Candidate Wind Turbine Generator Site Annual Data Summary for January 1979 Through December 1979

**W. F. Sandusky
D. S. Renné**

March 1981

**Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830**

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CANDIDATE WIND TURBINE GENERATOR SITE
ANNUAL DATA SUMMARY
FOR

JANUARY 1979 THROUGH DECEMBER 1979

by

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D. S. Renne

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Pacific Northwest Laboratory
Richland, Washington 99352

SUMMARY

Summarized hourly meteorological data for fifteen candidate and wind turbine generator sites are presented in this report. These data are collected for the Department of Energy for the purpose of evaluating the wind energy potential at these sites and are used to assist in selection of potential sites for installation and testing of large wind turbines in electric utility systems. For each site, data are given in eight tables and one figure. Use of information from these tables, with information about specific wind turbines, should allow the user to estimate the potential for wind energy production at each site.

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INTRODUCTION

In the spring of 1976 the Department of Energy (then known as the Energy Research and Development Administration) selected 17 candidate sites, each proposed by interested electric service organizations, to receive meteorological measuring equipment for the purpose of evaluating the wind energy potential at these sites. The Department of Energy's Wind Energy Systems Division uses this meteorological information to assist in selection of potential sites for installation and field testing of large wind turbines in electric utility systems. Meteorological measurements at these sites began in late 1976 and early 1977, and in 1979 data collection programs were operable at 16 sites.

This report presents summarized hourly meteorological data based on 2-min data at 15 of the candidate and wind turbine generator installation sites listed in Table 1. The data cover the period from January, 1979, through December, 1979. The data were collected from sensors at two or three levels on a meteorological tower. Selection of the levels was determined by site characteristics (and in one case, tower height). The data are recorded digitally at the site on a data cassette recording system with an instantaneous sample of data recorded every two minutes.

The two sites for which data are not reported are Kaena Point, Hawaii, and Augspurgen Mountain, Washington. The collection program and data analysis for the Kaena Point site was directed by the Department of Meteorology at the University of Hawaii. Data collection continued at the site until November, 1979. Pacific Northwest Laboratory received summarized data in a different format than reported herein and thus the Kaena Point data are not included. The collection program at Augspurgen Mountain continued until the tower collapsed in January, 1978.

The heights of the sensors at each site are given in Table 2. In that table and in later summary tables, the upper sensor is noted by the letter "A", the mid-level is noted by the letter "B" and the lower level is noted by the letter "C." Note that only four sites (Block Island, Rhode Island; Boone, North Carolina; Clayton, New Mexico; and Boardman, Oregon) have mid-level sensors.

TABLE 1. Site Identification and Location

Site	Identification Code	Date Collection Began	Latitude	Longitude	Elevation (meters)
Amarillo, TX	TX	03/01/77	35° 17'N	101° 45'W	1091
Block Island, RI	RI	12/11/76	41° 10'N	71° 34'W	14
Boardman, OR	OR	01/01/77	45° 41'N	119° 50'W	212
Boone, NC	NC	12/14/76	36° 15'N	81° 40'W	1347
Clayton, NM	NM	05/01/77	36° 26'N	103° 12'W	1536
Cold Bay, AK	AK	08/01/77	55° 12'N	162° 43'W	29
Culebra, PR	PR	03/01/77	18° 20'N	65° 18'W	80
Holyoke, MA	MA	12/16/76	42° 15'N	72° 38'W	372
Huron, SD	SD	12/10/76	44° 24'N	98° 08'W	396
Kingsley, NB	NB	12/05/76	41° 10'N	101° 39'W	1024
Ludington, MI	MI	04/01/77	43° 53'N	86° 26'W	213
Montauk, NY	NY	12/30/76	41° 03'N	71° 53'W	2
Point Arena, CA	CA	01/07/77	38° 56'N	123° 43'W	21
Russell, KS	KS	12/02/76	38° 50'N	98° 51'W	564
San Geronio, CA	SG	12/03/76	33° 56'N	116° 34'N	329

TABLE 2. Sensor Heights

Site Location	C-Lower Level(a)	B-Middle Level(a)	A-Upper Level(a)
Amarillo, TX	9.1	(b)	45.7
Block Island, RI	9.1	30.0	45.7
Boardman, OR	9.1	39.6	70.1
Boone, NC	13.2	45.7	76.2
Clayton, NM	9.1	30.0	45.7
Cold Bay, AK	9.1	(b)	21.8
Culebra, PR	9.1	(b)	45.7
Holyoke, MA	18.2	(b)	45.7
Huron, SD	9.1	(b)	45.7
Kingsley Dam, NB	9.1	(b)	45.7
Ludington, MI	18.2	(b)	45.7
Montauk, NY	18.2	(b)	45.7
Point Arena, CA	9.1	(b)	45.7
Russell, KS	9.1	(b)	45.7
San Geronio, CA	9.1	(b)	45.7

(a) Meters above ground level.

(b) No data collected.

In some cases, circumstances dictated the height of the sensor levels. The height of the sensor levels at Boone was increased to accommodate the MOD-1 turbine installed at the site. This turbine has a larger blade diameter and taller tower than the MOD-0A. At the Boardman site the levels reported are based on an ongoing monitoring program for the construction and operation of a nearby coal plant. The upper-level sensor at the Cold Bay, Alaska, site is at 21.8 m since an existing FAA beacon tower is used to support the sensors. Four sites have the lower sensors at 18.2 m above ground level to measure wind data above trees or buildings near the sites.

Table 3 provides an all-site summary of data recovery rates and wind speed characteristics for the calendar year 1979. In that table, data under the column "S.D." represent standard deviation of wind speeds about the mean. Data under the column "MAX" represent maximum hourly average values during the reporting period.

Table 4 presents a summary of the mean annual wind speed obtained from each sensor level for the duration of this program to date. A 3-yr mean is also included.

The data for each site are presented in summary tables; the format of these tables is described in the next section. Information in the summary tables is provided on data recovery rates, maximum values observed, annual mean values, diurnal mean values, frequency distribution of wind speed, wind speed persistence, and power law exponent as a function of wind direction. The information from the summary tables combined with information about specific wind turbines should allow the user to estimate the potential for wind energy production at each site.

TABLE 3. Summary of Hourly Data for the Period
January 1979 Through December 1979

SITE CODE	SENSOR LEVEL (M)	% SAMPLE RECOVERY	WIND SPEED (M/S)		
			MEAN	S.D.	MAX

TX (C)	9.1	94.5	5.8	2.7	17.7
RI (C)	9.1	83.3	4.6	2.2	14.6
OR (C)	9.1	93.8	3.8	2.7	34.9
NC (C)	18.2	96.6	5.5	3.8	28.8
NM (C)	9.1	79.6	5.3	2.9	21.3
AK (C)	9.1	63.4	6.2	3.7	18.8
PR (C)	9.1	75.1	6.5	2.5	29.1
MA (C)	18.2	93.2	4.3	2.3	15.5
SD (C)	9.1	87.2	4.5	2.6	16.2
NB (C)	9.1	81.4	4.8	2.5	15.4
MI (C)	18.2	96.5	5.0	2.9	19.3
NY (C)	18.2	98.2	5.6	3.3	20.1
CA (C)	9.1	93.2	4.7	2.5	16.0
KS (C)	9.1	84.5	5.1	2.6	16.4
SG (C)	9.1	90.4	5.6	3.8	18.7

RI (B)	30.0	55.2	5.7	2.6	16.2
OR (B)	39.6	94.2	4.8	3.5	39.8
NC (B)	45.7	89.1	7.0	3.9	29.9
NM (B)	30.0	79.6	6.7	3.2	25.0

TX (A)	45.7	94.5	7.6	3.3	22.3
RI (A)	45.7	83.1	7.0	3.1	21.5
OR (A)	70.1	94.3	5.4	3.9	27.7
NC (A)	76.2	93.5	7.8	4.5	34.6
NM (A)	45.7	79.6	7.3	3.3	27.3
AK (A)	21.8	64.5	7.1	4.2	22.9
PR (A)	45.7	74.7	7.4	2.6	31.7
MA (A)	45.7	93.5	6.5	3.6	25.5
SD (A)	45.7	87.3	6.5	3.2	19.1
NB (A)	45.7	81.3	6.2	3.1	18.8
MI (A)	45.7	95.7	7.2	3.7	25.6
NY (A)	45.7	92.9	6.7	3.5	21.4
CA (A)	45.7	86.2	6.4	3.4	20.5
KS (A)	45.7	84.8	7.0	3.1	19.1
SG (A)	45.7	90.0	7.2	5.2	24.3

Note: S.D. = Standard deviation
 MAX = Maximum value
 A = Upper level
 B = Mid-level
 C = Lower level.

TABLE 4. Mean Annual Wind Speeds
Based on Monthly Means

SITE CODE	SENSOR LEVEL (M)	$\bar{V}$ (M/S) 1977	$\bar{V}$ (M/S) 1978	$\bar{V}$ (M/S) 1979	$\bar{V}$ (M/S) 3-YR AVERAGE
TX (C)	9.1	6.5	6.7	5.8	6.3
RI (C)	9.1	4.8	5.0	4.6	4.8
OR (C)	9.1	4.5	3.9	3.8	4.1
NC (C)	18.2	5.9	5.6	5.5	5.7
NM (C)	9.1	5.4	5.5	5.3	5.4
AK (C)	9.1	6.8	7.5	6.2	6.8
PR (C)	9.1	6.3	6.4	6.5	6.4
MA (C)	18.2	4.9	4.7	4.3	4.6
SD (C)	9.1	5.0	4.8	4.5	4.8
NB (C)	9.1	5.7	5.6	4.8	5.4
MI (C)(c)	18.2	4.4	4.9	5.0	4.8
NY (C)	18.2	6.1	6.1	5.6	5.9
CA (C)	9.1	5.2	4.8	4.7	4.9
KS (C)	9.1	5.6	5.7	5.1	5.5
SG (C)	9.1	6.5	6.7	5.6	6.3
RI (B)	30.0	N/A	N/A	5.7	5.7
OR (B)	39.6	5.9	4.8	4.8	5.2
NC (B)	45.7	8.0	7.7	7.0	7.6
NM (B)	30.0	N/A	7.3(b)	6.7	7.0
TX (A)	45.7	8.3	8.0	7.6	8.0
RI (A)	45.7	7.4	7.4	7.0	7.3
OR (A)	70.1	N/A	N/A	5.4	5.4
NC (A)	76.2	N/A	7.0(a)	7.8	7.4
NM (A)	45.7	7.4	7.4	7.3	7.4
AK (A)	21.8	9.6	8.3	7.1	8.3
PR (A)	45.7	6.9	7.1	7.4	7.1
MA (A)	45.7	7.2	7.1	6.5	6.9
SD (A)	45.7	6.7	6.6	6.5	6.6
NB (A)	45.7	6.8	7.0	6.2	6.7
MI (A)(c)	45.7	7.5	7.8	7.2	7.5
NY (A)	45.7	7.2	7.4	6.7	7.1
CA (A)	45.7	6.7	6.8	6.4	6.6
KS (A)	45.7	7.5	7.5	7.0	7.3
SG (A)	45.7	7.9	8.1	7.2	7.7

(a) Data reporting began in July of 1978

(b) Data reporting began in March of 1978

(c) Collection program terminated on November 3, 1979

N/A = Not available.

SUMMARY TABLES

Summarized hourly data for each site are presented in eight tables and one figure. The hourly data are obtained by averaging the 2-min instantaneous data that are routinely collected at the site. A valid hourly value was calculated from at least 10 valid 2-min values acquired during the hour.

Discussion of data represented in each table and the method of calculation is given below. The notation "W/S" refers to wind speed, which is reported in meters per second. The notation "W/D" refers to wind direction, which is reported in degrees. Information on site elevation is reported in meters.

A value reported as -999.99 indicates missing data. At several sites no mid-level sensors exist. This condition is noted at the bottom of Table 1.3. The values for the mid-level wind speed in Table 1.3 under the column "Other Levels" are therefore indicated as missing, -999.99. If no mid-level sensors exist, the values reported for Level B in Tables 1.4, 1.5, and 1.6 are zero. Also, no information for Level B is provided in Tables 1.1 and 1.2.

TITLE AND FUNCTION

Table 1.1

Sensor Performance. Sensor performance identifies the percentage of time the recording system was operating and the percentage of time acceptable data were acquired by the meteorological sensors. The values given under the label "% On-Line" are obtained by dividing the total number of data scans collected by the total possible number of data scans. The values given under the label "% Recovered" are obtained by dividing the total number of acceptable data scans collected by the total possible number of data scans.

Table 1.2

Annual Means and Standard Deviations. This table provides the mean wind speed, wind direction, and standard deviation of wind speed for each available sensor level during the reporting period. The value for wind direction indicates the direction from which the wind blows with 0° and 360° being north, 90° being east, 180° being south and 270° being west. Thus, a mean wind

direction of 220° indicates winds that blow primarily from the southwest. The value reported for standard deviation of wind speed indicates the range, both positive and negative of mean wind speed values that would include about 68% of all observed wind speed values for that reporting level.

Table 1.3

Maximum Wind Speed. The highest calculated hourly value for each available sensor level is given along with date and time of occurrence. For this maximum hourly wind speed value, the mean hourly wind direction is given along with the hourly wind speeds that occurred at the other levels.

Table 1.4

Wind Speed and Direction Versus Time-of-Day. Mean hourly wind speed and direction values are reported for each hour of the day for the reporting period. Data reported for each hour represent the average of all hourly values calculated for that hour. Data are provided for each level of instrumentation. If the site has no sensor at the mid-level (B), the values for wind speed and wind direction are reported as 0.0.

Table 1.5

Frequency Distribution of Wind Speed. For each sensor level, the total number of observations and percentage of occurrences are given for a number of classes of wind speed. The first class, 0.0 to 0.5, represents winds from 0.0 up to and including 0.5 m/s. For the rest of the classes, except the last, the number under the "Count" column indicates the number of occurrences of hourly wind speeds greater than the lower limit and less than or equal to the upper limit. Thus, the class 0.5 to 1.0 indicates the condition $0.5 < \text{wind speed (m/s)} \leq 1.0$. The recovery rate, in percent, for each wind speed sensor is given at the bottom of the table. If no mid-level sensor is available, all values under Level B and the recovery rate for Level B will be 0 or 0.0.

Table 1.6

Cumulative Frequency Distribution of Wind Speed. Both the cumulative number of observations and percentage of cumulative frequency distribution of

hourly wind speed values are given for various wind speed intervals. The value of 2.0 under the column "wind speed" represents wind speed occurrences up to and including 2.0 m/s. The corresponding number of cumulative hourly wind speed values is noted under the column "CFD" for each sensor level. If the site has no mid-level sensor, the values for Level B under the columns "CFD(ABS)" and "CFD(%)" will be 0 and 0.0, respectively.

Table 1.7

Wind Speed Persistence Frequency. Information presented in this table indicates the length of time the wind speed at the upper sensor level (A) occurs within a specified wind speed interval. For example, if in the "Hours" row of 2.0 and under the wind speed column of 4 to 12 m/s a value of 3 was reported, this indicates that during the reporting period there were three occurrences of wind speeds between 4 and 12 m/s that lasted for two hours.

Table 1.8

Power Law Exponent. A power law exponent, expressed as "ALPHA," between sensor levels is computed as indicated in the notes at the bottom of the table for each hour of data. These values are summed according to the wind direction occurring at the upper sensor level. After all data has have analyzed for the reporting period, mean values of "ALPHA" are computed according to the total number of values of "ALPHA" summed for each directional sector. The purpose of this type of data representation is to investigate how the topographical features surrounding the site may influence general wind flow characteristics.

The value under the column ALPHA(A,B,C) represents a best fit of the values for ALPHA(A,B), ALPHA(B,C), and ALPHA(A,C). These values are only computed for sites with three levels of sensors. If the site has two levels of instrumentation, i.e., no Level B sensor, no best fit value will be calculated and information on ALPHA will be found under the column "ALPHA(A,C)."

The percentage of occurrence of wind direction for each sensor is also given in this table. That information is provided under the columns "%A," "%B," "%C" for the upper, mid-, and lower sensor levels, respectively.

AMARILLO, TEXAS

SITE ID: TX
 SITE LOCATION: AMARILLO, TX.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	94.5
WD(A)	100.0	94.5
WS(C)	100.0	94.5
WD(C)	100.0	94.5

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA (A)	45.7	7.6	200.5	3.3
(C)	9.1	5.8	199.0	2.7

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	22.3	319.4	10/31/79	02:00	(B)-999.9 (C) 17.7
(C) 9.1	17.7	327.0	10/31/79	02:00	(A) 22.3 (B)-999.9

 NOTES:

1. SITE ELEVATION: 1091 METERS ABOVE SEA LEVEL.
3. SENSOR LEVEL B NOT AVAILABLE AT SITE TX.

SITE ID: TX
 SITE LOCATION: AMARILLO, TX.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	8.4	179.5	0.0	0.0	5.8	177.6
01:00	8.3	187.9	0.0	0.0	5.8	186.4
02:00	8.3	195.5	0.0	0.0	5.8	193.1
03:00	8.2	205.8	0.0	0.0	5.7	204.2
04:00	7.9	219.5	0.0	0.0	5.6	215.1
05:00	7.7	227.9	0.0	0.0	5.4	223.0
06:00	7.5	233.8	0.0	0.0	5.2	229.3
07:00	7.1	239.7	0.0	0.0	5.1	235.3
08:00	7.0	243.9	0.0	0.0	5.4	241.7
09:00	7.0	249.5	0.0	0.0	5.9	252.9
10:00	7.1	253.5	0.0	0.0	6.1	257.7
11:00	7.1	247.4	0.0	0.0	6.2	251.4
12:00	7.0	237.7	0.0	0.0	6.1	241.4
13:00	7.0	218.5	0.0	0.0	6.2	222.9
14:00	7.1	210.9	0.0	0.0	6.2	213.0
15:00	7.1	206.8	0.0	0.0	6.2	209.6
16:00	7.2	193.1	0.0	0.0	6.2	193.1
17:00	7.2	181.2	0.0	0.0	6.0	181.0
18:00	7.3	166.7	0.0	0.0	5.8	166.7
19:00	7.7	153.6	0.0	0.0	5.8	154.2
20:00	7.9	149.3	0.0	0.0	5.6	149.7
21:00	8.2	153.5	0.0	0.0	5.7	152.9
22:00	8.2	160.6	0.0	0.0	5.7	160.9
23:00	8.5	166.3	0.0	0.0	5.8	166.7

