00	211	6.5	2.63
W	0.06	0.37	1.04	1.09	0.32	0.04	0.02	0.00	0.00	0.00	236	7.9	2.95
WNW	0.01	0.22	0.87	1.30	1.15	0.20	0.00	0.00	0.00	0.00	301	10.6	3.76
NW	0.05	0.24	1.41	3.08	2.43	0.56	0.05	0.00	0.00	0.00	627	11.4	7.82
NNW	0.31	1.35	5.02	3.44	2.35	0.89	0.24	0.00	0.00	0.00	1089	9.2	13.59
%TOT	6.2	22.1	33.1	23.5	11.8	2.7	0.6	0.0	0.0	0.0			100.00

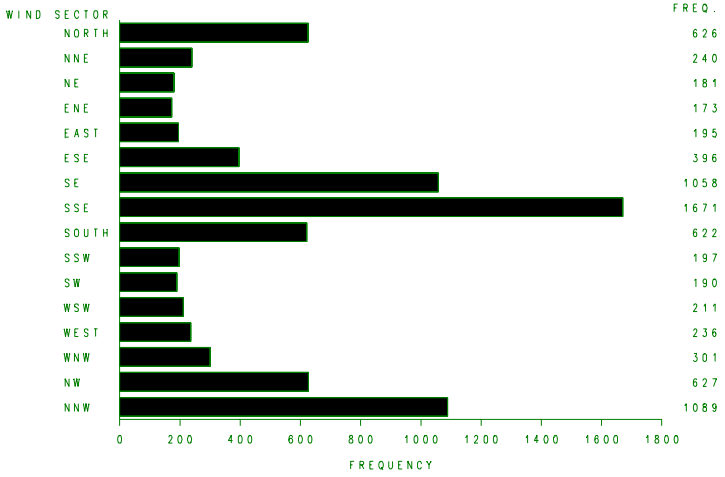


Figure A3-15

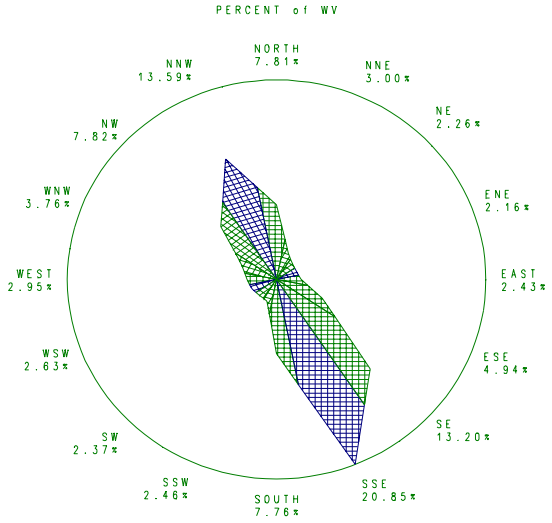


Figure A3-16

1995 Little Knife #5 Wind Data Summary

Table A3-9

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.08	0.26	1.33	0.97	0.58	0.09	0.00	0.00	0.00	0.00	282	8.5	3.31
NNE	0.13	0.29	1.00	0.49	0.43	0.06	0.00	0.00	0.00	0.00	205	7.8	2.41
NE	0.11	0.42	0.85	0.88	0.59	0.42	0.11	0.00	0.00	0.00	287	10.4	3.37
ENE	0.08	0.55	1.69	1.09	0.29	0.07	0.00	0.00	0.00	0.00	322	7.2	3.78
E	0.07	0.46	1.84	1.49	0.68	0.53	0.01	0.00	0.00	0.00	433	9.4	5.08
ESE	0.14	0.53	3.17	2.01	1.12	0.59	0.00	0.00	0.00	0.00	643	9.0	7.55
SE	0.15	0.68	4.06	1.80	0.81	0.60	0.06	0.00	0.00	0.00	695	8.3	8.16
SSE	0.05	0.47	2.03	2.20	1.28	0.20	0.01	0.00	0.00	0.00	531	9.3	6.23
S	0.14	0.76	1.81	1.64	0.87	0.11	0.00	0.00	0.00	0.00	454	8.1	5.33
SSW	0.18	0.58	2.16	1.22	0.31	0.15	0.01	0.00	0.00	0.00	392	7.1	4.60
SW	0.06	0.21	2.16	0.95	0.41	0.05	0.00	0.00	0.00	0.00	327	7.4	3.84
WSW	0.02	0.18	1.94	1.73	0.27	0.00	0.00	0.00	0.00	0.00	352	7.7	4.13
W	0.01	0.11	3.04	2.13	0.93	0.22	0.02	0.00	0.00	0.00	550	8.8	6.46
WNW	0.06	0.27	3.76	3.59	1.89	0.79	0.11	0.01	0.00	0.00	892	10.1	10.47
NW	0.06	0.34	3.83	5.34	4.14	1.56	0.89	0.04	0.00	0.00	1380	12.2	16.20
NNW	0.05	0.33	2.79	3.36	1.83	0.60	0.11	0.00	0.00	0.00	772	10.2	9.06
%TOT	1.4	6.4	37.5	30.9	16.4	6.0	1.3	0.0	0.0	0.0			100.00