SITE ID: TX
 SITE LOCATION: AMARILLO, TX.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	%
0.0- 0.5	6	0.1	0	0.1
0.5- 1.0	30	0.4	0	0.7
1.0- 1.5	71	0.9	0	1.9
1.5- 2.0	127	1.5	0	3.3
2.0- 2.5	172	2.1	0	5.1
2.5- 3.0	226	2.7	0	5.2
3.0- 3.5	271	3.3	0	6.1
3.5- 4.0	302	3.6	0	6.5
4.0- 4.5	385	4.7	0	6.4
4.5- 5.0	434	5.2	0	7.6
5.0- 5.5	435	5.3	0	6.5
5.5- 6.0	410	5.0	0	6.6
6.0- 6.5	430	5.2	0	6.9
6.5- 7.0	419	5.1	0	6.1
7.0- 7.5	443	5.4	0	5.8
7.5- 8.0	470	5.7	0	5.0
8.0- 8.5	447	5.4	0	4.2
8.5- 9.0	458	5.5	0	3.5
9.0- 9.5	448	5.4	0	2.7
9.5-10.0	385	4.7	0	2.5
10.0-11.0	652	7.9	0	3.2
11.0-12.0	495	6.0	0	1.9
12.0-13.0	300	3.6	0	1.1
13.0-14.0	199	2.4	0	0.6
14.0-15.0	111	1.3	0	0.3
15.0-16.0	65	0.8	0	0.3
16.0-17.0	45	0.5	0	0.1
17.0-18.0	23	0.3	0	0.0
18.0-19.0	11	0.1	0	0.0
19.0-20.0	5	0.1	0	0.0
20.0-21.0	1	0.0	0	0.0
>21.0	3	0.0	0	0.0

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 94.5 0.0 94.5

SITE ID: TX
 SITE LOCATION: AMARILLO, TX.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A		LEVEL B		LEVEL C	
	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	6	0.07	0	0.00	9	0.11
1.0	36	0.43	0	0.00	67	0.81
1.5	107	1.29	0	0.00	222	2.68
2.0	234	2.83	0	0.00	497	6.00
2.5	406	4.90	0	0.00	917	11.08
3.0	632	7.63	0	0.00	1347	16.27
3.5	903	10.91	0	0.00	1851	22.36
4.0	1205	14.55	0	0.00	2391	28.89
4.5	1590	19.21	0	0.00	2924	35.33
5.0	2024	24.45	0	0.00	3551	42.90
5.5	2459	29.70	0	0.00	4089	49.40
6.0	2869	34.65	0	0.00	4635	56.00
6.5	3299	39.85	0	0.00	5202	62.65
7.0	3718	44.91	0	0.00	5709	68.97
7.5	4161	50.26	0	0.00	6186	74.74
8.0	4631	55.94	0	0.00	6599	79.73
8.5	5078	61.34	0	0.00	6943	83.88
9.0	5536	66.87	0	0.00	7229	87.34
9.5	5984	72.28	0	0.00	7456	90.08
10.0	6369	76.93	0	0.00	7659	92.53
11.0	7021	84.80	0	0.00	7927	95.77
12.0	7516	90.78	0	0.00	8084	97.67
13.0	7816	94.41	0	0.00	8172	98.73
14.0	8015	96.81	0	0.00	8220	99.31
15.0	8126	98.15	0	0.00	8248	99.65
16.0	8191	98.94	0	0.00	8269	99.90
17.0	8236	99.48	0	0.00	8274	99.96
18.0	8259	99.76	0	0.00	8277	100.00
19.0	8270	99.89	0	0.00	8277	100.00
20.0	8275	99.95	0	0.00	8277	100.00
21.0	8276	99.96	0	0.00	8277	100.00
>21.0	8279	100.00	0	0.00	8277	100.00

SITE ID: TX
 SITE LOCATION: AMARILLO, TX.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

HOURS	NUMBER OF OCCURENCES			
	PERS. ≤ 4	WIND SPEED, M/S		
		4-12	12-20	>20
1	96	91	81	1
2	74	39	37	0
3	38	36	22	1
4	25	32	18	0
5	19	25	11	0
6	25	19	13	0
7	11	24	8	0
8	12	32	5	0
9	5	15	4	0
10	2	25	5	0
11	6	19	3	0
12	3	15	1	0
13	2	16	2	0
14	3	10	0	0
15	3	18	1	0
16	0	11	0	0
17	0	10	1	0
18	0	8	0	0
19	0	7	1	0
20	0	8	0	0
21	0	11	0	0
22	2	6	0	0
23	0	3	0	0
>23	0	65	1	0

SITE ID: TX
SITE LOCATION: AMARILLO, TX.
DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR

(ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.00	0.00	0.12	0.00	5.23	0.00	4.52
NNE	0.00	0.00	0.11	0.00	7.11	0.00	7.27
NE	0.00	0.00	0.19	0.00	3.48	0.00	3.81
ENE	0.00	0.00	0.16	0.00	2.74	0.00	2.68
E	0.00	0.00	0.19	0.00	2.50	0.00	2.42
ESE	0.00	0.00	0.17	0.00	3.09	0.00	3.02
SE	0.00	0.00	0.19	0.00	6.33	0.00	6.39
SSE	0.00	0.00	0.23	0.00	11.14	0.00	11.66
S	0.00	0.00	0.15	0.00	11.47	0.00	11.74
SSW	0.00	0.00	0.13	0.00	13.25	0.00	12.43
SW	0.00	0.00	0.18	0.00	9.75	0.00	10.17
WSW	0.00	0.00	0.18	0.00	6.29	0.00	6.83
W	0.00	0.00	0.19	0.00	4.44	0.00	4.51
WNW	0.00	0.00	0.24	0.00	4.52	0.00	4.14
NW	0.00	0.00	0.20	0.00	4.05	0.00	4.14
NNW	0.00	0.00	0.12	0.00	4.59	0.00	4.26

NOTES:

$$1. \frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)} \quad \text{ALPHA}$$

$$2. \text{ ALPHA} = \frac{\text{LOG(WS(UP)/WS(LO))}}{\text{LOG(Z(UP)/Z(LO))}} \quad \text{WHERE; } \begin{array}{l} \text{Z=ELEVATION} \\ \text{WS=WIND SPEED} \end{array}$$

COUNT OF WIND SPEED VS. DIRECTION
 EACH LINE OF CHARACTERS REPRESENTS 40 OBSERVATIONS
 SPEED INCREASES WITH DISTANCE FROM CENTER OF CIRCLES
 ASSOCIATED RANGES IN MPS ARE 0 -4 4 -10 10 -20 20 -

FIGURE 1. (TX) Wind Rose for Lowest Sensor Level

BLOCK ISLAND, RHODE ISLAND

SITE ID: RI
 SITE LOCATION: BLACK ISLAND, RI.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	83.1
WD(A)	100.0	77.5
WS(B)	100.0	55.2
WD(B)	100.0	53.3
WS(C)	100.0	83.3
WD(C)	100.0	82.4

1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA (A)	45.7	7.0	253.5	3.1
(B)	30.0	5.7	240.3	2.6
(C)	9.1	4.6	252.0	2.2

1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	21.5	142.1	01/25/79	01:00	(B)-999.9 (C) 14.6
(B) 30.0	16.2	38.6	08/12/79	16:00	(A) 17.4 (C) 11.6
(C) 9.1	14.6	131.3	01/25/79	01:00	(A) 21.5 (B)-999.9

NOTES:

1. SITE ELEVATION: 14 METERS ABOVE SEA LEVEL.

SITE ID: RI
 SITE LOCATION: BLOCK ISLAND, RI.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	7.2	265.7	5.7	249.3	4.4	266.4
01:00	7.1	275.1	5.6	254.2	4.3	274.4
02:00	6.9	280.2	5.5	257.8	4.3	273.3
03:00	6.8	286.2	5.4	266.2	4.2	278.1
04:00	6.8	289.1	5.4	269.1	4.2	280.3
05:00	6.7	294.4	5.4	271.8	4.1	277.2
06:00	6.7	294.9	5.3	273.8	4.2	280.8
07:00	6.6	296.3	5.3	276.1	4.4	294.3
08:00	6.6	307.4	5.5	287.0	4.6	313.0
09:00	6.5	304.6	5.5	289.5	4.8	315.6
10:00	6.5	279.0	5.6	275.4	4.9	295.2
11:00	6.6	262.0	5.7	251.9	4.9	262.8
12:00	6.7	238.6	5.8	229.7	5.0	240.3
13:00	6.9	230.7	5.9	219.9	5.1	232.7
14:00	7.1	225.6	6.1	213.8	5.2	227.0
15:00	7.2	224.0	6.1	211.8	5.1	224.2
16:00	7.3	222.1	6.1	211.0	5.0	222.6
17:00	7.4	224.4	6.1	214.4	4.9	224.1
18:00	7.5	226.2	6.0	218.5	4.8	226.5
19:00	7.5	229.3	6.0	221.6	4.7	230.3
20:00	7.5	235.0	5.9	227.1	4.6	234.9
21:00	7.5	242.4	5.9	230.9	4.5	241.2
22:00	7.4	251.5	5.9	236.0	4.5	248.4
23:00	7.4	259.5	5.9	241.8	4.5	256.2

SITE ID: RI
 SITE LOCATION: BLOCK ISLAND, RI.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	%
0.0- 0.5	7	0.1	38	0.0
0.5- 1.0	33	0.5	35	1.7
1.0- 1.5	78	1.1	58	3.5
1.5- 2.0	123	1.7	102	5.2
2.0- 2.5	188	2.6	187	6.7
2.5- 3.0	247	3.4	249	7.3
3.0- 3.5	281	3.9	297	8.3
3.5- 4.0	321	4.4	355	9.4
4.0- 4.5	349	4.8	319	10.0
4.5- 5.0	417	5.7	395	9.6
5.0- 5.5	426	5.9	414	7.9
5.5- 6.0	437	6.0	387	6.5
6.0- 6.5	419	5.8	357	5.5
6.5- 7.0	480	6.6	312	3.8
7.0- 7.5	450	6.2	275	3.4
7.5- 8.0	433	6.0	208	3.3
8.0- 8.5	410	5.6	173	2.1
8.5- 9.0	377	5.2	136	1.5
9.0- 9.5	294	4.0	122	1.5
9.5-10.0	278	3.8	95	0.8
10.0-11.0	454	6.2	130	1.1
11.0-12.0	331	4.5	81	0.5
12.0-13.0	168	2.3	52	0.3
13.0-14.0	115	1.6	26	0.1
14.0-15.0	69	0.9	21	0.0
15.0-16.0	44	0.6	7	0.0
16.0-17.0	28	0.4	2	0.0
17.0-18.0	12	0.2	0	0.0
18.0-19.0	6	0.1	0	0.0
19.0-20.0	0	0.0	0	0.0
20.0-21.0	0	0.0	0	0.0
>21.0	1	0.0	0	0.0

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 83.1 55.2 83.3

SITE ID: RI
 SITE LOCATION: BLOCK ISLAND, RI.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

	LEVEL A		LEVEL B		LEVEL C	
WIND SPEED	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	7	0.10	38	0.79	2	0.03
1.0	40	0.55	73	1.51	128	1.75
1.5	118	1.62	131	2.71	380	5.21
2.0	241	3.31	233	4.82	762	10.45
2.5	429	5.90	420	8.69	1254	17.19
3.0	676	9.29	669	13.84	1786	24.48
3.5	957	13.15	966	19.99	2392	32.79
4.0	1278	17.56	1321	27.33	3081	42.23
4.5	1627	22.36	1640	33.93	3814	52.28
5.0	2044	28.09	2035	42.11	4511	61.84
5.5	2470	33.95	2449	50.67	5085	69.71
6.0	2907	39.95	2836	58.68	5561	76.23
6.5	3326	45.71	3193	66.07	5965	81.77
7.0	3806	52.31	3505	72.52	6241	85.55
7.5	4256	58.49	3780	78.21	6489	88.95
8.0	4689	64.44	3988	82.52	6727	92.21
8.5	5099	70.08	4161	86.10	6879	94.30
9.0	5476	75.26	4297	88.91	6986	95.76
9.5	5770	79.30	4419	91.43	7093	97.23
10.0	6048	83.12	4514	93.40	7153	98.05
11.0	6502	89.36	4644	96.09	7232	99.14
12.0	6833	93.91	4725	97.77	7268	99.63
13.0	7001	96.22	4777	98.84	7287	99.89
14.0	7116	97.80	4803	99.38	7294	99.99
15.0	7185	98.75	4824	99.81	7295	100.00
16.0	7229	99.35	4831	99.96	7295	100.00
17.0	7257	99.74	4833	100.00	7295	100.00
18.0	7269	99.90	4833	100.00	7295	100.00
19.0	7275	99.99	4833	100.00	7295	100.00
20.0	7275	99.99	4833	100.00	7295	100.00
21.0	7275	99.99	4833	100.00	7295	100.00
>21.0	7276	100.00	4833	100.00	7295	100.00

SITE ID: RI
 SITE LOCATION: BLOCK ISLAND, RI.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

HOURS	NUMBER OF OCCURENCES			
	PERS. ≤ 4	WIND SPEED, M/S		
		4-12	12-20	>20
1	56	56	46	1
2	37	39	13	0
3	22	24	2	0
4	27	17	11	0
5	12	12	1	0
6	14	6	6	0
7	10	9	3	0
8	5	9	3	0
9	6	2	1	0
10	6	8	5	0
11	3	6	0	0
12	6	7	2	0
13	3	8	0	0
14	7	7	0	0
15	1	7	1	0
16	1	7	1	0
17	1	8	3	0
18	1	4	1	0
19	3	7	0	0
20	1	2	0	0
21	2	3	0	0
22	1	6	0	0
23	1	7	0	0
>23	5	79	2	0

SITE ID: RI
 SITE LOCATION: BLOCK ISLAND, RI.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR (ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	1.41	-0.22	0.20	0.11	4.98	3.29	4.07
NNE	0.16	0.27	0.24	0.24	4.95	4.86	4.10
NE	0.17	0.31	0.27	0.28	5.00	6.10	4.98
ENE	0.31	0.14	0.18	0.17	3.15	2.94	4.14
E	1.87	-0.21	0.33	0.21	3.70	1.90	2.92
ESE	1.28	-0.16	0.21	0.13	3.16	2.15	3.59
SE	1.06	-0.01	0.27	0.21	3.81	3.12	4.51
SSSE	0.40	0.19	0.25	0.23	4.69	5.34	4.22
S	0.59	0.18	0.29	0.27	6.23	8.13	7.29
SSW	0.49	0.25	0.31	0.30	8.97	11.69	9.80
SW	0.50	0.26	0.32	0.31	11.23	13.37	10.72
WSW	0.59	0.24	0.33	0.31	6.86	8.65	8.57
W	0.34	0.25	0.27	0.27	5.72	5.81	7.13
WNW	0.35	0.25	0.27	0.27	6.34	6.48	6.91
NW	0.27	0.15	0.18	0.18	8.36	8.38	8.57
NNW	0.82	-0.06	0.17	0.12	5.94	4.47	7.39

 NOTES:

$$1. \frac{WS(UP)}{WS(L0)} = \frac{Z(UP)}{Z(L0)} \quad \text{ALPHA}$$

$$2. \text{ALPHA} = \frac{\log(WS(UP)/WS(L0))}{\log(Z(UP)/Z(L0))} \quad \text{WHERE; } \begin{matrix} Z=\text{ELEVATION} \\ WS=\text{WIND SPEED} \end{matrix}$$

COUNT OF WIND SPEED VS. DIRECTION
 EACH LINE OF CHARACTERS REPRESENTS 40 OBSERVATIONS
 SPEED INCREASES WITH DISTANCE FROM CENTER OF CIRCLES
 ASSOCIATED RANGES IN MPS ARE 0 -4 4 -10 10 -20 20 -

FIGURE 1. (RI) Wind Rose for Lowest Sensor Level

BOARDMAN, OREGON

SITE ID: OR
 SITE LOCATION: BOARDMAN, OR
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	94.3
WD(A)	100.0	94.9
WS(B)	100.0	94.2
WD(B)	100.0	94.9
WS(C)	100.0	93.8
WD(C)	100.0	94.9

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA	(A) 70.1	5.4	250.8	3.9
	(B) 39.6	4.8	241.2	3.5
	(C) 9.1	3.8	237.7	2.7

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 70.1	27.7	249.0	07/28/79	00:00	(B)-999.9 (C)-999.9
(B) 39.6	39.8	271.0	07/01/79	13:00	(A)-999.9 (C) 34.9
(C) 9.1	34.9	275.0	07/01/79	13:00	(A)-999.9 (B) 39.8

 NOTES:

1. SITE ELEVATION: 212 METERS ABOVE SEA LEVEL.

SITE ID: OR
 SITE LOCATION: BOARDMAN, OR
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	5.7	231.3	5.0	219.3	3.6	213.3
01:00	5.6	233.1	5.0	221.4	3.6	214.0
02:00	5.6	233.0	4.9	219.4	3.5	214.5
03:00	5.5	233.4	4.8	220.1	3.4	214.0
04:00	5.4	235.5	4.6	221.7	3.4	215.3
05:00	5.2	237.2	4.6	225.0	3.4	222.3
06:00	5.0	241.8	4.5	235.3	3.6	233.4
07:00	4.8	254.8	4.5	251.5	3.7	248.3
08:00	4.7	264.3	4.4	259.5	3.7	262.9
09:00	4.7	272.5	4.3	269.2	3.7	274.1
10:00	4.8	281.6	4.5	276.3	3.9	282.0
11:00	4.8	289.6	4.4	288.1	3.9	290.1
12:00	4.8	292.6	4.5	291.4	3.9	291.4
13:00	4.9	291.6	4.7	293.7	4.1	294.4
14:00	5.0	290.4	4.7	299.1	4.0	293.8
15:00	5.3	296.2	4.8	294.2	4.0	295.6
16:00	5.3	278.8	4.9	277.9	3.9	278.5
17:00	5.6	258.0	5.0	252.0	3.8	247.0
18:00	5.9	241.0	5.2	234.0	3.8	228.9
19:00	6.3	232.7	5.4	224.2	3.9	221.9
20:00	6.3	234.7	5.5	225.6	4.0	223.0
21:00	6.3	235.6	5.5	226.2	4.0	223.8
22:00	6.0	237.8	5.3	227.2	3.9	223.7
23:00	5.8	234.6	5.1	221.3	3.7	216.7