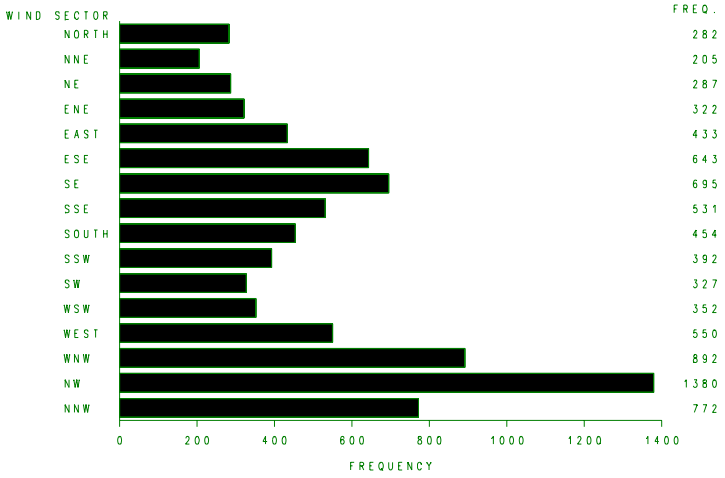


Figure A3-17

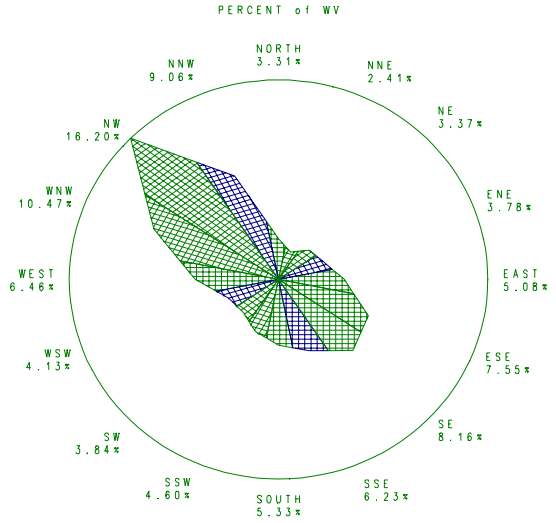


Figure A3-18

1995 Mandan — Refinery Wind Data Summary

Table A3-10

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.33	2.32	6.62	0.99	0.00	0.00	0.00	0.00	0.00	0.00	31	5.2	10.26
NNE	0.00	0.99	1.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7	3.4	2.32
NE	0.33	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3	1.7	0.99
ENE	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2	4.5	0.66
E	0.00	0.00	3.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10	6.4	3.31
ESE	0.33	0.99	4.30	0.33	0.00	0.00	0.00	0.00	0.00	0.00	18	5.1	5.96
SE	0.66	0.33	4.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16	5.1	5.30
SSE	0.00	1.99	10.93	1.32	0.00	0.00	0.00	0.00	0.00	0.00	43	5.5	14.24
S	0.00	1.66	4.30	7.62	0.00	0.00	0.00	0.00	0.00	0.00	41	7.4	13.58
SSW	0.00	3.31	4.64	0.33	0.00	0.00	0.00	0.00	0.00	0.00	25	4.0	8.28
SW	0.00	0.66	1.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7	3.9	2.32
WSW	0.33	0.66	1.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7	3.6	2.32
W	0.33	0.66	0.99	0.33	0.00	0.00	0.00	0.00	0.00	0.00	7	3.9	2.32
WNW	0.00	1.32	4.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19	4.5	6.29
NW	0.00	0.33	7.95	3.31	0.00	0.00	0.00	0.00	0.00	0.00	35	6.4	11.59
NNW	0.66	0.66	6.29	2.32	0.33	0.00	0.00	0.00	0.00	0.00	31	6.1	10.26
%TOT	3.0	16.6	63.6	16.6	0.3	0.0	0.0	0.0	0.0	0.0			100.00