SITE ID: OR
 SITE LOCATION: BOARDMAN, OR
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	%		
0.0- 0.5	363	4.4	371	4.5	384	4.7
0.5- 1.0	471	5.7	506	6.1	616	7.5
1.0- 1.5	540	6.5	571	6.9	684	8.3
1.5- 2.0	554	6.7	610	7.4	816	9.9
2.0- 2.5	546	6.6	574	7.0	700	8.5
2.5- 3.0	456	5.5	497	6.0	591	7.2
3.0- 3.5	390	4.7	408	4.9	647	7.9
3.5- 4.0	350	4.2	356	4.3	608	7.4
4.0- 4.5	637	7.7	731	8.9	837	10.2
4.5- 5.0	262	3.2	329	4.0	290	3.5
5.0- 5.5	275	3.3	303	3.7	258	3.1
5.5- 6.0	247	3.0	317	3.8	216	2.6
6.0- 6.5	278	3.4	302	3.7	238	2.9
6.5- 7.0	239	2.9	265	3.2	212	2.6
7.0- 7.5	235	2.8	226	2.7	174	2.1
7.5- 8.0	226	2.7	222	2.7	166	2.0
8.0- 8.5	428	5.2	415	5.0	277	3.4
8.5- 9.0	193	2.3	162	2.0	129	1.6
9.0- 9.5	204	2.5	192	2.3	89	1.1
9.5-10.0	193	2.3	135	1.6	78	0.9
10.0-11.0	319	3.9	258	3.1	95	1.2
11.0-12.0	265	3.2	191	2.3	50	0.6
12.0-13.0	290	3.5	184	2.2	24	0.3
13.0-14.0	129	1.6	61	0.7	10	0.1
14.0-15.0	84	1.0	18	0.2	3	0.0
15.0-16.0	29	0.4	15	0.2	7	0.1
16.0-17.0	25	0.3	13	0.2	4	0.0
17.0-18.0	11	0.1	5	0.1	3	0.0
18.0-19.0	10	0.1	2	0.0	1	0.0
19.0-20.0	3	0.0	0	0.0	0	0.0
20.0-21.0	6	0.1	3	0.0	1	0.0
>21.0	6	0.1	10	0.1	8	0.1

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 94.3 94.2 93.8

SITE ID: OR
 SITE LOCATION: BOARDMAN, OR
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

	LEVEL A		LEVEL B		LEVEL C	
WIND SPEED	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	363	4.39	371	4.50	384	4.67
1.0	834	10.09	877	10.63	1000	12.17
1.5	1374	16.63	1448	17.55	1684	20.50
2.0	1928	23.33	2058	24.94	2500	30.43
2.5	2474	29.94	2632	31.90	3200	38.95
3.0	2930	35.45	3129	37.92	3791	46.14
3.5	3320	40.17	3537	42.86	4438	54.02
4.0	3670	44.41	3893	47.18	5046	61.42
4.5	4307	52.12	4624	56.03	5883	71.60
5.0	4569	55.29	4953	60.02	6173	75.13
5.5	4844	58.62	5256	63.69	6431	78.27
6.0	5091	61.60	5573	67.54	6647	80.90
6.5	5369	64.97	5875	71.19	6885	83.80
7.0	5608	67.86	6140	74.41	7097	86.38
7.5	5843	70.70	6366	77.14	7271	88.50
8.0	6069	73.44	6588	79.84	7437	90.52
8.5	6497	78.62	7003	84.86	7714	93.89
9.0	6690	80.95	7165	86.83	7843	95.46
9.5	6894	83.42	7357	89.15	7932	96.54
10.0	7087	85.76	7492	90.79	8010	97.49
11.0	7406	89.62	7750	93.92	8105	98.65
12.0	7671	92.82	7941	96.23	8155	99.26
13.0	7961	96.33	8125	98.46	8179	99.55
14.0	8090	97.89	8186	99.20	8189	99.67
15.0	8174	98.91	8204	99.42	8192	99.71
16.0	8203	99.26	8219	99.60	8199	99.79
17.0	8228	99.56	8232	99.76	8203	99.84
18.0	8239	99.70	8237	99.82	8206	99.88
19.0	8249	99.82	8239	99.84	8207	99.89
20.0	8252	99.85	8239	99.84	8207	99.89
21.0	8258	99.93	8242	99.88	8208	99.90
>21.0	8264	100.00	8252	100.00	8216	100.00

SITE ID: OR
 SITE LOCATION: BOARDMAN, OR
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
HOURS	< 4	4-12	12-20	>20
	-----	-----	-----	-----
1	61	98	64	9
2	37	65	40	0
3	26	52	19	1
4	17	30	18	0
5	19	33	13	0
6	20	22	2	0
7	19	16	2	0
8	16	17	4	0
9	17	12	2	0
10	14	21	1	0
11	12	10	1	0
12	12	14	0	0
13	9	13	1	0
14	8	12	0	0
15	10	11	0	0
16	7	9	1	0
17	6	7	1	0
18	4	7	0	0
19	6	7	1	0
20	1	7	1	0
21	2	9	0	0
22	1	3	0	0
23	3	5	0	0
>23	27	24	2	0

SITE ID: OR
 SITE LOCATION: BOARDMAN, OR
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR (ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.31	0.08	0.15	0.14	2.86	2.48	3.14
NNE	0.06	0.09	0.08	0.09	4.11	3.67	3.26
NE	0.26	0.09	0.14	0.13	5.86	5.82	4.08
ENE	0.39	0.02	0.12	0.10	5.28	5.32	3.97
E	0.30	0.08	0.14	0.13	4.25	3.62	2.92
ESE	0.12	0.17	0.15	0.15	2.43	3.05	1.94
SE	0.01	0.17	0.12	0.13	1.80	2.00	1.69
SSE	-0.01	0.15	0.10	0.11	1.16	1.37	1.63
S	0.15	0.24	0.21	0.22	2.13	3.14	5.55
SSW	-0.04	0.23	0.15	0.17	4.84	10.14	16.47
SW	0.19	0.20	0.20	0.20	16.23	16.15	12.43
WSW	0.14	0.17	0.16	0.17	27.98	24.19	20.81
W	0.06	0.07	0.06	0.06	12.16	10.77	12.57
WNW	-0.01	0.07	0.05	0.05	3.91	3.70	4.64
NW	-0.09	0.05	0.01	0.02	2.70	2.47	2.62
NNW	-0.17	0.15	0.06	0.08	2.23	1.98	2.22

 NOTES:

$$1. \quad \frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)}^{\text{ALPHA}}$$

$$2. \quad \text{ALPHA} = \frac{\text{LOG}(WS(UP)/WS(LO))}{\text{LOG}(Z(UP)/Z(LO))} \quad \text{WHERE; } \begin{array}{l} Z=\text{ELEVATION} \\ WS=\text{WIND SPEED} \end{array}$$

FIGURE 1. (OR) Wind Rose for Lowest Sensor Level

BOONE, NORTH CAROLINA

SITE ID: NC
 SITE LOCATION: BOONE, NC.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	93.5
WD(A)	100.0	87.9
WS(B)	100.0	89.1
WD(B)	100.0	91.7
WS(C)	100.0	96.6
WD(C)	100.0	89.2

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA	(A) 76.2	7.8	273.3	4.5
	(B) 45.7	7.0	285.2	3.9
	(C) 18.2	5.5	278.4	3.8

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 76.2	34.6	322.3	01/25/79	22:00	(R)-999.9
					(C) 26.2
(B) 45.7	29.9	337.1	12/25/79	20:00	(A) 31.0
					(C) 24.3
(C) 18.2	28.8	337.8	01/25/79	18:00	(A) 29.1
					(R)-999.9

 NOTES:

1. SITE ELEVATION: 1347 METERS ABOVE SEA LEVEL.

SITE ID: NC
 SITE LOCATION: BOONE, NC.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	8.5	263.7	7.5	278.6	5.9	273.9
01:00	8.5	266.6	7.5	279.3	5.9	275.7
02:00	8.6	270.7	7.6	283.2	6.0	278.9
03:00	8.5	271.4	7.6	284.3	6.0	280.2
04:00	8.6	274.5	7.7	287.5	6.1	283.7
05:00	8.6	279.1	7.7	290.4	6.2	286.7
06:00	8.4	281.3	7.5	293.1	6.0	289.0
07:00	8.2	283.9	7.2	296.0	5.7	292.1
08:00	7.8	287.0	6.9	297.8	5.5	291.9
09:00	7.4	285.5	6.6	294.4	5.3	285.1
10:00	7.2	279.4	6.5	290.3	5.1	278.7
11:00	7.2	275.7	6.5	287.0	5.1	276.6
12:00	7.0	273.2	6.4	284.2	4.9	273.8
13:00	6.9	269.0	6.2	280.8	4.8	270.2
14:00	6.9	265.5	6.4	275.9	4.8	266.0
15:00	7.1	266.1	6.5	276.5	4.9	267.3
16:00	7.0	269.1	6.5	280.2	4.9	270.6
17:00	7.1	272.0	6.5	282.3	4.9	271.9
18:00	7.4	269.4	6.7	281.0	5.1	274.2
19:00	7.6	269.1	6.8	281.7	5.3	279.4
20:00	8.0	273.5	7.1	284.6	5.6	281.8
21:00	8.1	270.1	7.3	283.2	5.7	276.8
22:00	8.2	269.4	7.4	282.8	5.7	278.4
23:00	8.3	266.3	7.4	280.4	5.8	274.7

SITE ID: NC
 SITE LOCATION: BOONE, NC.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT
0.0- 0.5	5	0.1	7
0.5- 1.0	46	0.6	47
1.0- 1.5	95	1.2	108
1.5- 2.0	169	2.1	186
2.0- 2.5	224	2.7	265
2.5- 3.0	289	3.5	313
3.0- 3.5	302	3.7	358
3.5- 4.0	380	4.6	395
4.0- 4.5	401	4.9	465
4.5- 5.0	428	5.2	492
5.0- 5.5	471	5.8	495
5.5- 6.0	466	5.7	511
6.0- 6.5	478	5.8	478
6.5- 7.0	460	5.6	456
7.0- 7.5	405	4.9	399
7.5- 8.0	373	4.6	359
8.0- 8.5	331	4.0	317
8.5- 9.0	295	3.6	271
9.0- 9.5	319	3.9	240
9.5-10.0	225	2.7	227
10.0-11.0	441	5.4	337
11.0-12.0	355	4.3	273
12.0-13.0	276	3.4	211
13.0-14.0	204	2.5	132
14.0-15.0	144	1.8	109
15.0-16.0	124	1.5	98
16.0-17.0	95	1.2	68
17.0-18.0	90	1.1	47
18.0-19.0	62	0.8	51
19.0-20.0	57	0.7	24
20.0-21.0	46	0.6	16
>21.0	135	1.6	51

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 93.5 89.1 96.6

SITE ID: NC
 SITE LOCATION: BOONE, NC.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A		LEVEL B		LEVEL C	
	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	5	0.06	7	0.09	64	0.76
1.0	51	0.62	54	0.69	455	5.38
1.5	146	1.78	162	2.08	909	10.74
2.0	315	3.85	348	4.46	1395	16.49
2.5	539	6.58	613	7.85	1851	21.88
3.0	828	10.11	926	11.86	2329	27.53
3.5	1130	13.80	1284	16.45	2870	33.92
4.0	1510	18.43	1679	21.51	3454	40.82
4.5	1911	23.33	2144	27.47	4023	47.55
5.0	2339	28.56	2636	33.77	4557	53.86
5.5	2810	34.31	3131	40.11	5056	59.76
6.0	3276	40.00	3642	46.66	5506	65.08
6.5	3754	45.83	4120	52.78	5894	69.66
7.0	4214	51.45	4576	58.62	6246	73.82
7.5	4619	56.39	4975	63.73	6564	77.58
8.0	4992	60.94	5334	68.33	6848	80.94
8.5	5323	64.99	5651	72.39	7067	83.52
9.0	5618	68.59	5922	75.86	7266	85.88
9.5	5937	72.48	6162	78.94	7443	87.97
10.0	6162	75.23	6389	81.85	7562	89.37
11.0	6603	80.61	6726	86.16	7779	91.94
12.0	6958	84.95	6999	89.66	7916	93.56
13.0	7234	88.32	7210	92.36	8040	95.02
14.0	7438	90.81	7342	94.06	8147	96.29
15.0	7582	92.57	7451	95.45	8207	97.00
16.0	7706	94.08	7549	96.71	8264	97.67
17.0	7801	95.24	7617	97.58	8314	98.26
18.0	7891	96.34	7664	98.18	8344	98.62
19.0	7953	97.09	7715	98.83	8373	98.96
20.0	8010	97.79	7739	99.14	8403	99.31
21.0	8056	98.35	7755	99.35	8419	99.50
>21.0	8191	100.00	7806	100.00	8461	100.00

SITE ID: NC
 SITE LOCATION: BOONE, NC.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

HOURS	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
	< 4	4-12	12-20	>20
1	100	121	91	13
2	53	71	45	9
3	42	41	27	4
4	28	22	26	3
5	20	30	18	1
6	17	19	7	1
7	11	21	10	1
8	8	19	6	2
9	5	26	3	1
10	4	19	6	1
11	7	16	8	0
12	2	11	4	1
13	5	7	2	1
14	4	11	1	0
15	8	14	1	1
16	0	8	2	1
17	4	8	0	1
18	1	7	2	0
19	1	6	1	0
20	1	6	0	0
21	1	6	0	0
22	2	5	0	0
23	0	2	1	0
>23	3	62	1	0

SITE ID: NC
SITE LOCATION: BOONE, NC.
DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR

(ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	ZA	ZB	ZC
----------	----------------	----------------	----------------	------------------	----	----	----

N	-0.03	0.30	0.18	0.19	3.19	4.28	4.11
NNE	-0.18	0.37	0.17	0.20	1.22	1.45	1.16
NE	0.28	0.42	0.37	0.38	0.79	0.88	1.24
ENE	0.15	0.49	0.37	0.38	1.36	1.59	1.75
E	0.47	0.75	0.65	0.66	1.73	1.76	2.29
ESE	0.15	1.11	0.76	0.80	2.56	2.49	1.89
SE	0.09	1.11	0.74	0.79	4.50	5.35	2.15
SSE	0.18	0.97	0.69	0.72	4.33	4.69	3.91
S	0.18	0.71	0.52	0.55	5.51	5.76	6.57
SSW	0.26	0.36	0.32	0.33	9.45	8.06	9.35
SW	0.02	0.42	0.28	0.30	9.00	9.76	8.52
WSW	0.15	0.24	0.21	0.21	4.60	4.79	4.70
W	0.47	0.13	0.25	0.24	5.52	4.19	5.01
WNW	0.35	0.19	0.24	0.24	11.22	9.36	10.18
NW	0.32	0.06	0.16	0.14	18.34	16.60	17.22
NNW	0.11	0.14	0.13	0.13	10.66	13.27	12.22

NOTES:

$$1. \frac{WS(UP)}{WS(L0)} = \frac{Z(UP)}{Z(L0)}$$
$$2. \text{ ALPHA} = \frac{\text{LOG(WS(UP)/WS(LO))}}{\text{LOG(Z(UP)/Z(LO))}} \quad \text{WHERE; } \begin{array}{l} \text{Z=ELEVATION} \\ \text{WS=WIND SPEED} \end{array}$$

FIGURE 1. (NC) Wind Rose for Lowest Sensor Level

CLAYTON, NEW MEXICO

SITE ID: NM
 SITE LOCATION: CLAYTON, NM.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	79.6
WD(A)	100.0	76.9
WS(B)	100.0	79.6
WD(B)	100.0	79.6
WS(C)	100.0	79.6
WD(C)	100.0	79.6

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA (A)	45.7	7.3	216.2	3.3
(B)	30.0	6.7	224.7	3.2
(C)	9.1	5.3	223.2	2.9

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	27.3	-999.9	10/30/79	18:00	(B) 25.0 (C) 21.1
(B) 30.0	25.0	317.1	10/30/79	18:00	(A) 27.3 (C) 21.1
(C) 9.1	21.3	298.6	03/22/79	11:00	(A) 25.2 (B) 24.4

 NOTES:

1. SITE ELEVATION: 1536 METERS ABOVE SEA LEVEL.

SITE ID: NM
 SITE LOCATION: CLAYTON, NM.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	6.9	230.0	6.0	239.7	4.2	240.7
01:00	6.9	238.1	6.0	247.3	4.2	247.3
02:00	7.1	245.1	6.1	252.7	4.3	251.0
03:00	7.1	249.2	6.2	255.9	4.3	251.7
04:00	7.1	253.4	6.2	259.0	4.3	253.9
05:00	7.0	259.5	6.1	263.4	4.2	257.0
06:00	6.9	261.6	6.0	266.2	4.3	259.2
07:00	6.8	261.4	6.1	264.3	4.9	255.4
08:00	7.1	256.8	6.7	259.9	5.8	252.2
09:00	7.4	239.8	7.2	243.3	6.4	239.1
10:00	7.5	219.1	7.3	224.7	6.5	223.1
11:00	7.6	192.7	7.4	199.6	6.6	198.1
12:00	7.6	177.6	7.4	184.2	6.6	182.4
13:00	7.8	174.5	7.6	181.9	6.8	178.9
14:00	7.9	170.9	7.7	176.7	6.8	173.4
15:00	7.8	165.6	7.6	171.9	6.6	167.6
16:00	7.8	161.6	7.4	167.3	6.3	163.0
17:00	7.4	153.5	7.0	158.6	5.7	153.5
18:00	7.3	151.1	6.6	157.1	5.2	154.2
19:00	7.3	157.1	6.5	166.1	4.8	166.0
20:00	7.3	174.8	6.4	186.0	4.5	185.4
21:00	7.2	185.2	6.3	197.7	4.5	203.8
22:00	7.1	204.3	6.2	218.6	4.3	224.4
23:00	7.1	218.9	6.1	229.6	4.3	232.7

SITE ID: NM
 SITE LOCATION: CLAYTON, NM.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	%
0.0- 0.5	0	0.0	0	0.0
0.5- 1.0	10	0.1	9	0.1
1.0- 1.5	25	0.4	27	0.4
1.5- 2.0	76	1.1	103	1.5
2.0- 2.5	152	2.2	199	2.9
2.5- 3.0	221	3.2	299	4.3
3.0- 3.5	257	3.7	371	5.3
3.5- 4.0	310	4.4	421	6.0
4.0- 4.5	353	5.1	481	6.9
4.5- 5.0	408	5.9	465	6.7
5.0- 5.5	421	6.0	459	6.6
5.5- 6.0	435	6.2	439	6.3
6.0- 6.5	454	6.5	492	7.1
6.5- 7.0	471	6.8	457	6.6
7.0- 7.5	383	5.5	358	5.1
7.5- 8.0	391	5.6	361	5.2
8.0- 8.5	387	5.5	356	5.1
8.5- 9.0	355	5.1	285	4.1
9.0- 9.5	315	4.5	258	3.7
9.5-10.0	284	4.1	191	2.7
10.0-11.0	419	6.0	324	4.6
11.0-12.0	301	4.3	210	3.0
12.0-13.0	211	3.0	156	2.2
13.0-14.0	116	1.7	86	1.2
14.0-15.0	75	1.1	48	0.7
15.0-16.0	30	0.4	38	0.5
16.0-17.0	34	0.5	29	0.4
17.0-18.0	30	0.4	20	0.3
18.0-19.0	14	0.2	7	0.1
19.0-20.0	9	0.1	5	0.1
20.0-21.0	4	0.1	3	0.0
>21.0	22	0.3	19	0.3

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 79.6 79.6 79.6

SITE ID: NM
 SITE LOCATION: CLAYTON, NM.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A		LEVEL B		LEVEL C	
	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	0	0.00	0	0.00	1	0.01
1.0	10	0.14	9	0.13	59	0.85
1.5	35	0.50	36	0.52	356	5.10
2.0	111	1.59	139	1.99	790	11.32
2.5	263	3.77	338	4.85	1225	17.56
3.0	484	6.94	637	9.13	1664	23.85
3.5	741	10.63	1008	14.45	2155	30.89
4.0	1051	15.07	1429	20.48	2667	38.23
4.5	1404	20.13	1910	27.38	3184	45.64
5.0	1812	25.99	2375	34.05	3689	52.88
5.5	2233	32.02	2834	40.62	4177	59.88
6.0	2668	38.26	3273	46.92	4606	66.03
6.5	3122	44.77	3765	53.97	4972	71.27
7.0	3593	51.53	4222	60.52	5291	75.85
7.5	3976	57.02	4580	65.65	5601	80.29
8.0	4367	62.63	4941	70.83	5835	83.64
8.5	4754	68.18	5297	75.93	6043	86.63
9.0	5109	73.27	5582	80.02	6222	89.19
9.5	5424	77.79	5840	83.72	6367	91.27
10.0	5708	81.86	6031	86.45	6496	93.12
11.0	6127	87.87	6355	91.10	6680	95.76
12.0	6428	92.18	6565	94.11	6790	97.33
13.0	6639	95.21	6721	96.34	6855	98.27
14.0	6755	96.87	6807	97.58	6898	98.88
15.0	6830	97.95	6855	98.27	6928	99.31
16.0	6860	98.38	6893	98.81	6947	99.58
17.0	6894	98.87	6922	99.23	6956	99.71
18.0	6924	99.30	6942	99.51	6960	99.77
19.0	6938	99.50	6949	99.61	6964	99.83
20.0	6947	99.63	6954	99.68	6969	99.90
21.0	6951	99.68	6957	99.73	6974	99.97
>21.0	6973	100.00	6976	100.00	6976	100.00

SITE ID: NM
 SITE LOCATION: CLAYTON, NM.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
HOURS	< 4	4-12	12-20	>20
	-----	-----	-----	-----
1	106	77	58	2
2	70	55	32	1
3	36	30	15	0
4	41	18	10	0
5	27	18	11	0
6	14	23	9	0
7	7	17	5	0
8	9	25	6	1
9	3	25	3	0
10	1	12	4	0
11	2	21	3	0
12	4	13	0	0
13	2	22	0	0
14	0	4	0	1
15	2	12	0	0
16	0	12	0	0
17	0	9	0	0
18	0	10	0	0
19	0	11	0	0
20	0	6	1	0
21	1	5	0	0
22	0	6	0	0
23	0	6	0	0
>23	0	53	0	0

SITE ID: NM
 SITE LOCATION: CLAYTON, NM.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR (ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.16	0.17	0.17	0.17	6.71	6.59	6.36
NNE	0.15	0.15	0.15	0.15	3.80	4.69	4.13
NE	-0.01	0.18	0.13	0.14	2.67	2.52	2.41
ENE	0.09	0.22	0.18	0.19	2.34	2.49	2.42
E	0.26	0.15	0.18	0.18	2.52	2.54	2.51
ESE	0.18	0.14	0.15	0.15	3.20	2.90	3.17
SE	0.29	0.11	0.16	0.15	4.43	3.81	4.57
SSE	0.12	0.17	0.16	0.16	8.05	7.60	8.11
S	0.20	0.15	0.16	0.16	14.01	13.69	13.46
SSW	0.05	0.20	0.16	0.17	10.63	11.22	10.44
SW	0.26	0.26	0.26	0.26	9.85	9.83	10.02
WSW	0.36	0.30	0.32	0.31	8.27	10.46	9.68
W	0.41	0.39	0.39	0.39	3.57	4.77	4.66
WNW	0.36	0.29	0.31	0.30	4.13	4.42	4.80
NW	-0.06	0.19	0.13	0.14	6.15	6.57	7.01
NNW	0.31	0.12	0.17	0.16	6.27	5.89	6.25

 NOTES:

$$1. \quad \frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)}^{\text{ALPHA}}$$

$$2. \quad \text{ALPHA} = \frac{\text{LOG}(WS(UP)/WS(LO))}{\text{LOG}(Z(UP)/Z(LO))} \quad \text{WHERE; } \begin{array}{l} Z=\text{ELEVATION} \\ WS=\text{WIND SPEED} \end{array}$$

COUNT OF WIND SPEED VS. DIRECTION
 EACH LINE OF CHARACTERS REPRESENTS 40 OBSERVATIONS
 SPEED INCREASES WITH DISTANCE FROM CENTER OF CIRCLES
 ASSOCIATED RANGES IN MPS ARE 0 -4 4 -10 10 -20 20 -

FIGURE 1. (NM) Wind Rose for Lowest Sensor Level

COLD BAY, ALASKA

SITE ID: AK
 SITE LOCATION: COLD BAY, AK.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	64.5
WD(A)	100.0	63.5
WS(C)	100.0	63.4
WD(C)	100.0	53.8

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA (A)	21.8	7.1	187.7	4.2
(C)	9.1	6.2	215.0	3.7

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 21.8	22.9	137.4	11/09/79	14:00	(B) 0.0
					(C) 18.7
(C) 9.1	18.8	147.3	11/09/79	15:00	(A) 22.6
					(B) 0.0

 NOTES:

1. SITE ELEVATION: 29 METERS ABOVE SEA LEVEL.
3. SENSOR LEVEL B NOT AVAILABLE AT SITE AK.

SITE ID: AK
 SITE LOCATION: COLD BAY, AK.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	6.8	189.3	0.0	0.0	5.8	209.6
01:00	6.9	178.4	0.0	0.0	5.9	210.8
02:00	6.9	186.8	0.0	0.0	6.0	208.8
03:00	6.8	189.2	0.0	0.0	5.9	218.5
04:00	6.8	184.0	0.0	0.0	5.8	213.4
05:00	6.8	173.7	0.0	0.0	5.8	212.7
06:00	6.8	185.1	0.0	0.0	6.0	218.5
07:00	6.7	182.7	0.0	0.0	6.0	222.5
08:00	7.0	188.4	0.0	0.0	6.3	227.4
09:00	7.1	195.4	0.0	0.0	6.4	228.7
10:00	7.2	204.2	0.0	0.0	6.4	224.7
11:00	7.4	195.9	0.0	0.0	6.7	218.2
12:00	7.5	196.8	0.0	0.0	6.7	230.6
13:00	7.6	180.1	0.0	0.0	6.8	208.3
14:00	7.8	184.5	0.0	0.0	6.9	209.1
15:00	7.6	206.9	0.0	0.0	6.8	221.9
16:00	7.5	189.9	0.0	0.0	6.7	212.3
17:00	7.4	189.8	0.0	0.0	6.5	214.6
18:00	7.2	182.0	0.0	0.0	6.3	216.1
19:00	7.0	184.0	0.0	0.0	6.1	210.1
20:00	6.9	189.7	0.0	0.0	6.0	210.3
21:00	6.9	185.0	0.0	0.0	5.9	206.5
22:00	6.7	178.4	0.0	0.0	5.7	203.2
23:00	6.7	190.2	0.0	0.0	5.7	213.8

SITE ID: AK
 SITE LOCATION: COLD BAY, AK.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT
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0.0- 0.5	34	0.6	0
0.5- 1.0	106	1.9	0
1.0- 1.5	153	2.7	0
1.5- 2.0	206	3.6	0
2.0- 2.5	220	3.9	0
2.5- 3.0	248	4.4	0
3.0- 3.5	302	5.3	0
3.5- 4.0	293	5.2	0
4.0- 4.5	318	5.6	0
4.5- 5.0	246	4.4	0
5.0- 5.5	249	4.4	0
5.5- 6.0	274	4.9	0
6.0- 6.5	249	4.4	0
6.5- 7.0	237	4.2	0
7.0- 7.5	216	3.8	0
7.5- 8.0	184	3.3	0
8.0- 8.5	197	3.5	0
8.5- 9.0	199	3.5	0
9.0- 9.5	160	2.8	0
9.5-10.0	180	3.2	0
10.0-11.0	323	5.7	0
11.0-12.0	265	4.7	0
12.0-13.0	220	3.9	0
13.0-14.0	161	2.9	0
14.0-15.0	128	2.3	0
15.0-16.0	89	1.6	0
16.0-17.0	80	1.4	0
17.0-18.0	45	0.8	0
18.0-19.0	33	0.6	0
19.0-20.0	15	0.3	0
20.0-21.0	13	0.2	0
>21.0	4	0.1	0

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 64.5 0.0 63.4

SITE ID: AK
 SITE LOCATION: COLD BAY, AK.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A		LEVEL B		LEVEL C	
	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	34	0.60	0	0.00	62	1.12
1.0	140	2.48	0	0.00	271	4.88
1.5	293	5.19	0	0.00	507	9.13
2.0	499	8.84	0	0.00	759	13.67
2.5	719	12.73	0	0.00	967	17.41
3.0	967	17.12	0	0.00	1226	22.08
3.5	1269	22.47	0	0.00	1528	27.52
4.0	1562	27.66	0	0.00	1811	32.61
4.5	1880	33.29	0	0.00	2086	37.57
5.0	2126	37.65	0	0.00	2335	42.05
5.5	2375	42.06	0	0.00	2640	47.54
6.0	2649	46.91	0	0.00	2896	52.15
6.5	2898	51.32	0	0.00	3168	57.05
7.0	3135	55.52	0	0.00	3380	60.87
7.5	3351	59.34	0	0.00	3590	64.65
8.0	3535	62.60	0	0.00	3834	69.04
8.5	3732	66.09	0	0.00	4052	72.97
9.0	3931	69.61	0	0.00	4247	76.48
9.5	4091	72.45	0	0.00	4429	79.76
10.0	4271	75.63	0	0.00	4617	83.14
11.0	4594	81.35	0	0.00	4916	88.53
12.0	4859	86.05	0	0.00	5135	92.47
13.0	5079	89.94	0	0.00	5300	95.44
14.0	5240	92.79	0	0.00	5394	97.14
15.0	5368	95.06	0	0.00	5461	98.34
16.0	5457	96.64	0	0.00	5514	99.30
17.0	5537	98.05	0	0.00	5540	99.77
18.0	5582	98.85	0	0.00	5547	99.89
19.0	5615	99.43	0	0.00	5553	100.00
20.0	5630	99.70	0	0.00	5553	100.00
21.0	5643	99.93	0	0.00	5553	100.00
>21.0	5647	100.00	0	0.00	5553	100.00

SITE ID: AK
 SITE LOCATION: COLD BAY, AK.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

HOURS	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
	4	4-12	12-20	>20
1	81	96	47	5
2	43	60	19	3
3	19	31	16	2
4	22	29	11	0
5	12	16	6	0
6	16	33	8	0
7	15	13	5	0
8	8	7	1	0
9	14	13	1	0
10	1	6	3	0
11	5	8	4	0
12	4	9	3	0
13	8	9	4	0
14	8	8	2	0
15	2	8	0	0
16	1	7	3	0
17	0	4	0	0
18	4	1	2	0
19	1	5	1	0
20	1	3	0	0
21	2	6	1	0
22	1	3	1	0
23	2	2	0	0
23	6	30	4	0

SITE ID: AK
 SITE LOCATION: COLD BAY, AK.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR (ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.00	0.00	0.00	0.00	2.16	0.00	2.63
NNE	0.00	0.00	-0.13	0.00	0.89	0.00	0.72
NE	0.00	0.00	0.02	0.00	1.54	0.00	1.42
ENE	0.00	0.00	0.05	0.00	2.83	0.00	2.11
E	0.00	0.00	0.00	0.00	3.35	0.00	2.38
ESE	0.00	0.00	0.22	0.00	13.60	0.00	8.00
SE	0.00	0.00	0.26	0.00	19.64	0.00	15.33
SSE	0.00	0.00	-0.10	0.00	3.93	0.00	7.65
S	0.00	0.00	0.16	0.00	1.42	0.00	1.53
SSW	0.00	0.00	-0.22	0.00	1.86	0.00	1.69
SW	0.00	0.00	-0.57	0.00	5.31	0.00	3.91
WSW	0.00	0.00	0.05	0.00	7.54	0.00	5.89
W	0.00	0.00	0.13	0.00	10.01	0.00	7.94
WNW	0.00	0.00	0.16	0.00	9.24	0.00	9.29
NW	0.00	0.00	0.14	0.00	8.16	0.00	8.50
NNW	0.00	0.00	0.14	0.00	5.83	0.00	5.06

 NOTES:

$$1. \quad \frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)}^{\text{ALPHA}}$$

$$2. \quad \text{ALPHA} = \frac{\text{LOG}(WS(UP)/WS(LO))}{\text{LOG}(Z(UP)/Z(LO))} \quad \text{WHERE; } \begin{array}{l} Z=\text{ELEVATION} \\ WS=\text{WIND SPEED} \end{array}$$

COUNT OF WIND SPEED VS. DIRECTION
 EACH LINE OF CHARACTERS REPRESENTS 40 OBSERVATIONS
 SPEED INCREASES WITH DISTANCE FROM CENTER OF CIRCLES
 ASSOCIATED RANGES IN MPS ARE 0 -4 4 -10 10 -20 20 -

FIGURE 1. (AK) Wind Rose for Lowest Sensor Level

CULEBRA, PUERTO RICO

SITE ID: PR
 SITE LOCATION: CULEBRA, PR.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	74.7
WD(A)	100.0	76.4
WS(C)	100.0	75.1
WD(C)	100.0	74.7

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA	(A) 45.7	7.4	79.5	2.6
	(C) 9.1	6.5	81.7	2.5

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	31.7	65.3	09/01/79	02:00	(B)-999.9
					(C) 29.1
(C) 9.1	29.1	70.2	09/01/79	02:00	(A) 31.7
					(B)-999.9

 NOTES:

1. SITE ELEVATION: 80 METERS ABOVE SEA LEVEL.
3. SENSOR LEVEL B NOT AVAILABLE AT SITE PR.

SITE ID: PR
 SITE LOCATION: CULEBRA, PR.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	7.4	80.9	0.0	0.0	6.3	82.9
01:00	7.3	80.4	0.0	0.0	6.2	83.0
02:00	7.2	81.5	0.0	0.0	6.1	83.5
03:00	7.2	80.9	0.0	0.0	6.1	82.9
04:00	7.2	80.7	0.0	0.0	6.2	83.0
05:00	7.3	81.4	0.0	0.0	6.2	83.4
06:00	7.2	81.5	0.0	0.0	6.1	83.0
07:00	7.1	80.2	0.0	0.0	6.3	80.2
08:00	7.3	79.2	0.0	0.0	6.6	78.7
09:00	7.6	78.2	0.0	0.0	6.9	79.2
10:00	7.7	78.4	0.0	0.0	7.0	79.8
11:00	7.8	78.4	0.0	0.0	7.0	80.6
12:00	7.8	78.6	0.0	0.0	7.0	80.6
13:00	7.6	79.1	0.0	0.0	6.9	80.6
14:00	7.5	79.1	0.0	0.0	6.7	80.8
15:00	7.4	79.9	0.0	0.0	6.5	81.0
16:00	7.3	80.3	0.0	0.0	6.4	81.6
17:00	7.4	80.5	0.0	0.0	6.4	82.5
18:00	7.5	79.2	0.0	0.0	6.4	82.8
19:00	7.6	78.0	0.0	0.0	6.5	82.6
20:00	7.5	77.5	0.0	0.0	6.5	82.0
21:00	7.5	77.6	0.0	0.0	6.5	81.9
22:00	7.5	77.8	0.0	0.0	6.5	81.2
23:00	7.4	79.8	0.0	0.0	6.3	82.6

SITE ID: PR
 SITE LOCATION: CULEBRA, PR.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	%
0.0- 0.5	0	0.0	0	0.0
0.5- 1.0	2	0.0	3	0.0
1.0- 1.5	10	0.2	20	0.3
1.5- 2.0	21	0.3	55	0.8
2.0- 2.5	48	0.7	134	2.0
2.5- 3.0	73	1.1	190	2.9
3.0- 3.5	101	1.5	274	4.2
3.5- 4.0	156	2.4	303	4.6
4.0- 4.5	224	3.4	357	5.4
4.5- 5.0	315	4.8	394	6.0
5.0- 5.5	380	5.8	603	9.2
5.5- 6.0	525	8.0	658	10.0
6.0- 6.5	659	10.1	608	9.2
6.5- 7.0	679	10.4	587	8.9
7.0- 7.5	613	9.4	468	7.1
7.5- 8.0	568	8.7	405	6.2
8.0- 8.5	438	6.7	322	4.9
8.5- 9.0	346	5.3	280	4.3
9.0- 9.5	238	3.6	219	3.3
9.5-10.0	223	3.4	171	2.6
10.0-11.0	377	5.8	241	3.7
11.0-12.0	222	3.4	121	1.8
12.0-13.0	123	1.9	61	0.9
13.0-14.0	78	1.2	43	0.7
14.0-15.0	32	0.5	21	0.3
15.0-16.0	34	0.5	9	0.1
16.0-17.0	21	0.3	9	0.1
17.0-18.0	13	0.2	3	0.0
18.0-19.0	8	0.1	5	0.1
19.0-20.0	4	0.1	5	0.1
20.0-21.0	7	0.1	0	0.0
>21.0	9	0.1	6	0.1

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 74.7 0.0 75.1

SITE ID: PR
 SITE LOCATION: CULEBRA, PR.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

	LEVEL A		LEVEL B		LEVEL C	
WIND SPEED	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	0	0.00	0	0.00	0	0.00
1.0	2	0.03	0	0.00	3	0.05
1.5	12	0.18	0	0.00	23	0.35
2.0	33	0.50	0	0.00	78	1.19
2.5	81	1.24	0	0.00	212	3.22
3.0	154	2.35	0	0.00	402	6.11
3.5	255	3.89	0	0.00	676	10.28
4.0	411	6.28	0	0.00	979	14.89
4.5	635	9.70	0	0.00	1336	20.32
5.0	950	14.51	0	0.00	1730	26.31
5.5	1330	20.31	0	0.00	2333	35.48
6.0	1855	28.33	0	0.00	2991	45.49
6.5	2514	38.40	0	0.00	3599	54.74
7.0	3193	48.77	0	0.00	4186	63.67
7.5	3806	58.13	0	0.00	4654	70.78
8.0	4374	66.81	0	0.00	5059	76.94
8.5	4812	73.50	0	0.00	5381	81.84
9.0	5158	78.78	0	0.00	5661	86.10
9.5	5396	82.42	0	0.00	5880	89.43
10.0	5619	85.83	0	0.00	6051	92.03
11.0	5996	91.58	0	0.00	6292	95.70
12.0	6218	94.97	0	0.00	6413	97.54
13.0	6341	96.85	0	0.00	6474	98.46
14.0	6419	98.04	0	0.00	6517	99.12
15.0	6451	98.53	0	0.00	6538	99.44
16.0	6485	99.05	0	0.00	6547	99.57
17.0	6506	99.37	0	0.00	6556	99.71
18.0	6519	99.57	0	0.00	6559	99.76
19.0	6527	99.69	0	0.00	6564	99.83
20.0	6531	99.76	0	0.00	6569	99.91
21.0	6538	99.86	0	0.00	6569	99.91
>21.0	6547	100.00	0	0.00	6575	100.00