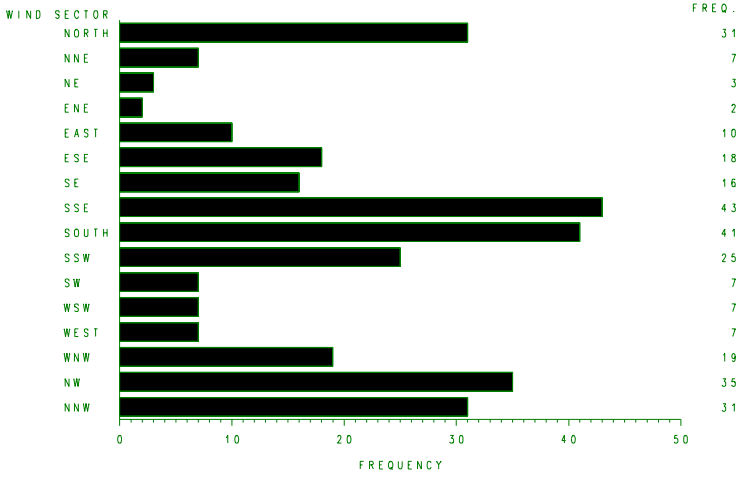


Figure A3-19

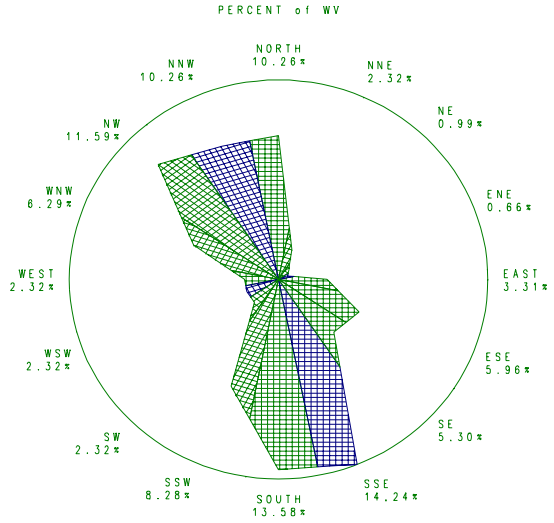


Figure A3-20

1995 Sharon Wind Data Summary

Table A3-11

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.13	0.61	2.75	2.29	1.20	0.05	0.02	0.00	0.00	0.00	604	8.3	7.05
NNE	0.08	0.77	2.79	2.04	1.45	0.14	0.00	0.00	0.00	0.00	623	8.6	7.27
NE	0.17	0.93	2.80	0.99	0.26	0.00	0.00	0.00	0.00	0.00	442	6.1	5.16
ENE	0.13	0.84	2.40	1.42	0.15	0.00	0.00	0.00	0.00	0.00	424	6.2	4.95
E	0.08	1.17	2.54	1.10	0.13	0.00	0.00	0.00	0.00	0.00	430	5.8	5.02
ESE	0.13	0.77	2.62	1.33	0.51	0.01	0.00	0.00	0.00	0.00	461	6.8	5.38
SE	0.08	1.05	3.37	1.68	0.16	0.01	0.00	0.00	0.00	0.00	545	6.1	6.36
SSE	0.10	1.35	3.22	1.00	0.02	0.00	0.00	0.00	0.00	0.00	489	5.4	5.70
S	0.06	1.05	2.33	0.66	0.00	0.00	0.00	0.00	0.00	0.00	352	5.1	4.11
SSW	0.02	0.89	2.37	1.19	0.12	0.00	0.00	0.00	0.00	0.00	393	6.0	4.58
SW	0.00	0.29	2.24	2.39	1.34	0.69	0.05	0.00	0.00	0.00	600	10.4	7.00
WSW	0.01	0.20	1.59	2.18	1.15	0.34	0.06	0.00	0.00	0.00	474	10.3	5.53
W	0.05	0.31	1.47	3.01	1.32	0.54	0.17	0.09	0.00	0.00	597	11.2	6.96
WNW	0.07	0.49	1.90	2.80	2.38	0.85	0.28	0.06	0.00	0.00	757	11.7	8.83
NW	0.03	0.38	1.99	2.93	2.75	1.14	0.19	0.08	0.00	0.00	815	12.0	9.51
NNW	0.05	0.47	2.08	2.31	1.29	0.38	0.03	0.00	0.00	0.00	567	9.7	6.61
%TOT	1.2	11.6	38.5	29.3	14.2	4.2	0.8	0.2	0.0	0.0			100.00