SITE ID: PR
 SITE LOCATION: CULEBRA, PR.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

HOURS	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
	< 4	4-12	12-20	>20
1	47	41	33	0
2	22	21	10	0
3	17	12	7	1
4	7	15	1	0
5	2	9	2	0
6	5	6	2	1
7	3	2	1	1
8	1	8	2	0
9	1	6	4	0
10	2	4	2	0
11	1	1	0	0
12	0	3	0	0
13	0	0	1	0
14	1	2	0	0
15	0	4	0	0
16	1	3	1	0
17	0	1	0	0
18	0	2	0	0
19	0	1	0	0
20	1	1	0	0
21	0	1	0	0
22	1	7	1	0
23	0	0	0	0
>23	2	58	2	0

SITE ID: PR
 SITE LOCATION: CULEBRA, PR.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR (ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
-----	-----	-----	-----	-----	-----	-----	-----
N	0.00	0.00	0.20	0.00	1.07	0.00	0.81
NNE	0.00	0.00	0.22	0.00	2.86	0.00	1.43
NE	0.00	0.00	0.15	0.00	12.07	0.00	7.32
ENE	0.00	0.00	0.03	0.00	36.67	0.00	35.65
E	0.00	0.00	0.06	0.00	27.48	0.00	38.16
ESE	0.00	0.00	0.17	0.00	11.01	0.00	7.42
SE	0.00	0.00	0.26	0.00	4.28	0.00	2.52
SSE	0.00	0.00	0.32	0.00	1.88	0.00	1.38
S	0.00	0.00	0.31	0.00	1.10	0.00	0.99
SSW	0.00	0.00	0.36	0.00	0.58	0.00	0.84
SW	0.00	0.00	0.01	0.00	0.14	0.00	0.44
WSW	0.00	0.00	0.21	0.00	0.06	0.00	0.17
W	0.00	0.00	0.00	0.00	0.09	0.00	0.08
WNW	0.00	0.00	0.22	0.00	0.08	0.00	0.09
NW	0.00	0.00	0.12	0.00	0.15	0.00	0.09
NNW	0.00	0.00	0.20	0.00	0.49	0.00	0.43

 NOTES:

$$\begin{aligned}
 &\text{ALPHA} \\
 1. &\frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)} \\
 2. &\text{ALPHA} = \frac{\log(WS(UP)/WS(LO))}{\log(Z(UP)/Z(LO))} \quad \text{WHERE: } Z=\text{ELEVATION} \\
 &\hspace{15em} WS=\text{WIND SPEED}
 \end{aligned}$$

FIGURE 1. (PR) Wind Rose for Lowest Sensor Level

HOLYOKE, MASSACHUSETTS

SITE ID: MA
 SITE LOCATION: HOLYOKE, MA.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	93.5
WD(A)	100.0	93.5
WS(C)	100.0	93.2
WD(C)	100.0	90.5

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA	(A) 45.7	6.5	243.9	3.6
	(C) 18.2	4.3	234.0	2.3

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	25.5	266.7	04/06/79	22:00	(B)-999.9
					(C) 15.0
(C) 18.2	15.5	260.5	04/06/79	21:00	(A) 22.6
					(B)-999.9

 NOTES:

1. SITE ELEVATION: 372 METERS ABOVE SEA LEVEL.
3. SENSOR LEVEL B NOT AVAILABLE AT SITE MA.

SITE ID: MA
 SITE LOCATION: HOLYOKE, MA.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	6.6	241.2	0.0	0.0	4.5	235.0
01:00	6.5	247.2	0.0	0.0	4.4	241.7
02:00	6.5	253.7	0.0	0.0	4.4	247.6
03:00	6.5	259.2	0.0	0.0	4.4	252.2
04:00	6.4	267.2	0.0	0.0	4.4	262.4
05:00	6.2	273.0	0.0	0.0	4.2	266.7
06:00	6.2	273.4	0.0	0.0	4.2	267.7
07:00	6.1	274.4	0.0	0.0	4.0	263.9
08:00	5.8	275.9	0.0	0.0	3.8	262.5
09:00	5.6	270.3	0.0	0.0	3.7	257.5
10:00	5.6	263.1	0.0	0.0	3.7	245.3
11:00	5.8	235.5	0.0	0.0	3.9	223.4
12:00	6.0	229.1	0.0	0.0	4.0	217.8
13:00	6.3	223.7	0.0	0.0	4.1	213.5
14:00	6.5	221.5	0.0	0.0	4.2	210.8
15:00	6.7	222.5	0.0	0.0	4.3	210.5
16:00	6.9	224.9	0.0	0.0	4.4	216.5
17:00	7.0	227.1	0.0	0.0	4.5	214.1
18:00	7.1	227.5	0.0	0.0	4.7	214.4
19:00	7.2	225.1	0.0	0.0	4.8	215.1
20:00	7.2	224.9	0.0	0.0	4.8	216.3
21:00	7.1	227.8	0.0	0.0	4.7	218.9
22:00	7.0	228.1	0.0	0.0	4.7	221.6
23:00	6.7	234.3	0.0	0.0	4.5	228.3

SITE ID: MA
 SITE LOCATION: HOLYOKE, MA.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	%
0.0- 0.5	49	0.6	0	0.0
0.5- 1.0	100	1.2	0	0.0
1.0- 1.5	244	3.0	0	0.0
1.5- 2.0	289	3.5	0	0.0
2.0- 2.5	326	4.0	0	0.0
2.5- 3.0	347	4.2	0	0.0
3.0- 3.5	394	4.8	0	0.0
3.5- 4.0	452	5.5	0	0.0
4.0- 4.5	449	5.5	0	0.0
4.5- 5.0	483	5.9	0	0.0
5.0- 5.5	457	5.6	0	0.0
5.5- 6.0	493	6.0	0	0.0
6.0- 6.5	493	6.0	0	0.0
6.5- 7.0	427	5.2	0	0.0
7.0- 7.5	450	5.5	0	0.0
7.5- 8.0	375	4.6	0	0.0
8.0- 8.5	369	4.5	0	0.0
8.5- 9.0	325	4.0	0	0.0
9.0- 9.5	234	2.9	0	0.0
9.5-10.0	221	2.7	0	0.0
10.0-11.0	342	4.2	0	0.0
11.0-12.0	214	2.6	0	0.0
12.0-13.0	177	2.2	0	0.0
13.0-14.0	135	1.6	0	0.0
14.0-15.0	124	1.5	0	0.0
15.0-16.0	87	1.1	0	0.0
16.0-17.0	47	0.6	0	0.0
17.0-18.0	36	0.4	0	0.0
18.0-19.0	21	0.3	0	0.0
19.0-20.0	11	0.1	0	0.0
20.0-21.0	7	0.1	0	0.0
>21.0	12	0.1	0	0.0

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 93.5 0.0 93.2

SITE ID: MA
 SITE LOCATION: HOLYOKE, MA.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A		LEVEL B		LEVEL C	
	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	49	0.60	0	0.00	19	0.23
1.0	149	1.82	0	0.00	213	2.61
1.5	393	4.80	0	0.00	627	7.68
2.0	682	8.33	0	0.00	1181	14.46
2.5	1008	12.31	0	0.00	1868	22.88
3.0	1355	16.54	0	0.00	2598	31.81
3.5	1749	21.36	0	0.00	3430	42.00
4.0	2201	26.87	0	0.00	4133	50.61
4.5	2650	32.36	0	0.00	4873	59.67
5.0	3133	38.25	0	0.00	5515	67.54
5.5	3590	43.83	0	0.00	6081	74.47
6.0	4083	49.85	0	0.00	6560	80.33
6.5	4576	55.87	0	0.00	6924	84.79
7.0	5003	61.09	0	0.00	7212	88.32
7.5	5453	66.58	0	0.00	7426	90.94
8.0	5828	71.16	0	0.00	7577	92.79
8.5	6197	75.67	0	0.00	7708	94.39
9.0	6522	79.63	0	0.00	7826	95.84
9.5	6756	82.49	0	0.00	7909	96.85
10.0	6977	85.19	0	0.00	7984	97.77
11.0	7319	89.37	0	0.00	8068	98.80
12.0	7533	91.98	0	0.00	8121	99.45
13.0	7710	94.14	0	0.00	8146	99.76
14.0	7845	95.79	0	0.00	8156	99.88
15.0	7969	97.30	0	0.00	8165	99.99
16.0	8056	98.36	0	0.00	8166	100.00
17.0	8103	98.94	0	0.00	8166	100.00
18.0	8139	99.38	0	0.00	8166	100.00
19.0	8160	99.63	0	0.00	8166	100.00
20.0	8171	99.77	0	0.00	8166	100.00
21.0	8178	99.85	0	0.00	8166	100.00
>21.0	8190	100.00	0	0.00	8166	100.00

SITE ID: MA
 SITE LOCATION: HOLYOKE, MA.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

HOURS	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
	≤ 4	4-12	12-20	>20
1	98	101	53	4
2	56	55	32	0
3	34	35	12	0
4	24	28	15	1
5	18	25	3	1
6	18	26	4	1
7	11	15	2	0
8	19	15	5	0
9	8	18	3	0
10	16	12	1	0
11	13	12	5	0
12	6	10	1	0
13	7	16	1	0
14	5	16	1	0
15	1	8	1	0
16	6	10	0	0
17	3	7	1	0
18	3	5	0	0
19	4	9	0	0
20	2	7	1	0
21	3	9	0	0
22	3	6	0	0
23	1	3	1	0
23	8	57	4	0

SITE ID: MA
SITE LOCATION: HOLYOKE, MA.
DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR
(ELEV A)

(ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.00	0.00	0.39	0.00	4.41	0.00	5.17
NNE	0.00	0.00	0.25	0.00	3.06	0.00	2.36
NE	0.00	0.00	0.32	0.00	2.83	0.00	2.30
ENE	0.00	0.00	0.30	0.00	2.76	0.00	3.15
E	0.00	0.00	0.22	0.00	2.37	0.00	2.87
ESE	0.00	0.00	0.23	0.00	3.43	0.00	3.99
SE	0.00	0.00	0.32	0.00	8.07	0.00	7.92
SSE	0.00	0.00	0.37	0.00	10.72	0.00	10.19
S	0.00	0.00	0.39	0.00	7.90	0.00	7.43
SSW	0.00	0.00	0.44	0.00	4.88	0.00	4.75
SW	0.00	0.00	0.42	0.00	3.98	0.00	5.01
WSW	0.00	0.00	0.32	0.00	6.78	0.00	8.46
W	0.00	0.00	0.50	0.00	16.59	0.00	16.96
WNW	0.00	0.00	0.74	0.00	10.82	0.00	6.23
NW	0.00	0.00	0.68	0.00	4.80	0.00	3.40
NNW	0.00	0.00	0.58	0.00	6.30	0.00	6.34

NOTES:

$$1. \frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)}$$
$$2. \text{ ALPHA} = \frac{\text{LOG(WS(UP)/WS(LO))}}{\text{LOG(Z(UP)/Z(LO))}} \quad \text{WHERE; } \begin{array}{l} \text{Z=ELEVATION} \\ \text{WS=WIND SPEED} \end{array}$$

FIGURE 1. (MA) Wind Rose for Lowest Sensor Level

HURON, SOUTH DAKOTA

SITE ID: SD
 SITE LOCATION: HURON, SD.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

--- -----
 1.1 SENSOR PERFORMANCE
 --- -----

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	87.3
WD(A)	100.0	78.0
WS(C)	100.0	87.2
WD(C)	100.0	90.0

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA (A)	45.7	6.5	114.3	3.2
(C)	9.1	4.5	103.8	2.6

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	19.1	144.5	04/18/79	16:00	(B)-999.9
					(C) 16.2
(C) 9.1	16.2	145.1	04/18/79	16:00	(A) 19.1
					(B)-999.9

 NOTES:

1. SITE ELEVATION: 396 METERS ABOVE SEA LEVEL.
3. SENSOR LEVEL B NOT AVAILABLE AT SITE SD.

SITE ID: SD
 SITE LOCATION: HURON, SD.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	6.6	109.8	0.0	0.0	4.1	113.4
01:00	6.6	117.0	0.0	0.0	4.0	122.0
02:00	6.5	126.4	0.0	0.0	4.0	115.7
03:00	6.5	145.8	0.0	0.0	4.0	125.5
04:00	6.3	145.2	0.0	0.0	4.0	127.6
05:00	6.3	137.6	0.0	0.0	3.9	117.6
06:00	6.3	143.8	0.0	0.0	3.9	115.4
07:00	6.0	150.6	0.0	0.0	3.9	112.3
08:00	5.9	132.0	0.0	0.0	4.2	121.8
09:00	6.0	141.0	0.0	0.0	4.6	130.3
10:00	6.1	210.0	0.0	0.0	4.9	155.5
11:00	6.3	192.2	0.0	0.0	5.1	153.0
12:00	6.5	260.3	0.0	0.0	5.3	240.9
13:00	6.8	269.0	0.0	0.0	5.5	250.9
14:00	6.8	301.9	0.0	0.0	5.5	270.9
15:00	6.8	285.2	0.0	0.0	5.4	283.1
16:00	6.7	299.5	0.0	0.0	5.2	291.7
17:00	6.7	320.1	0.0	0.0	5.0	348.0
18:00	6.7	1.7	0.0	0.0	4.7	32.0
19:00	6.4	16.1	0.0	0.0	4.3	44.2
20:00	6.3	47.1	0.0	0.0	4.0	70.1
21:00	6.4	77.1	0.0	0.0	3.9	81.1
22:00	6.7	88.3	0.0	0.0	4.1	85.5
23:00	6.7	97.7	0.0	0.0	4.1	103.4

SITE ID: SD
 SITE LOCATION: HURON, SD.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	%
0.0- 0.5	30	0.4	0	0.0
0.5- 1.0	91	1.2	0	0.0
1.0- 1.5	161	2.1	0	0.0
1.5- 2.0	217	2.8	0	0.0
2.0- 2.5	273	3.6	0	0.0
2.5- 3.0	297	3.9	0	0.0
3.0- 3.5	349	4.6	0	0.0
3.5- 4.0	426	5.6	0	0.0
4.0- 4.5	454	5.9	0	0.0
4.5- 5.0	440	5.8	0	0.0
5.0- 5.5	466	6.1	0	0.0
5.5- 6.0	445	5.8	0	0.0
6.0- 6.5	527	6.9	0	0.0
6.5- 7.0	450	5.9	0	0.0
7.0- 7.5	385	5.0	0	0.0
7.5- 8.0	381	5.0	0	0.0
8.0- 8.5	359	4.7	0	0.0
8.5- 9.0	292	3.8	0	0.0
9.0- 9.5	309	4.0	0	0.0
9.5-10.0	265	3.5	0	0.0
10.0-11.0	379	5.0	0	0.0
11.0-12.0	241	3.2	0	0.0
12.0-13.0	151	2.0	0	0.0
13.0-14.0	104	1.4	0	0.0
14.0-15.0	69	0.9	0	0.0
15.0-16.0	41	0.5	0	0.0
16.0-17.0	29	0.4	0	0.0
17.0-18.0	15	0.2	0	0.0
18.0-19.0	2	0.0	0	0.0
19.0-20.0	1	0.0	0	0.0
20.0-21.0	0	0.0	0	0.0
>21.0	0	0.0	0	0.0

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 87.3 0.0 87.2

SITE ID: SD
 SITE LOCATION: HURON, SD.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A		LEVEL B		LEVEL C	
	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	30	0.39	0	0.00	74	0.97
1.0	121	1.58	0	0.00	282	3.69
1.5	282	3.69	0	0.00	694	9.08
2.0	499	6.52	0	0.00	1286	16.83
2.5	772	10.09	0	0.00	1943	25.43
3.0	1069	13.98	0	0.00	2678	35.04
3.5	1418	18.54	0	0.00	3314	43.37
4.0	1844	24.11	0	0.00	3858	50.48
4.5	2298	30.04	0	0.00	4442	58.13
5.0	2738	35.80	0	0.00	4911	64.26
5.5	3204	41.89	0	0.00	5294	69.28
6.0	3649	47.71	0	0.00	5678	74.30
6.5	4176	54.60	0	0.00	6015	78.71
7.0	4626	60.48	0	0.00	6293	82.35
7.5	5011	65.51	0	0.00	6555	85.78
8.0	5392	70.49	0	0.00	6780	88.72
8.5	5751	75.19	0	0.00	6979	91.32
9.0	6043	79.00	0	0.00	7134	93.35
9.5	6352	83.04	0	0.00	7260	95.00
10.0	6617	86.51	0	0.00	7363	96.35
11.0	6996	91.46	0	0.00	7499	98.13
12.0	7237	94.61	0	0.00	7577	99.15
13.0	7388	96.59	0	0.00	7621	99.73
14.0	7492	97.95	0	0.00	7638	99.95
15.0	7561	98.85	0	0.00	7641	99.99
16.0	7602	99.39	0	0.00	7641	99.99
17.0	7631	99.76	0	0.00	7642	100.00
18.0	7646	99.96	0	0.00	7642	100.00
19.0	7648	99.99	0	0.00	7642	100.00
20.0	7649	100.00	0	0.00	7642	100.00
21.0	7649	100.00	0	0.00	7642	100.00
>21.0	7649	100.00	0	0.00	7642	100.00

SITE ID: SD
 SITE LOCATION: HURON, SD.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

HOURS	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
	< 4	4-12	12-20	>20
1	97	83	36	0
2	70	60	14	0
3	45	37	12	0
4	34	21	6	0
5	20	14	6	0
6	22	18	4	0
7	8	18	5	0
8	16	23	2	0
9	9	23	5	0
10	13	10	1	0
11	6	12	2	0
12	9	10	1	0
13	4	11	2	0
14	4	10	0	0
15	4	8	0	0
16	2	8	2	0
17	2	5	0	0
18	3	10	0	0
19	1	4	0	0
20	1	8	0	0
21	1	3	0	0
22	0	5	0	0
23	0	10	0	0
>23	5	70	1	0

SITE ID: SD
 SITE LOCATION: HURON, SD.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR (ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.00	0.00	0.24	0.00	3.87	0.00	4.46
NNE	0.00	0.00	0.22	0.00	2.78	0.00	2.89
NE	0.00	0.00	0.25	0.00	2.42	0.00	2.41
ENE	0.00	0.00	0.23	0.00	3.03	0.00	3.25
E	0.00	0.00	0.22	0.00	4.48	0.00	5.19
ESE	0.00	0.00	0.23	0.00	7.36	0.00	8.69
SE	0.00	0.00	0.27	0.00	14.73	0.00	15.61
SSE	0.00	0.00	0.17	0.00	8.07	0.00	8.44
S	0.00	0.00	0.21	0.00	3.56	0.00	3.36
SSW	0.00	0.00	0.24	0.00	1.73	0.00	1.69
SW	0.00	0.00	0.25	0.00	2.04	0.00	2.67
WSW	0.00	0.00	0.30	0.00	2.88	0.00	3.27
W	0.00	0.00	0.26	0.00	5.24	0.00	4.87
WNW	0.00	0.00	0.26	0.00	7.92	0.00	8.09
NW	0.00	0.00	0.20	0.00	8.93	0.00	10.32
NNW	0.00	0.00	0.16	0.00	8.84	0.00	10.15

 NOTES:

$$1. \quad \frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)}^{\text{ALPHA}}$$

$$2. \quad \text{ALPHA} = \frac{\text{LOG}(WS(UP)/WS(LO))}{\text{LOG}(Z(UP)/Z(LO))}$$

WHERE; Z=ELEVATION
 WS=WIND SPEED

FIGURE 1. (SD) Wind Rose for Lowest Sensor Level

KINGSLEY DAM, NEBRASKA

SITE ID: NB
 SITE LOCATION: KINGSLEY DAM, NB.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	81.3
WD(A)	100.0	81.4
WS(C)	100.0	81.4
WD(C)	100.0	81.4

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA (A)	45.7	6.2	274.4	3.1
(C)	9.1	4.8	278.4	2.5

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	18.8	180.6	04/22/79	23:00	(B)-999.9
					(C) 15.2
(C) 9.1	15.4	167.6	04/18/79	10:00	(A) 17.5
					(B)-999.9

 NOTES:

1. SITE ELEVATION: 1024 METERS ABOVE SEA LEVEL.
3. SENSOR LEVEL B NOT AVAILABLE AT SITE NB.

SITE ID: NB
 SITE LOCATION: KINGSLEY DAM, NB.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	6.6	193.8	0.0	0.0	4.7	193.8
01:00	6.5	248.4	0.0	0.0	4.7	252.6
02:00	6.3	253.7	0.0	0.0	4.6	249.8
03:00	6.1	266.3	0.0	0.0	4.4	270.4
04:00	5.9	272.1	0.0	0.0	4.3	274.2
05:00	5.8	274.1	0.0	0.0	4.2	265.4
06:00	5.7	268.2	0.0	0.0	4.2	259.1
07:00	5.7	274.1	0.0	0.0	4.4	276.2
08:00	5.6	280.5	0.0	0.0	4.7	289.3
09:00	5.7	279.8	0.0	0.0	4.9	288.9
10:00	5.9	288.1	0.0	0.0	5.0	299.1
11:00	6.0	289.1	0.0	0.0	5.1	299.4
12:00	6.1	290.8	0.0	0.0	5.2	300.1
13:00	6.2	288.6	0.0	0.0	5.3	296.6
14:00	6.2	291.6	0.0	0.0	5.3	299.3
15:00	6.4	297.4	0.0	0.0	5.3	310.5
16:00	6.4	330.5	0.0	0.0	5.1	347.6
17:00	6.2	27.7	0.0	0.0	4.8	44.7
18:00	6.2	81.4	0.0	0.0	4.5	98.1
19:00	6.4	100.6	0.0	0.0	4.5	118.0
20:00	6.6	106.3	0.0	0.0	4.6	118.6
21:00	6.8	126.6	0.0	0.0	4.8	139.1
22:00	6.7	151.7	0.0	0.0	4.8	152.7
23:00	6.7	168.6	0.0	0.0	4.8	162.8

SITE ID: NB
 SITE LOCATION: KINGSLEY DAM, NB.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	%
0.0- 0.5	2	0.0	0	0.0
0.5- 1.0	62	0.9	0	0.0
1.0- 1.5	139	2.0	0	0.0
1.5- 2.0	217	3.0	0	0.0
2.0- 2.5	296	4.2	0	0.0
2.5- 3.0	335	4.7	0	0.0
3.0- 3.5	383	5.4	0	0.0
3.5- 4.0	418	5.9	0	0.0
4.0- 4.5	463	6.5	0	0.0
4.5- 5.0	477	6.7	0	0.0
5.0- 5.5	452	6.3	0	0.0
5.5- 6.0	483	6.8	0	0.0
6.0- 6.5	431	6.1	0	0.0
6.5- 7.0	453	6.4	0	0.0
7.0- 7.5	383	5.4	0	0.0
7.5- 8.0	350	4.9	0	0.0
8.0- 8.5	315	4.4	0	0.0
8.5- 9.0	260	3.7	0	0.0
9.0- 9.5	218	3.1	0	0.0
9.5-10.0	168	2.4	0	0.0
10.0-11.0	260	3.7	0	0.0
11.0-12.0	183	2.6	0	0.0
12.0-13.0	166	2.3	0	0.0
13.0-14.0	89	1.2	0	0.0
14.0-15.0	60	0.8	0	0.0
15.0-16.0	38	0.5	0	0.0
16.0-17.0	9	0.1	0	0.0
17.0-18.0	10	0.1	0	0.0
18.0-19.0	3	0.0	0	0.0
19.0-20.0	0	0.0	0	0.0
20.0-21.0	0	0.0	0	0.0
>21.0	0	0.0	0	0.0

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 81.3 0.0 81.4

SITE ID: NB
 SITE LOCATION: KINGSLEY DAM, NB.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A		LEVEL B		LEVEL C	
	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	2	0.03	0	0.00	15	0.21
1.0	64	0.90	0	0.00	176	2.47
1.5	203	2.85	0	0.00	477	6.69
2.0	420	5.90	0	0.00	856	12.01
2.5	716	10.05	0	0.00	1350	18.94
3.0	1051	14.76	0	0.00	1890	26.51
3.5	1434	20.13	0	0.00	2456	34.45
4.0	1852	26.00	0	0.00	3085	43.27
4.5	2315	32.50	0	0.00	3633	50.96
5.0	2792	39.20	0	0.00	4214	59.11
5.5	3244	45.54	0	0.00	4745	66.56
6.0	3727	52.32	0	0.00	5174	72.58
6.5	4158	58.37	0	0.00	5561	78.01
7.0	4611	64.73	0	0.00	5895	82.69
7.5	4994	70.11	0	0.00	6157	86.37
8.0	5344	75.02	0	0.00	6341	88.95
8.5	5659	79.45	0	0.00	6519	91.44
9.0	5919	83.10	0	0.00	6683	93.74
9.5	6137	86.16	0	0.00	6790	95.24
10.0	6305	88.52	0	0.00	6880	96.51
11.0	6565	92.17	0	0.00	7010	98.33
12.0	6748	94.74	0	0.00	7081	99.33
13.0	6914	97.07	0	0.00	7108	99.71
14.0	7003	98.32	0	0.00	7122	99.90
15.0	7063	99.16	0	0.00	7127	99.97
16.0	7101	99.69	0	0.00	7129	100.00
17.0	7110	99.82	0	0.00	7129	100.00
18.0	7120	99.96	0	0.00	7129	100.00
19.0	7123	100.00	0	0.00	7129	100.00
20.0	7123	100.00	0	0.00	7129	100.00
21.0	7123	100.00	0	0.00	7129	100.00
>21.0	7123	100.00	0	0.00	7129	100.00

SITE ID: NB
 SITE LOCATION: KINGSLEY DAM, NB.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
HOURS	< 4	4-12	12-20	>20
	-----	-----	-----	-----
1	120	120	47	0
2	86	64	22	0
3	50	49	15	0
4	37	44	7	0
5	27	35	4	0
6	36	22	3	0
7	18	15	2	0
8	9	25	4	0
9	14	18	4	0
10	13	21	0	0
11	4	14	3	0
12	6	9	1	0
13	4	16	0	0
14	1	9	1	0
15	4	11	1	0
16	1	7	0	0
17	3	9	1	0
18	0	9	0	0
19	1	10	0	0
20	0	5	0	0
21	1	6	0	0
22	1	7	0	0
23	1	3	0	0
>23	2	42	0	0

SITE ID: NB
 SITE LOCATION: KINGSLEY DAM, NB.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR (ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.00	0.00	0.18	0.00	6.19	0.00	5.92
NNE	0.00	0.00	0.15	0.00	4.82	0.00	5.57
NE	0.00	0.00	0.08	0.00	4.89	0.00	5.16
ENE	0.00	0.00	0.11	0.00	5.55	0.00	5.62
E	0.00	0.00	0.17	0.00	4.80	0.00	5.84
ESE	0.00	0.00	0.23	0.00	4.25	0.00	4.73
SE	0.00	0.00	0.21	0.00	5.53	0.00	4.97
SSE	0.00	0.00	0.20	0.00	8.25	0.00	6.65
S	0.00	0.00	0.14	0.00	8.31	0.00	7.98
SSW	0.00	0.00	0.12	0.00	5.53	0.00	6.52
SW	0.00	0.00	0.08	0.00	3.80	0.00	3.62
WSW	0.00	0.00	0.19	0.00	4.31	0.00	5.29
W	0.00	0.00	0.21	0.00	7.60	0.00	7.97
WNW	0.00	0.00	0.15	0.00	12.78	0.00	11.56
NW	0.00	0.00	0.16	0.00	6.94	0.00	7.45
NNW	0.00	0.00	0.18	0.00	6.44	0.00	5.15

 NOTES:

$$1. \quad \frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)}^{\text{ALPHA}}$$

$$2. \quad \text{ALPHA} = \frac{\text{LOG}(WS(UP)/WS(LO))}{\text{LOG}(Z(UP)/Z(LO))} \quad \text{WHERE:} \quad \begin{array}{l} Z=\text{ELEVATION} \\ WS=\text{WIND SPEED} \end{array}$$

FIGURE 1. (NB) Wind Rose for Lowest Sensor Level

LUDINGTON, MICHIGAN

SITE ID: MI
 SITE LOCATION: LUDINGTON, MI.
 DATA : JANUARY 1979 THROUGH OCTOBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 7296

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	95.7
WD(A)	100.0	95.2
WS(C)	100.0	96.5
WD(C)	100.0	91.7

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA (A)	45.7	7.2	208.3	3.7
(C)	18.2	5.0	165.5	2.9

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	25.6	315.6	04/05/79	23:00	(B)-999.9
					(C) 10.0
(C) 18.2	19.3	229.2	10/31/79	22:00	(A) 20.5
					(B)-999.9

 NOTES:

1. SITE ELEVATION: 213 METERS ABOVE SEA LEVEL.
3. SENSOR LEVEL B NOT AVAILABLE AT SITE MI.

SITE ID: MI
 SITE LOCATION: LUDINGTON, MI.
 DATA : JANUARY 1979 THROUGH OCTOBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	7.5	120.3	0.0	0.0	5.2	122.8
01:00	7.5	125.1	0.0	0.0	5.3	121.7
02:00	7.6	132.7	0.0	0.0	5.4	128.5
03:00	7.6	136.1	0.0	0.0	5.4	131.7
04:00	7.5	136.8	0.0	0.0	5.2	131.2
05:00	7.5	139.8	0.0	0.0	5.2	134.6
06:00	7.4	140.4	0.0	0.0	5.2	133.3
07:00	7.4	138.8	0.0	0.0	5.1	133.7
08:00	7.1	147.4	0.0	0.0	5.0	142.2
09:00	7.0	153.1	0.0	0.0	4.9	148.9
10:00	6.8	201.2	0.0	0.0	4.8	177.1
11:00	6.7	247.2	0.0	0.0	4.7	221.4
12:00	6.8	261.0	0.0	0.0	4.7	236.5
13:00	6.9	272.3	0.0	0.0	4.8	245.5
14:00	7.0	276.2	0.0	0.0	4.8	253.7
15:00	7.1	280.9	0.0	0.0	5.0	260.7
16:00	7.1	284.6	0.0	0.0	5.1	263.6
17:00	7.1	290.0	0.0	0.0	5.1	269.2
18:00	7.0	294.4	0.0	0.0	4.9	273.7
19:00	6.9	305.3	0.0	0.0	4.9	256.8
20:00	7.1	308.7	0.0	0.0	4.9	139.5
21:00	7.2	98.2	0.0	0.0	4.9	119.0
22:00	7.3	104.9	0.0	0.0	5.1	109.9
23:00	7.4	118.1	0.0	0.0	5.2	117.6

SITE ID: MI
 SITE LOCATION: LUDINGTON, MI.
 DATA : JANUARY 1979 THROUGH OCTOBER 1979

 1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	LEVEL C COUNT	LEVEL C %
0.0- 0.5	0	0.0	0	0.0	72 1.0
0.5- 1.0	48	0.7	0	0.0	278 3.9
1.0- 1.5	105	1.5	0	0.0	335 4.8
1.5- 2.0	188	2.7	0	0.0	367 5.2
2.0- 2.5	256	3.7	0	0.0	390 5.5
2.5- 3.0	280	4.0	0	0.0	427 6.1
3.0- 3.5	282	4.0	0	0.0	475 6.7
3.5- 4.0	319	4.6	0	0.0	471 6.7
4.0- 4.5	322	4.6	0	0.0	493 7.0
4.5- 5.0	348	5.0	0	0.0	476 6.8
5.0- 5.5	348	5.0	0	0.0	501 7.1
5.5- 6.0	326	4.7	0	0.0	475 6.7
6.0- 6.5	382	5.5	0	0.0	393 5.6
6.5- 7.0	388	5.6	0	0.0	352 5.0
7.0- 7.5	384	5.5	0	0.0	280 4.0
7.5- 8.0	354	5.1	0	0.0	223 3.2
8.0- 8.5	398	5.7	0	0.0	198 2.8
8.5- 9.0	300	4.3	0	0.0	161 2.3
9.0- 9.5	257	3.7	0	0.0	141 2.0
9.5-10.0	248	3.6	0	0.0	104 1.5
10.0-11.0	432	6.2	0	0.0	158 2.2
11.0-12.0	308	4.4	0	0.0	121 1.7
12.0-13.0	244	3.5	0	0.0	66 0.9
13.0-14.0	156	2.2	0	0.0	33 0.5
14.0-15.0	117	1.7	0	0.0	29 0.4
15.0-16.0	60	0.9	0	0.0	16 0.2
16.0-17.0	40	0.6	0	0.0	3 0.0
17.0-18.0	37	0.5	0	0.0	2 0.0
18.0-19.0	25	0.4	0	0.0	2 0.0
19.0-20.0	11	0.2	0	0.0	2 0.0
20.0-21.0	9	0.1	0	0.0	0 0.0
>21.0	12	0.2	0	0.0	0 0.0

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 95.7 0.0 96.5

SITE ID: MI
 SITE LOCATION: LUDINGTON, MI.
 DATA : JANUARY 1979 THROUGH OCTOBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A		LEVEL B		LEVEL C	
	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	0	0.00	0	0.00	72	1.02
1.0	48	0.69	0	0.00	350	4.97
1.5	153	2.19	0	0.00	685	9.72
2.0	341	4.88	0	0.00	1052	14.93
2.5	597	8.55	0	0.00	1442	20.47
3.0	877	12.56	0	0.00	1869	26.53
3.5	1159	16.60	0	0.00	2344	33.28
4.0	1478	21.16	0	0.00	2815	39.96
4.5	1800	25.77	0	0.00	3308	46.96
5.0	2148	30.76	0	0.00	3784	53.72
5.5	2496	35.74	0	0.00	4285	60.83
6.0	2822	40.41	0	0.00	4760	67.58
6.5	3204	45.88	0	0.00	5153	73.15
7.0	3592	51.43	0	0.00	5505	78.15
7.5	3976	56.93	0	0.00	5785	82.13
8.0	4330	62.00	0	0.00	6008	85.29
8.5	4728	67.70	0	0.00	6206	88.10
9.0	5028	71.99	0	0.00	6367	90.39
9.5	5285	75.67	0	0.00	6508	92.39
10.0	5533	79.22	0	0.00	6612	93.87
11.0	5965	85.41	0	0.00	6770	96.11
12.0	6273	89.82	0	0.00	6891	97.83
13.0	6517	93.31	0	0.00	6957	98.76
14.0	6673	95.55	0	0.00	6990	99.23
15.0	6790	97.22	0	0.00	7019	99.65
16.0	6850	98.08	0	0.00	7035	99.87
17.0	6890	98.65	0	0.00	7038	99.91
18.0	6927	99.18	0	0.00	7040	99.94
19.0	6952	99.54	0	0.00	7042	99.97
20.0	6963	99.70	0	0.00	7044	100.00
21.0	6972	99.83	0	0.00	7044	100.00
>21.0	6984	100.00	0	0.00	7044	100.00

SITE ID: MI
 SITE LOCATION: LUDINGTON, MI.
 DATA : JANUARY 1979 THROUGH OCTOBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
HOURS	< 4	4-12	12-20	>20

1	98	78	38	2
2	42	48	21	1
3	31	38	15	0
4	19	22	8	1
5	15	26	8	0
6	24	15	7	0
7	9	13	7	0
8	11	14	7	0
9	6	10	6	0
10	4	13	2	0
11	8	11	3	1
12	8	9	1	0
13	3	12	2	0
14	8	9	1	0
15	4	7	1	0
16	3	10	1	0
17	2	9	1	0
18	1	5	0	0
19	1	5	0	0
20	3	8	0	0
21	0	8	0	0
22	1	3	2	0
23	0	3	1	0
>23	2	54	2	0

SITE ID: MI
 SITE LOCATION: LUDINGTON, MI.
 DATA : JANUARY 1979 THROUGH OCTOBER 1979

 1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR (ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.00	0.00	0.14	0.00	10.07	0.00	8.90
NNE	0.00	0.00	0.20	0.00	7.46	0.00	6.81
NE	0.00	0.00	0.24	0.00	5.00	0.00	4.49
ENE	0.00	0.00	0.09	0.00	3.78	0.00	4.37
E	0.00	0.00	0.10	0.00	3.89	0.00	4.61
ESE	0.00	0.00	0.26	0.00	5.53	0.00	6.52
SE	0.00	0.00	0.35	0.00	6.87	0.00	6.29
SSE	0.00	0.00	0.44	0.00	5.03	0.00	5.12
S	0.00	0.00	0.39	0.00	6.11	0.00	7.51
SSW	0.00	0.00	0.34	0.00	13.60	0.00	14.59
SW	0.00	0.00	0.41	0.00	8.22	0.00	5.49
WSW	0.00	0.00	0.58	0.00	3.94	0.00	3.62
W	0.00	0.00	0.71	0.00	2.91	0.00	2.67
WNW	0.00	0.00	0.77	0.00	4.60	0.00	4.07
NW	0.00	0.00	0.77	0.00	5.48	0.00	4.83
NNW	0.00	0.00	0.43	0.00	5.87	0.00	4.90

 NOTES:

ALPHA

1. $\frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)}$

2. $ALPHA = \frac{\log(WS(UP)/WS(LO))}{\log(Z(UP)/Z(LO))}$

WHERE; Z=ELEVATION
 WS=WIND SPEED

COUNT OF WIND SPEED VS. DIRECTION
 EACH LINE OF CHARACTERS REPRESENTS 40 OBSERVATIONS
 SPEED INCREASES WITH DISTANCE FROM CENTER OF CIRCLES
 ASSOCIATED RANGES IN MPS ARE 0 -4 4 -10 10 -20 20 -