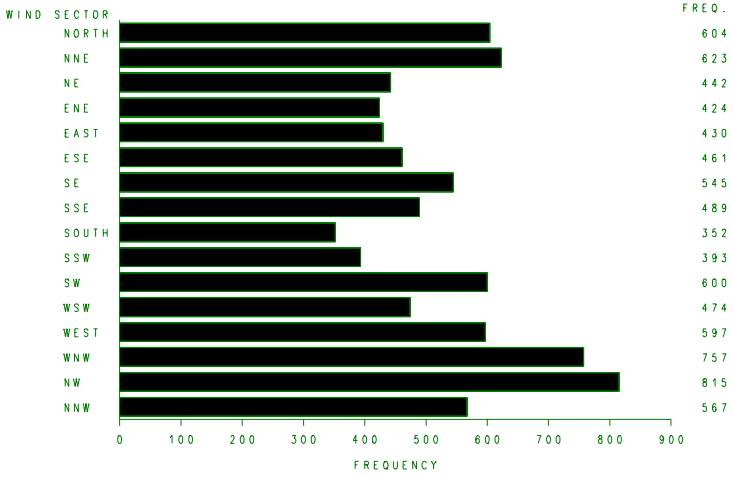


Figure A3-21

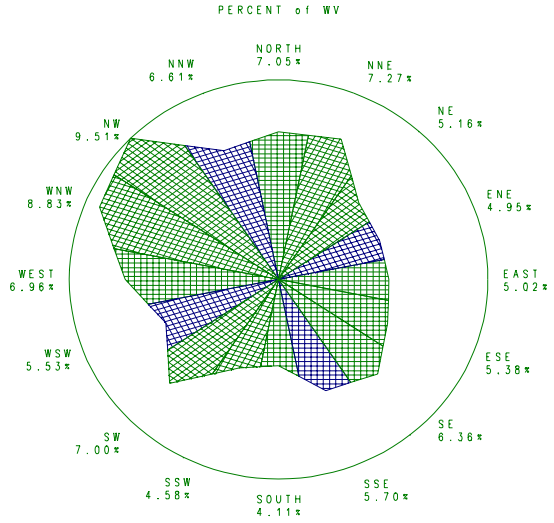


Figure A3-22

1995 TRNP — NU Wind Data Summary

Table A3-12

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.17	0.85	1.38	1.21	0.40	0.06	0.00	0.00	0.00	0.00	356	7.0	4.07
NNE	0.10	0.47	1.04	1.04	0.27	0.08	0.00	0.00	0.00	0.00	263	7.5	3.01
NE	0.16	1.03	1.12	0.97	0.31	0.01	0.00	0.00	0.00	0.00	315	6.3	3.60
ENE	0.17	1.45	1.55	0.90	0.48	0.00	0.00	0.00	0.00	0.00	399	6.1	4.56
E	0.33	2.72	2.01	0.81	0.32	0.02	0.00	0.00	0.00	0.00	544	4.9	6.22
ESE	0.33	2.71	3.98	1.36	1.19	0.05	0.00	0.00	0.00	0.00	841	6.0	9.61
SE	0.26	1.41	5.30	3.22	1.52	0.37	0.03	0.00	0.00	0.00	1060	7.8	12.11
SSE	0.22	0.77	1.58	2.10	0.90	0.17	0.00	0.00	0.00	0.00	502	8.5	5.74
S	0.15	0.55	0.75	1.41	0.81	0.00	0.00	0.00	0.00	0.00	321	8.6	3.67