FIGURE 1. (MI) Wind Rose for Lowest Sensor Level

MONTAUK POINT, NEW YORK

SITE ID: NY
 SITE LOCATION: MONTAUK POINT, NY.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	92.9
WD(A)	100.0	98.5
WS(C)	100.0	98.2
WD(C)	100.0	98.4

1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA (A)	45.7	6.7	243.9	3.5
(C)	18.2	5.6	254.1	3.3

1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	21.4	309.3	12/28/79	09:00	(B)-999.9 (C) 20.1
(C) 18.2	20.1	310.8	12/28/79	09:00	(A) 21.4 (B)-999.9

NOTES:

1. SITE ELEVATION: 2 METERS ABOVE SEA LEVEL.
3. SENSOR LEVEL B NOT AVAILABLE AT SITE NY.

SITE ID: NY
 SITE LOCATION: MONTAUK POINT, NY.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	6.6	256.6	0.0	0.0	5.3	267.1
01:00	6.5	260.0	0.0	0.0	5.2	271.5
02:00	6.4	266.9	0.0	0.0	5.2	277.5
03:00	6.4	268.5	0.0	0.0	5.1	279.8
04:00	6.5	269.1	0.0	0.0	5.2	281.0
05:00	6.4	271.9	0.0	0.0	5.1	284.5
06:00	6.4	270.2	0.0	0.0	5.2	282.0
07:00	6.4	273.4	0.0	0.0	5.3	286.9
08:00	6.4	269.0	0.0	0.0	5.4	285.6
09:00	6.5	259.7	0.0	0.0	5.6	276.8
10:00	6.6	253.9	0.0	0.0	5.7	272.2
11:00	6.7	245.7	0.0	0.0	5.8	262.9
12:00	6.8	238.0	0.0	0.0	6.0	248.0
13:00	6.9	233.6	0.0	0.0	6.0	241.0
14:00	7.0	223.4	0.0	0.0	6.1	228.6
15:00	7.0	220.7	0.0	0.0	6.1	225.9
16:00	7.0	218.4	0.0	0.0	5.9	224.4
17:00	7.1	217.4	0.0	0.0	5.9	222.4
18:00	7.1	218.7	0.0	0.0	5.8	223.2
19:00	7.2	220.8	0.0	0.0	5.7	225.3
20:00	7.1	228.1	0.0	0.0	5.7	232.6
21:00	7.0	235.6	0.0	0.0	5.6	243.9
22:00	6.9	244.4	0.0	0.0	5.5	252.9
23:00	6.8	254.3	0.0	0.0	5.4	265.2

SITE ID: NY
 SITE LOCATION: MONTAUK POINT, NY.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	%
0.0- 0.5	10	0.1	0	0.0
0.5- 1.0	86	1.1	0	0.0
1.0- 1.5	164	2.0	0	0.0
1.5- 2.0	245	3.0	0	0.0
2.0- 2.5	304	3.7	0	0.0
2.5- 3.0	310	3.8	0	0.0
3.0- 3.5	326	4.0	0	0.0
3.5- 4.0	389	4.8	0	0.0
4.0- 4.5	445	5.5	0	0.0
4.5- 5.0	487	6.0	0	0.0
5.0- 5.5	510	6.3	0	0.0
5.5- 6.0	489	6.0	0	0.0
6.0- 6.5	459	5.6	0	0.0
6.5- 7.0	506	6.2	0	0.0
7.0- 7.5	495	6.1	0	0.0
7.5- 8.0	394	4.8	0	0.0
8.0- 8.5	392	4.8	0	0.0
8.5- 9.0	350	4.3	0	0.0
9.0- 9.5	258	3.2	0	0.0
9.5-10.0	229	2.8	0	0.0
10.0-11.0	360	4.4	0	0.0
11.0-12.0	271	3.3	0	0.0
12.0-13.0	169	2.1	0	0.0
13.0-14.0	139	1.7	0	0.0
14.0-15.0	105	1.3	0	0.0
15.0-16.0	88	1.1	0	0.0
16.0-17.0	66	0.8	0	0.0
17.0-18.0	47	0.6	0	0.0
18.0-19.0	18	0.2	0	0.0
19.0-20.0	15	0.2	0	0.0
20.0-21.0	11	0.1	0	0.0
>21.0	2	0.0	0	0.0

RECOVERY RATES

LEVEL A LEVEL B LEVEL C
 92.9 0.0 98.2

SITE ID: NY
 SITE LOCATION: MONTAUK POINT, NY.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

	LEVEL A		LEVEL B		LEVEL C	
WIND SPEED	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	10	0.12	0	0.00	35	0.41
1.0	96	1.18	0	0.00	258	3.00
1.5	260	3.19	0	0.00	601	6.99
2.0	505	6.20	0	0.00	990	11.51
2.5	809	9.94	0	0.00	1401	16.28
3.0	1119	13.75	0	0.00	1910	22.20
3.5	1445	17.75	0	0.00	2469	28.70
4.0	1834	22.53	0	0.00	3061	35.58
4.5	2279	28.00	0	0.00	3713	43.15
5.0	2766	33.98	0	0.00	4323	50.24
5.5	3276	40.25	0	0.00	4888	56.81
6.0	3765	46.26	0	0.00	5400	62.76
6.5	4224	51.90	0	0.00	5880	68.34
7.0	4730	58.12	0	0.00	6293	73.14
7.5	5225	64.20	0	0.00	6655	77.35
8.0	5619	69.04	0	0.00	6972	81.03
8.5	6011	73.85	0	0.00	7206	83.75
9.0	6361	78.15	0	0.00	7408	86.10
9.5	6619	81.32	0	0.00	7588	88.19
10.0	6848	84.14	0	0.00	7735	89.90
11.0	7208	88.56	0	0.00	7974	92.68
12.0	7479	91.89	0	0.00	8147	94.69
13.0	7648	93.97	0	0.00	8302	96.49
14.0	7787	95.68	0	0.00	8398	97.61
15.0	7892	96.97	0	0.00	8473	98.48
16.0	7980	98.05	0	0.00	8527	99.11
17.0	8046	98.86	0	0.00	8564	99.54
18.0	8093	99.43	0	0.00	8587	99.80
19.0	8111	99.66	0	0.00	8601	99.97
20.0	8126	99.84	0	0.00	8603	99.99
21.0	8137	99.98	0	0.00	8604	100.00
>21.0	8139	100.00	0	0.00	8604	100.00

SITE ID: NY
 SITE LOCATION: MONTAUK POINT, NY.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

HOURS	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
	< 4	4-12	12-20	>20
-----	-----	-----	-----	-----
1	103	77	30	5
2	49	44	20	1
3	34	33	11	2
4	28	23	7	0
5	27	19	7	0
6	14	13	1	0
7	10	23	6	0
8	9	9	2	0
9	9	12	0	0
10	7	18	2	0
11	8	9	4	0
12	7	10	2	0
13	1	12	4	0
14	1	6	1	0
15	3	13	0	0
16	8	3	1	0
17	6	8	2	0
18	4	7	1	0
19	2	4	0	0
20	1	3	0	0
21	0	8	0	0
22	3	7	0	0
23	0	2	0	0
>23	7	70	5	0

SITE ID: NY
 SITE LOCATION: MONTAUK POINT, NY.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR (ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.00	0.00	0.09	0.00	2.69	0.00	2.86
NNE	0.00	0.00	0.24	0.00	3.58	0.00	3.14
NE	0.00	0.00	0.18	0.00	5.46	0.00	5.25
ENE	0.00	0.00	0.30	0.00	3.75	0.00	3.58
E	0.00	0.00	0.13	0.00	2.86	0.00	3.05
ESE	0.00	0.00	0.38	0.00	2.38	0.00	2.21
SE	0.00	0.00	0.38	0.00	4.45	0.00	4.77
SSE	0.00	0.00	0.34	0.00	6.11	0.00	5.97
S	0.00	0.00	0.33	0.00	7.02	0.00	7.73
SSW	0.00	0.00	0.31	0.00	8.83	0.00	9.38
SW	0.00	0.00	0.22	0.00	9.21	0.00	9.00
WSW	0.00	0.00	0.24	0.00	7.59	0.00	7.50
W	0.00	0.00	0.15	0.00	10.36	0.00	8.26
WNW	0.00	0.00	0.23	0.00	11.17	0.00	10.47
NW	0.00	0.00	0.01	0.00	9.58	0.00	11.03
NNW	0.00	0.00	0.05	0.00	4.96	0.00	5.81

 NOTES:

$$1. \quad \frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)}^{\text{ALPHA}}$$

$$2. \quad \text{ALPHA} = \frac{\text{LOG}(WS(UP)/WS(LO))}{\text{LOG}(Z(UP)/Z(LO))} \quad \text{WHERE; } \begin{array}{l} Z=\text{ELEVATION} \\ WS=\text{WIND SPEED} \end{array}$$

FIGURE 1. (NY) Wind Rose for Lowest Sensor Level

POINT ARENA, CALIFORNIA

SITE ID: CA
 SITE LOCATION: POINT ARENA, CA.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	86.2
WD(A)	100.0	94.3
WS(C)	100.0	93.2
WD(C)	100.0	83.8

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA (A)	45.7	6.4	5.7	3.4
(C)	9.1	4.7	358.3	2.5

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	20.5	122.6	01/07/79	13:00	(B)-999.9 (C) 15.9
(C) 9.1	16.0	-999.9	10/24/79	13:00	(A) 19.5 (B)-999.9

NOTES:

1. SITE ELEVATION: 21 METERS ABOVE SEA LEVEL.
3. SENSOR LEVEL B NOT AVAILABLE AT SITE CA.

SITE ID: CA
 SITE LOCATION: POINT ARENA, CA.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	6.4	19.1	0.0	0.0	4.4	15.1
01:00	6.3	19.5	0.0	0.0	4.4	16.9
02:00	6.2	18.3	0.0	0.0	4.4	18.4
03:00	6.2	22.8	0.0	0.0	4.4	20.7
04:00	6.1	27.2	0.0	0.0	4.3	23.3
05:00	6.1	30.0	0.0	0.0	4.3	24.0
06:00	6.0	29.1	0.0	0.0	4.2	20.0
07:00	5.8	28.6	0.0	0.0	4.3	14.3
08:00	6.0	33.1	0.0	0.0	4.4	359.9
09:00	6.2	12.3	0.0	0.0	4.7	339.9
10:00	6.5	333.8	0.0	0.0	5.0	326.6
11:00	6.7	313.1	0.0	0.0	5.2	318.2
12:00	7.0	316.1	0.0	0.0	5.4	319.3
13:00	7.0	319.3	0.0	0.0	5.4	321.5
14:00	6.9	324.1	0.0	0.0	5.3	322.3
15:00	6.8	332.2	0.0	0.0	5.3	329.5
16:00	6.9	341.7	0.0	0.0	5.2	337.5
17:00	6.8	353.9	0.0	0.0	5.0	348.5
18:00	6.7	1.3	0.0	0.0	4.8	357.1
19:00	6.6	6.2	0.0	0.0	4.6	2.2
20:00	6.5	9.7	0.0	0.0	4.5	4.9
21:00	6.3	14.0	0.0	0.0	4.4	8.1
22:00	6.3	15.7	0.0	0.0	4.3	11.7
23:00	6.4	15.0	0.0	0.0	4.4	13.8

SITE ID: CA
 SITE LOCATION: POINT ARENA, CA.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	%
0.0- 0.5	30	0.4	0	0.0
0.5- 1.0	154	2.0	0	0.0
1.0- 1.5	216	2.9	0	0.0
1.5- 2.0	280	3.7	0	0.0
2.0- 2.5	370	4.9	0	0.0
2.5- 3.0	360	4.8	0	0.0
3.0- 3.5	366	4.8	0	0.0
3.5- 4.0	339	4.5	0	0.0
4.0- 4.5	320	4.2	0	0.0
4.5- 5.0	331	4.4	0	0.0
5.0- 5.5	341	4.5	0	0.0
5.5- 6.0	377	5.0	0	0.0
6.0- 6.5	359	4.8	0	0.0
6.5- 7.0	385	5.1	0	0.0
7.0- 7.5	408	5.4	0	0.0
7.5- 8.0	428	5.7	0	0.0
8.0- 8.5	383	5.1	0	0.0
8.5- 9.0	388	5.1	0	0.0
9.0- 9.5	350	4.6	0	0.0
9.5-10.0	298	3.9	0	0.0
10.0-11.0	432	5.7	0	0.0
11.0-12.0	262	3.5	0	0.0
12.0-13.0	140	1.9	0	0.0
13.0-14.0	85	1.1	0	0.0
14.0-15.0	59	0.8	0	0.0
15.0-16.0	35	0.5	0	0.0
16.0-17.0	24	0.3	0	0.0
17.0-18.0	10	0.1	0	0.0
18.0-19.0	9	0.1	0	0.0
19.0-20.0	7	0.1	0	0.0
20.0-21.0	2	0.0	0	0.0
>21.0	0	0.0	0	0.0

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 86.2 0.0 93.2

SITE ID: CA
 SITE LOCATION: POINT ARENA, CA.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A		LEVEL B		LEVEL C	
	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	30	0.40	0	0.00	40	0.49
1.0	184	2.44	0	0.00	298	3.65
1.5	400	5.30	0	0.00	802	9.82
2.0	680	9.01	0	0.00	1364	16.71
2.5	1050	13.91	0	0.00	1928	23.62
3.0	1410	18.68	0	0.00	2442	29.92
3.5	1776	23.53	0	0.00	2975	36.44
4.0	2115	28.02	0	0.00	3505	42.94
4.5	2435	32.26	0	0.00	4028	49.34
5.0	2766	36.65	0	0.00	4591	56.24
5.5	3107	41.16	0	0.00	5092	62.38
6.0	3484	46.16	0	0.00	5616	68.80
6.5	3843	50.91	0	0.00	6170	75.58
7.0	4228	56.01	0	0.00	6677	81.80
7.5	4636	61.42	0	0.00	7084	86.78
8.0	5064	67.09	0	0.00	7374	90.33
8.5	5447	72.16	0	0.00	7587	92.94
9.0	5835	77.31	0	0.00	7746	94.89
9.5	6185	81.94	0	0.00	7870	96.41
10.0	6483	85.89	0	0.00	7952	97.42
11.0	6915	91.61	0	0.00	8042	98.52
12.0	7177	95.08	0	0.00	8109	99.34
13.0	7317	96.94	0	0.00	8135	99.66
14.0	7402	98.07	0	0.00	8147	99.80
15.0	7461	98.85	0	0.00	8159	99.95
16.0	7496	99.31	0	0.00	8163	100.00
17.0	7520	99.63	0	0.00	8163	100.00
18.0	7530	99.76	0	0.00	8163	100.00
19.0	7539	99.88	0	0.00	8163	100.00
20.0	7546	99.97	0	0.00	8163	100.00
21.0	7548	100.00	0	0.00	8163	100.00
>21.0	7548	100.00	0	0.00	8163	100.00

SITE ID: CA
 SITE LOCATION: POINT ARENA, CA.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

HOURS	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
	< 4	4-12	12-20	>20
1	68	73	33	2
2	49	41	10	0
3	26	27	8	0
4	26	21	3	0
5	19	17	1	0
6	20	7	1	0
7	15	16	5	0
8	9	12	3	0
9	13	12	3	0
10	5	11	3	0
11	7	4	3	0
12	8	6	1	0
13	6	10	0	0
14	9	4	0	0
15	8	6	2	0
16	4	5	0	0
17	4	6	0	0
18	3	4	1	0
19	4	3	0	0
20	3	3	0	0
21	1	6	1	0
22	3	4	0	0
23	1	1	0	0
>23	8	70	1	0

SITE ID: CA
 SITE LOCATION: POINT ARENA, CA.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR (ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.00	0.00	0.14	0.00	12.52	0.00	12.95
NNE	0.00	0.00	0.18	0.00	2.97	0.00	2.95
NE	0.00	0.00	0.22	0.00	1.17	0.00	1.75
ENE	0.00	0.00	0.24	0.00	0.89	0.00	1.89
E	0.00	0.00	0.45	0.00	1.51	0.00	1.81
ESE	0.00	0.00	0.64	0.00	3.72	0.00	1.78
SE	0.00	0.00	0.22	0.00	15.33	0.00	10.68
SSE	0.00	0.00	0.19	0.00	8.80	0.00	8.22
S	0.00	0.00	0.11	0.00	2.12	0.00	1.64
SSW	0.00	0.00	0.21	0.00	1.17	0.00	0.82
SW	0.00	0.00	0.08	0.00	0.90	0.00	0.78
WSW	0.00	0.00	0.12	0.00	0.93	0.00	0.60
W	0.00	0.00	0.24	0.00	1.23	0.00	1.15
WNW	0.00	0.00	0.29	0.00	1.96	0.00	1.58
NW	0.00	0.00	0.21	0.00	6.97	0.00	4.31
NNW	0.00	0.00	0.15	0.00	37.64	0.00	34.15

 NOTES:

$$1. \quad \frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)}^{\text{ALPHA}}$$

$$2. \quad \text{ALPHA} = \frac{\text{LOG}(WS(UP)/WS(LO))}{\text{LOG}(Z(UP)/Z(LO))} \quad \text{WHERE; } \begin{array}{l} Z=\text{ELEVATION} \\ WS=\text{WIND SPEED} \end{array}$$

FIGURE 1. (CA) Wind Rose for Lowest Sensor Level

RUSSELL, KANSAS

SITE ID: KS
 SITE LOCATION: RUSSELL, KS.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	84.8
WD(A)	100.0	84.1
WS(C)	100.0	84.5
WD(C)	100.0	84.4

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA (A)	45.7	7.0	136.4	3.1
(C)	9.1	5.1	158.6	2.6

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	19.1	345.6	12/11/79	07:00	(B)-999.9
					(C) 14.8
(C) 9.1	16.4	336.5	03/23/79	11:00	(A) 18.8
					(B)-999.9

 NOTES:

1. SITE ELEVATION: 564 METERS ABOVE SEA LEVEL.
3. SENSOR LEVEL B NOT AVAILABLE AT SITE KS.

SITE ID: KS
 SITE LOCATION: RUSSELL, KS.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	7.2	124.9	0.0	0.0	4.7	145.1
01:00	7.0	139.6	0.0	0.0	4.5	169.0
02:00	7.0	143.9	0.0	0.0	4.6	182.4
03:00	6.9	166.0	0.0	0.0	4.5	191.0
04:00	6.9	178.4	0.0	0.0	4.4	195.2
05:00	6.9	190.1	0.0	0.0	4.5	200.1
06:00	7.0	179.0	0.0	0.0	4.5	192.6
07:00	6.8	189.2	0.0	0.0	4.6	197.6
08:00	6.8	193.5	0.0	0.0	5.0	201.4
09:00	6.9	202.4	0.0	0.0	5.5	204.9
10:00	7.0	199.4	0.0	0.0	5.8	205.4
11:00	7.0	205.5	0.0	0.0	5.8	208.1
12:00	7.1	196.6	0.0	0.0	5.9	198.8
13:00	7.2	196.4	0.0	0.0	6.0	198.1
14:00	7.3	182.4	0.0	0.0	6.0	185.8
15:00	7.1	164.0	0.0	0.0	5.9	176.5
16:00	7.0	126.2	0.0	0.0	5.6	140.9
17:00	7.0	103.0	0.0	0.0	5.4	112.7
18:00	6.9	98.0	0.0	0.0	5.1	107.0
19:00	7.0	95.9	0.0	0.0	4.8	105.2
20:00	6.9	98.1	0.0	0.0	4.5	109.1
21:00	6.9	105.0	0.0	0.0	4.4	115.8
22:00	7.1	115.9	0.0	0.0	4.5	130.5
23:00	7.2	117.6	0.0	0.0	4.6	137.6

SITE ID: KS
 SITE LOCATION: RUSSELL, KS.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT
0.0- 0.5	4	0.1	0
0.5- 1.0	43	0.6	0
1.0- 1.5	91	1.2	0
1.5- 2.0	124	1.7	0
2.0- 2.5	190	2.6	0
2.5- 3.0	240	3.2	0
3.0- 3.5	278	3.7	0
3.5- 4.0	308	4.1	0
4.0- 4.5	433	5.8	0
4.5- 5.0	386	5.2	0
5.0- 5.5	449	6.0	0
5.5- 6.0	484	6.5	0
6.0- 6.5	486	6.5	0
6.5- 7.0	486	6.5	0
7.0- 7.5	412	5.5	0
7.5- 8.0	399	5.4	0
8.0- 8.5	401	5.4	0
8.5- 9.0	349	4.7	0
9.0- 9.5	328	4.4	0
9.5-10.0	289	3.9	0
10.0-11.0	455	6.1	0
11.0-12.0	272	3.7	0
12.0-13.0	194	2.6	0
13.0-14.0	156	2.1	0
14.0-15.0	73	1.0	0
15.0-16.0	43	0.6	0
16.0-17.0	23	0.3	0
17.0-18.0	21	0.3	0
18.0-19.0	8	0.1	0
19.0-20.0	1	0.0	0
20.0-21.0	0	0.0	0
>21.0	0	0.0	0

RECOVERY RATES
 LEVEL A LEVEL B LEVEL C
 84.8 0.0 84.5

SITE ID: KS
 SITE LOCATION: RUSSELL, KS.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

	LEVEL A		LEVEL B		LEVEL C	
WIND SPEED	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	4	0.05	0	0.00	10	0.14
1.0	47	0.63	0	0.00	95	1.28
1.5	138	1.86	0	0.00	302	4.08
2.0	262	3.53	0	0.00	619	8.36
2.5	452	6.09	0	0.00	1125	15.20
3.0	692	9.32	0	0.00	1759	23.77
3.5	970	13.06	0	0.00	2426	32.78
4.0	1278	17.21	0	0.00	3068	41.46
4.5	1711	23.04	0	0.00	3650	49.32
5.0	2097	28.24	0	0.00	4165	56.28
5.5	2546	34.28	0	0.00	4652	62.86
6.0	3030	40.80	0	0.00	5097	68.88
6.5	3516	47.35	0	0.00	5472	73.95
7.0	4002	53.89	0	0.00	5806	78.46
7.5	4414	59.44	0	0.00	6108	82.54
8.0	4813	64.81	0	0.00	6372	86.11
8.5	5214	70.21	0	0.00	6580	88.92
9.0	5563	74.91	0	0.00	6754	91.27
9.5	5891	79.33	0	0.00	6901	93.26
10.0	6180	83.22	0	0.00	7024	94.92
11.0	6635	89.35	0	0.00	7195	97.23
12.0	6907	93.01	0	0.00	7297	98.61
13.0	7101	95.62	0	0.00	7338	99.16
14.0	7257	97.72	0	0.00	7374	99.65
15.0	7330	98.71	0	0.00	7391	99.88
16.0	7373	99.29	0	0.00	7399	99.99
17.0	7396	99.60	0	0.00	7400	100.00
18.0	7417	99.88	0	0.00	7400	100.00
19.0	7425	99.99	0	0.00	7400	100.00
20.0	7426	100.00	0	0.00	7400	100.00
21.0	7426	100.00	0	0.00	7400	100.00
>21.0	7426	100.00	0	0.00	7400	100.00

SITE ID: KS
 SITE LOCATION: RUSSELL, KS.
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
HOURS	< 4	4-12	12-20	>20
	-----	-----	-----	-----
1	103	82	40	0
2	69	50	25	0
3	40	27	18	0
4	25	24	11	0
5	21	22	9	0
6	13	15	7	0
7	5	12	4	0
8	12	12	4	0
9	3	9	1	0
10	8	16	1	0
11	4	18	1	0
12	4	9	0	0
13	1	15	3	0
14	2	16	1	0
15	5	8	0	0
16	2	9	2	0
17	4	10	0	0
18	1	10	1	0
19	2	7	0	0
20	0	7	0	0
21	0	12	0	0
22	0	5	0	0
23	1	2	0	0
>23	0	68	2	0

SITE ID: KS
SITE LOCATION: RUSSELL, KS.
DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR

(ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.00	0.00	0.16	0.00	7.02	0.00	6.59
NNE	0.00	0.00	0.15	0.00	6.25	0.00	5.78
NE	0.00	0.00	0.16	0.00	5.40	0.00	5.49
ENE	0.00	0.00	0.17	0.00	4.44	0.00	4.45
E	0.00	0.00	0.24	0.00	4.24	0.00	3.81
ESE	0.00	0.00	0.28	0.00	4.09	0.00	4.23
SE	0.00	0.00	0.28	0.00	8.01	0.00	7.28
SSE	0.00	0.00	0.22	0.00	14.23	0.00	12.66
S	0.00	0.00	0.18	0.00	11.24	0.00	13.35
SSW	0.00	0.00	0.20	0.00	5.39	0.00	6.08
SW	0.00	0.00	0.29	0.00	3.22	0.00	4.64
WSW	0.00	0.00	0.31	0.00	3.02	0.00	3.47
W	0.00	0.00	0.29	0.00	3.02	0.00	3.20
WNW	0.00	0.00	0.25	0.00	4.26	0.00	4.34
NW	0.00	0.00	0.20	0.00	7.43	0.00	6.74
NNW	0.00	0.00	0.11	0.00	7.84	0.00	7.41

NOTES:

$$1. \frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)}$$
$$2. \text{ ALPHA} = \frac{\text{LOG(WS(UP)/WS(LO))}}{\text{LOG(Z(UP)/Z(LO))}} \quad \text{WHERE; } \begin{array}{l} \text{Z=ELEVATION} \\ \text{WS=WIND SPEED} \end{array}$$

COUNT OF WIND SPEED VS. DIRECTION
 EACH LINE OF CHARACTERS REPRESENTS 40 OBSERVATIONS
 SPEED INCREASES WITH DISTANCE FROM CENTER OF CIRCLES
 ASSOCIATED RANGES IN MPS ARE 0 -4 4 -10 10 -20 20 -

FIGURE 1. (KS) Wind Rose for Lowest Sensor Level

SAN GORGONIO PASS, CALIFORNIA

SITE ID: SG
 SITE LOCATION: SAN GORGONIO PASS, CA
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.1 SENSOR PERFORMANCE

TOTAL POSSIBLE SAMPLES: 8760

SENSOR	% ON-LINE	% RECOVERED
WS(A)	100.0	90.0
WD(A)	100.0	89.5
WS(C)	100.0	90.4
WD(C)	100.0	90.7

 1.2 ANNUAL MEANS AND STANDARD DEVIATIONS

	HEIGHT (METERS)	MEAN WS	MEAN WD	STD DEV SPEED
SITE DATA (A)	45.7	7.2	239.1	5.2
(C)	9.1	5.6	251.9	3.8

 1.3 MAXIMUM WIND SPEED

ELEVATION (METERS)	WIND SPEED	WIND DIR.	DATE	TIME	OTHER LEVELS
(A) 45.7	24.3	228.6	05/06/79	18:00	(B)-999.9 (C) 18.7
(C) 9.1	18.7	234.8	05/06/79	18:00	(A) 24.3 (B)-999.9

NOTES:

1. SITE ELEVATION: 329 METERS ABOVE SEA LEVEL.
3. SENSOR LEVEL B NOT AVAILABLE AT SITE SG.

SITE ID: SG
 SITE LOCATION: SAN GORGONIO PASS, CA
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.4 WIND SPEED AND DIRECTION VERSUS TIME-OF-DAY

TIME OF DAY	LEVEL A		LEVEL B		LEVEL C	
	WS	WD	WS	WD	WS	WD
00:00	7.4	259.1	0.0	0.0	5.7	267.9
01:00	7.3	261.2	0.0	0.0	5.5	270.6
02:00	7.1	265.7	0.0	0.0	5.5	275.2
03:00	6.8	265.4	0.0	0.0	5.2	275.5
04:00	6.8	264.9	0.0	0.0	5.2	275.5
05:00	6.6	267.9	0.0	0.0	5.0	277.5
06:00	6.2	271.9	0.0	0.0	4.7	281.7
07:00	5.9	275.5	0.0	0.0	4.5	279.6
08:00	5.7	251.0	0.0	0.0	4.5	247.8
09:00	5.9	170.4	0.0	0.0	4.7	169.9
10:00	6.1	159.9	0.0	0.0	4.9	162.0
11:00	6.5	157.6	0.0	0.0	5.2	158.9
12:00	6.8	160.5	0.0	0.0	5.5	161.1
13:00	7.1	163.1	0.0	0.0	5.7	164.1
14:00	7.4	172.1	0.0	0.0	5.8	173.4
15:00	7.6	182.9	0.0	0.0	6.0	183.7
16:00	7.8	194.9	0.0	0.0	6.0	205.7
17:00	8.2	222.2	0.0	0.0	6.2	244.5
18:00	8.5	239.9	0.0	0.0	6.4	254.6
19:00	8.7	245.7	0.0	0.0	6.5	257.5
20:00	8.5	250.7	0.0	0.0	6.5	258.1
21:00	8.4	249.6	0.0	0.0	6.3	259.9
22:00	8.0	253.0	0.0	0.0	6.0	262.8
23:00	7.7	256.9	0.0	0.0	5.8	265.3

SITE ID: SG
 SITE LOCATION: SAN GORGONIO PASS, CA
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

1.5 FREQUENCY DISTRIBUTION OF WIND SPEED

WIND SPEED	LEVEL A COUNT	LEVEL B % COUNT	LEVEL C % COUNT	LEVEL C %
0.0- 0.5	89	1.1	0	0.0
0.5- 1.0	370	4.7	0	0.0
1.0- 1.5	493	6.3	0	0.0
1.5- 2.0	496	6.3	0	0.0
2.0- 2.5	497	6.3	0	0.0
2.5- 3.0	429	5.4	0	0.0
3.0- 3.5	372	4.7	0	0.0
3.5- 4.0	332	4.2	0	0.0
4.0- 4.5	236	3.0	0	0.0
4.5- 5.0	228	2.9	0	0.0
5.0- 5.5	220	2.8	0	0.0
5.5- 6.0	176	2.2	0	0.0
6.0- 6.5	186	2.4	0	0.0
6.5- 7.0	151	1.9	0	0.0
7.0- 7.5	176	2.2	0	0.0
7.5- 8.0	188	2.4	0	0.0
8.0- 8.5	164	2.1	0	0.0
8.5- 9.0	181	2.3	0	0.0
9.0- 9.5	184	2.3	0	0.0
9.5-10.0	179	2.3	0	0.0
10.0-11.0	378	4.8	0	0.0
11.0-12.0	435	5.5	0	0.0
12.0-13.0	362	4.6	0	0.0
13.0-14.0	386	4.9	0	0.0
14.0-15.0	310	3.9	0	0.0
15.0-16.0	225	2.9	0	0.0
16.0-17.0	141	1.8	0	0.0
17.0-18.0	107	1.4	0	0.0
18.0-19.0	62	0.8	0	0.0
19.0-20.0	42	0.5	0	0.0
20.0-21.0	28	0.4	0	0.0
>21.0	59	0.7	0	0.0

RECOVERY RATES

LEVEL A	LEVEL B	LEVEL C
90.0	0.0	90.4

SITE ID: SG
 SITE LOCATION: SAN GORGONIO PASS, CA
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.6 CUMULATIVE FREQUENCY DISTRIBUTION OF WIND SPEED

	LEVEL A		LEVEL B		LEVEL C	
WIND SPEED	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)	CFD (ABS)	CFD (%)
0.5	89	1.13	0	0.00	19	0.24
1.0	459	5.82	0	0.00	256	3.23
1.5	952	12.08	0	0.00	786	9.93
2.0	1448	18.37	0	0.00	1513	19.11
2.5	1945	24.68	0	0.00	2186	27.61
3.0	2374	30.12	0	0.00	2828	35.72
3.5	2746	34.84	0	0.00	3291	41.57
4.0	3078	39.05	0	0.00	3674	46.41
4.5	3314	42.05	0	0.00	3974	50.20
5.0	3542	44.94	0	0.00	4273	53.97
5.5	3762	47.73	0	0.00	4541	57.36
6.0	3938	49.96	0	0.00	4765	60.19
6.5	4124	52.32	0	0.00	4959	62.64
7.0	4275	54.24	0	0.00	5192	65.58
7.5	4451	56.47	0	0.00	5425	68.52
8.0	4639	58.86	0	0.00	5685	71.81
8.5	4803	60.94	0	0.00	5934	74.95
9.0	4984	63.23	0	0.00	6178	78.03
9.5	5168	65.57	0	0.00	6439	81.33
10.0	5347	67.84	0	0.00	6696	84.58
11.0	5725	72.63	0	0.00	7145	90.25
12.0	6160	78.15	0	0.00	7459	94.21
13.0	6522	82.75	0	0.00	7655	96.69
14.0	6908	87.64	0	0.00	7759	98.00
15.0	7218	91.58	0	0.00	7825	98.84
16.0	7443	94.43	0	0.00	7865	99.34
17.0	7584	96.22	0	0.00	7900	99.79
18.0	7691	97.58	0	0.00	7914	99.96
19.0	7753	98.36	0	0.00	7917	100.00
20.0	7795	98.90	0	0.00	7917	100.00
21.0	7823	99.25	0	0.00	7917	100.00
>21.0	7882	100.00	0	0.00	7917	100.00

SITE ID: SG
 SITE LOCATION: SAN GORGONIO PASS, CA
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.7 WIND SPEED PERSISTENCE FREQUENCY (LEVEL A)

HOURS	NUMBER OF OCCURENCES			
	PERS.	WIND SPEED, M/S		
	< 4	4-12	12-20	>20
1	94	162	61	9
2	47	85	30	5
3	46	81	18	0
4	30	48	16	1
5	34	43	22	1
6	18	37	10	2
7	20	28	14	1
8	13	16	11	0
9	29	14	10	0
10	14	17	4	0
11	8	14	5	2
12	12	8	6	0
13	8	12	3	0
14	8	13	4	0
15	7	8	4	0
16	5	3	4	0
17	5	5	2	0
18	4	2	3	1
19	2	2	1	0
20	2	1	2	0
21	2	1	1	0
22	0	1	0	0
23	1	2	0	0
>23	22	7	12	0

SITE ID: SG
 SITE LOCATION: SAN GORGONIO PASS, CA
 DATA : JANUARY 1979 THROUGH DECEMBER 1979

 1.8 POWER LAW EXPONENT AND W/D DISTRIBUTION

WIND DIR (ELEV A)	ALPHA (A,B)	ALPHA (B,C)	ALPHA (A,C)	ALPHA (A,B,C)	%A	%B	%C
N	0.00	0.00	0.14	0.00	2.36	0.00	2.06
NNE	0.00	0.00	0.03	0.00	2.04	0.00	1.71
NE	0.00	0.00	-0.02	0.00	1.85	0.00	1.50
ENE	0.00	0.00	-0.01	0.00	2.35	0.00	1.67
E	0.00	0.00	0.10	0.00	5.85	0.00	4.80
ESE	0.00	0.00	0.09	0.00	7.75	0.00	7.24
SE	0.00	0.00	-0.14	0.00	2.82	0.00	2.89
SSE	0.00	0.00	-0.30	0.00	1.69	0.00	1.52
S	0.00	0.00	-0.05	0.00	1.73	0.00	1.17
SSW	0.00	0.00	0.07	0.00	2.80	0.00	2.34
SW	0.00	0.00	0.19	0.00	24.47	0.00	17.89
WSW	0.00	0.00	0.13	0.00	24.18	0.00	27.14
W	0.00	0.00	0.06	0.00	4.31	0.00	6.16
WNW	0.00	0.00	0.06	0.00	3.76	0.00	10.21
NW	0.00	0.00	0.19	0.00	7.26	0.00	9.51
NNW	0.00	0.00	0.09	0.00	3.67	0.00	2.17

 NOTES:

$$1. \quad \frac{WS(UP)}{WS(LO)} = \frac{Z(UP)}{Z(LO)}^{\text{ALPHA}}$$

$$2. \quad \text{ALPHA} = \frac{\text{LOG}(WS(UP)/WS(LO))}{\text{LOG}(Z(UP)/Z(LO))}$$

WHERE; Z=ELEVATION
 WS=WIND SPEED

FIGURE 1. (SG) Wind Rose for Lowest Sensor Level

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A. A. Churm
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Wind Energy Systems Division
600 E. Street N.W.
Washington, DC 20545

George P. Tennyson
Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, NM 87115

27 DOE Technical Information Center

Ronald L. Thomas
NASA-Lewis Research Center
Mail Stop 500-202
21000 Brookpark Road
Cleveland, OH 44135

Mr. Kenneth Ladd
Southwest Public Service Company
P.O. Box 1261
Amarillo, TX 79170

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Portland, OR 97204

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Blue Ridge Electric Corporation
1216 Blowing Rock Blvd., N.E.
Lenoir, NC 28645

Mr. Eli Garcia
City Manager
Clayton, NM 88415

Mr. John Slagle
Alaska Bussell Electric Company
P.O. Box 4-1325
Anchorage, AK 99509

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Puerto Rico Electric Power
Authority
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San Juan, PR 00936

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Gas and Electric Department
70 Suffolk Street
Holyoke, MA 01040

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East River Electric Power
Co-op, Inc.
Madison, SD 57042

Mr. Ed Hamilton
Central Nebraska Public Power
and Irrigation District Inc.
P.O. Box 356
Holdrege, NB 68949

Mr. Bruce E. Humenik
Senior Research and Development
Engineer
Long Island Lighting Company
175 East Old Country Road
Hicksville, NY 11801

Mr. Andrew Matura
Long Island Lighting Company
175 East Old Company Road
Hicksville, NY 11801

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Department of Engineering Research
3400 Crow Canyon Road
San Ramon, CA 94583

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