SSW	0.16	0.48	0.58	0.46	0.01	0.00	0.00	0.00	0.00	0.00	148	5.4	1.69
SW	0.22	0.64	0.82	0.40	0.11	0.00	0.00	0.00	0.00	0.00	192	5.1	2.19
WSW	0.25	0.78	1.04	0.34	0.06	0.00	0.00	0.00	0.00	0.00	216	4.7	2.47
W	0.39	1.61	2.02	1.03	0.46	0.05	0.01	0.00	0.00	0.00	487	5.9	5.57
WNW	0.41	3.27	3.84	2.46	1.53	0.61	0.01	0.00	0.00	0.00	1061	7.3	12.12
NW	0.41	2.46	4.70	5.43	3.14	0.82	0.11	0.00	0.00	0.00	1494	9.0	17.07
NNW	0.24	1.45	2.00	1.99	0.46	0.17	0.00	0.00	0.00	0.00	552	7.0	6.31
%TOT	4.0	22.6	33.7	25.1	12.0	2.4	0.2	0.0	0.0	0.0			100.00

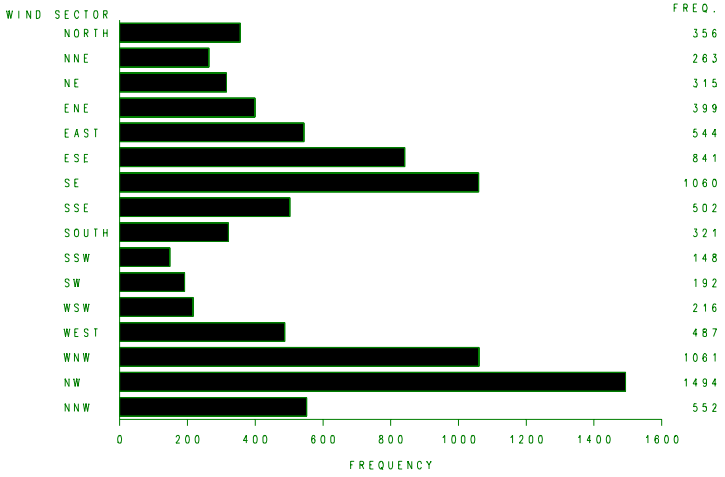


Figure A3-23

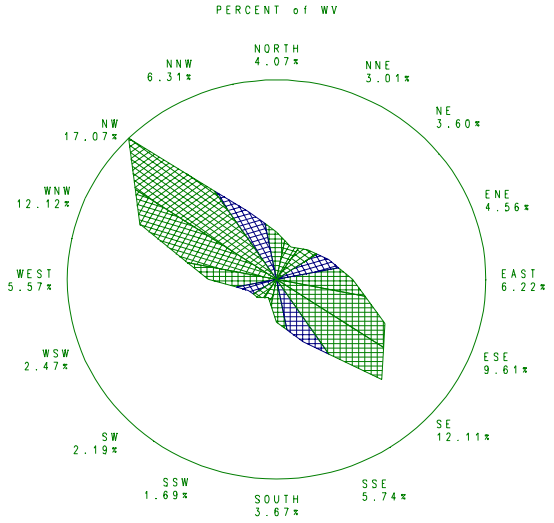


Figure A3-24

1995 Whiskey Joe Wind Data Summary

Table A3-13

Frequency Distribution of Wind Direction vs. Wind Speed
(Percentage of Wind Occurrence)

DIRECTION	SPEED (MPH)												
	00-01	02-03	04-07	08-12	13-18	19-24	25-31	32-38	39-46	> 46	TOT	AVE	%TOT
N	0.08	0.44	0.64	0.70	0.56	0.11	0.00	0.00	0.00	0.00	91	8.7	2.53
NNE	0.06	0.42	0.86	0.42	0.39	0.06	0.00	0.00	0.00	0.00	79	7.5	2.20
NE	0.08	0.47	1.06	0.86	0.39	0.00	0.03	0.00	0.00	0.00	104	7.4	2.89
ENE	0.11	0.61	0.78	1.14	0.28	0.06	0.00	0.00	0.00	0.00	107	7.8	2.98
E	0.08	0.95	1.42	1.72	0.75	0.06	0.00	0.00	0.00	0.00	179	8.1	4.98
ESE	0.06	1.28	1.47	2.14	1.78	0.67	0.14	0.00	0.00	0.00	271	10.5	7.54
SE	0.06	1.84	2.67	3.50	1.56	0.47	0.00	0.00	0.00	0.00	363	8.6	10.09
SSE	0.11	2.42	2.84	3.39	2.36	0.17	0.00	0.00	0.00	0.00	406	8.3	11.29
S	0.14	1.70	2.61	2.34	0.64	0.00	0.00	0.00	0.00	0.00	267	6.8	7.42
SSW	0.11	1.11	1.33	1.28	0.36	0.00	0.00	0.00	0.00	0.00	151	6.6	4.20
SW	0.14	0.75	1.31	1.47	0.53	0.00	0.00	0.00	0.00	0.00	151	7.3	4.20
WSW	0.08	0.64	1.06	1.47	0.58	0.19	0.00	0.00	0.00	0.00	145	8.6	4.03
W	0.19	0.58	1.78	2.06	1.95	1.33	0.14	0.00	0.00	0.00	289	11.9	8.04
WNW	0.03	1.08	1.53	2.92	3.06	3.03	0.56	0.08	0.03	0.00	443	13.9	12.32
NW	0.14	0.83	2.25	2.36	2.28	1.89	0.97	0.03	0.00	0.00	387	13.0	10.76
NNW	0.06	0.47	1.33	1.72	0.89	0.03	0.00	0.03	0.00	0.00	163	8.9	4.53
%TOT	1.5	15.6	24.9	29.5	18.4	8.1	1.8	0.1	0.0	0.0			100.00

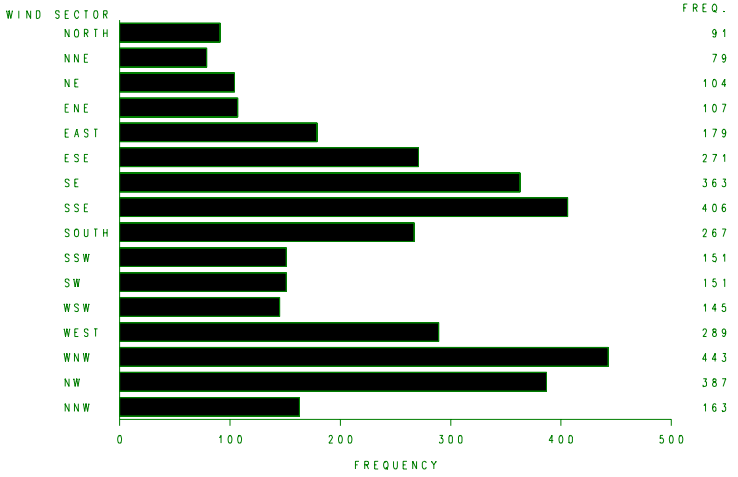


Figure A3-25

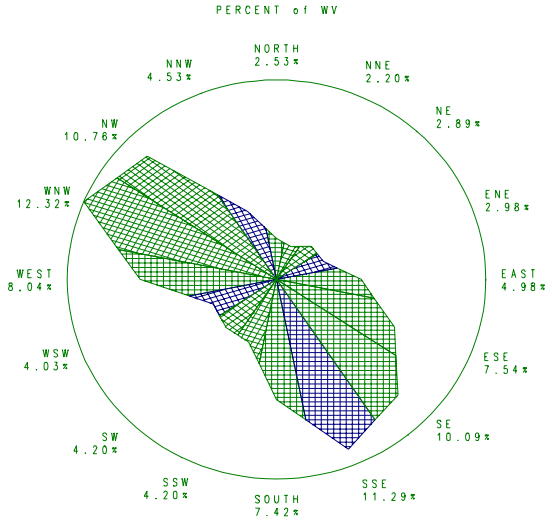


Figure A3-26